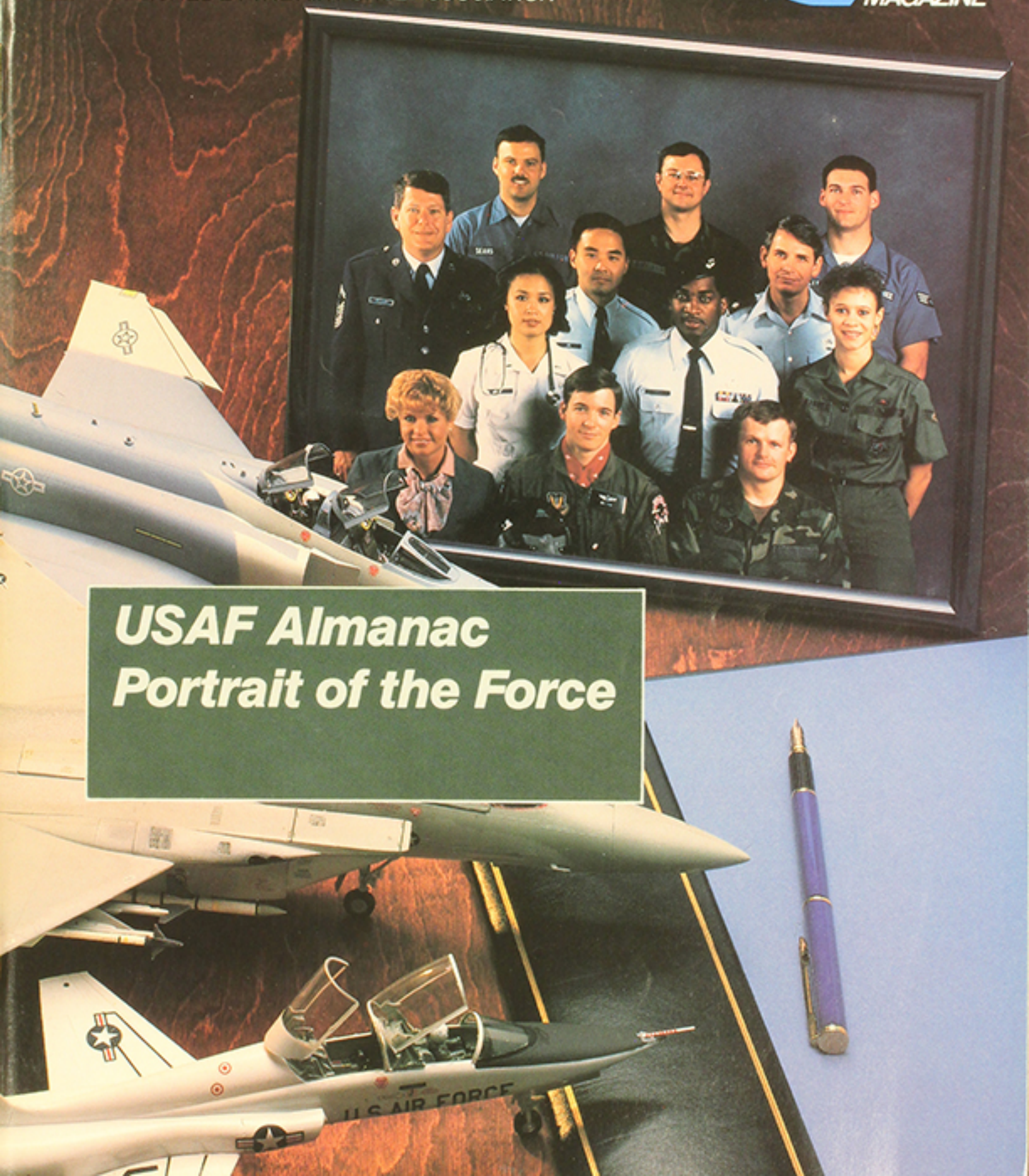
MAY 1989/$5

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



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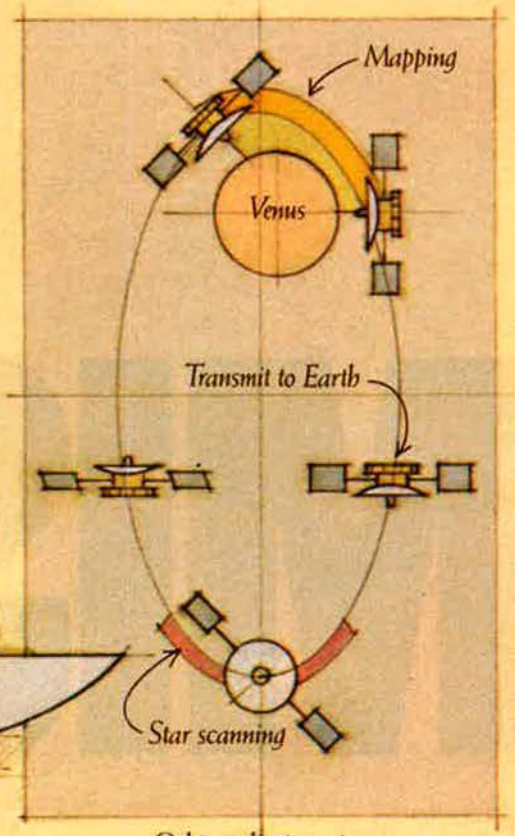

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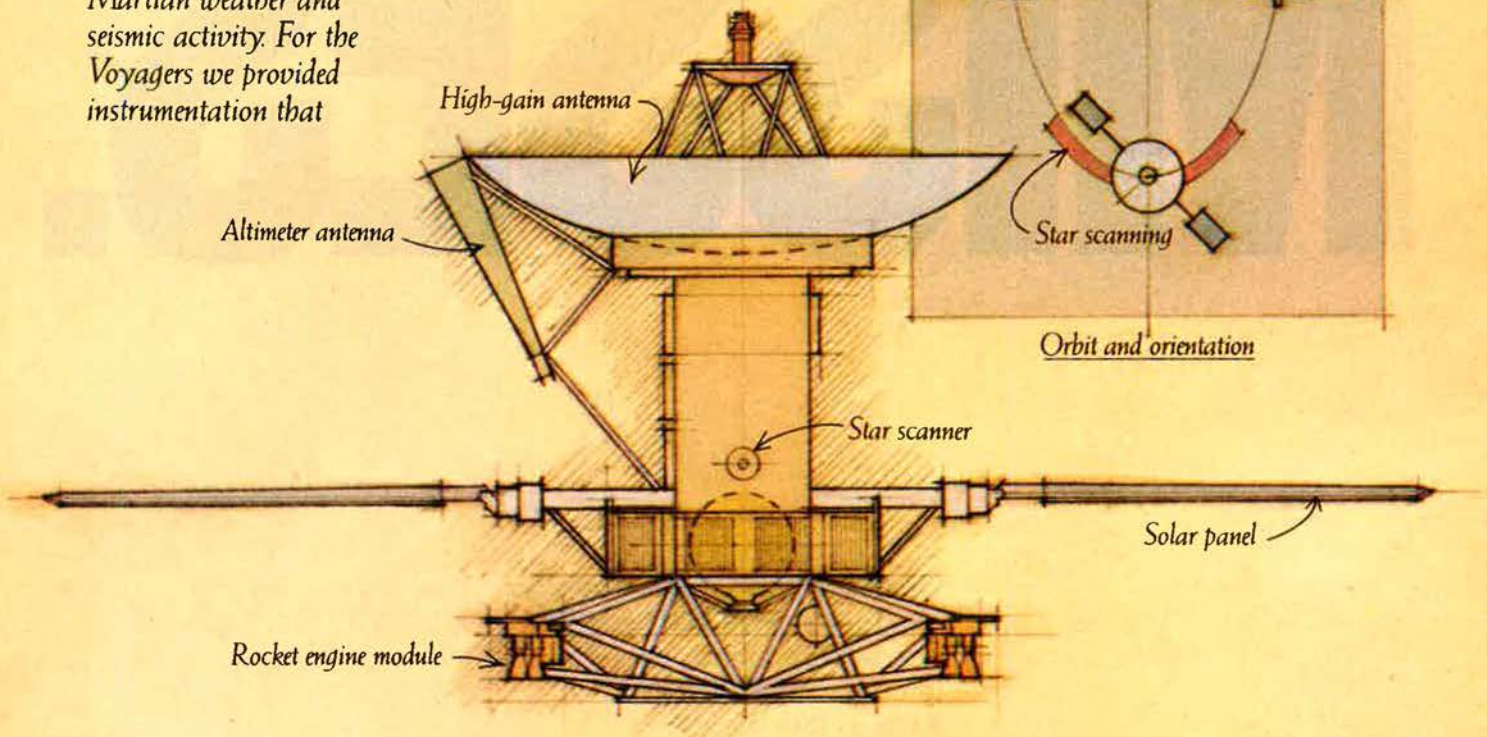

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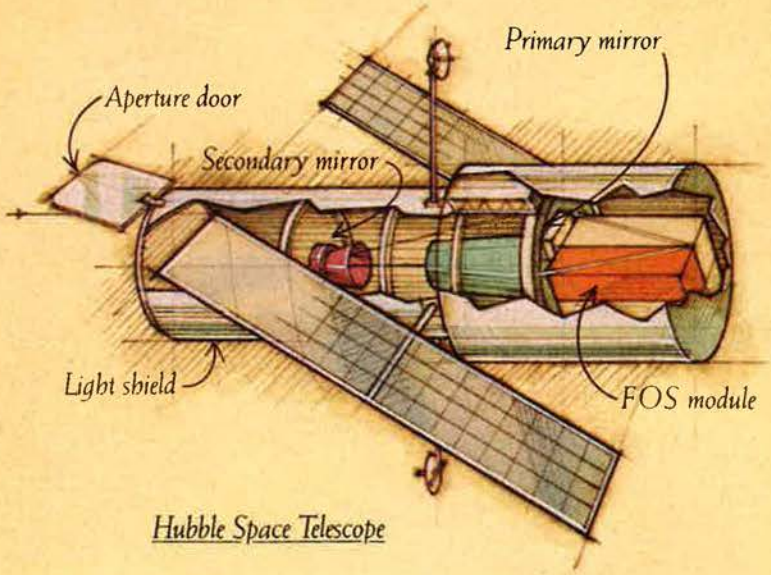

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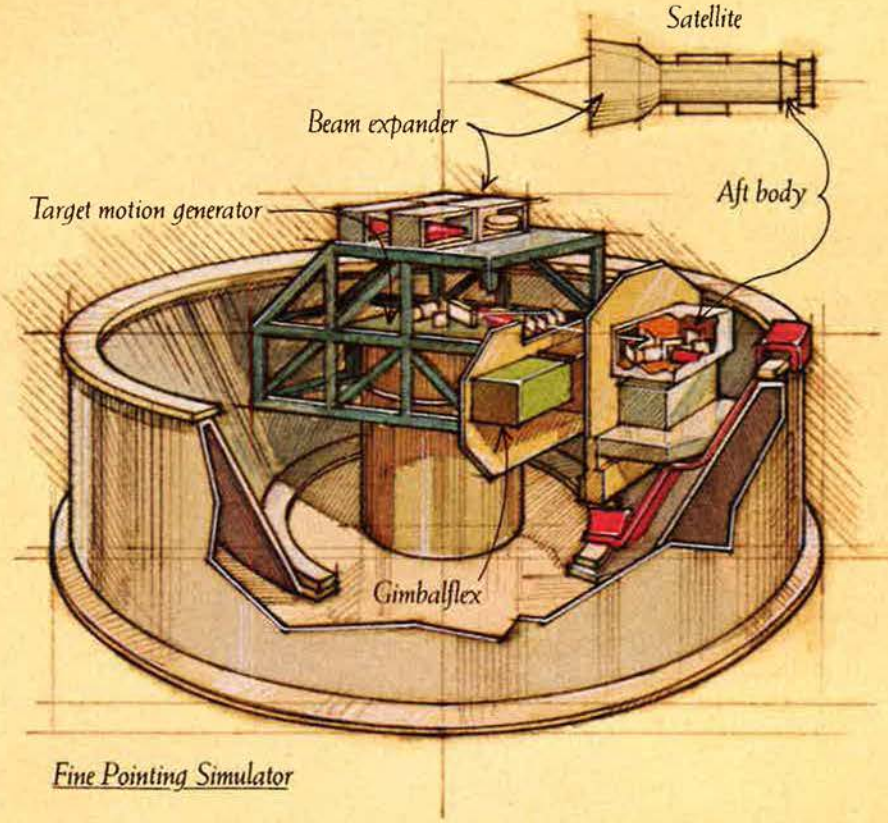

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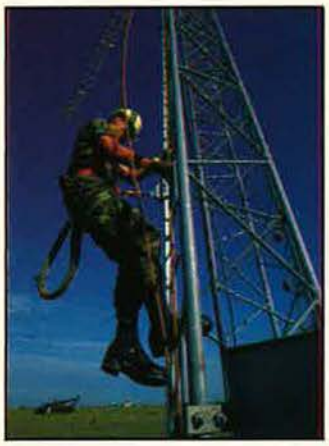

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About the cover: We invited a dozen individuals representing various USAF specialties to sit for the "Portrait of the Force." See box on p. 27 for an explanation of who these people are and what they do. Photo © Larry Chapman.

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An Editorial

Caught in the Box

By John T. Correll, EDITOR IN CHIEF

SUDDENLY there is talk in Washington that the $60.5 billion that President Bush took out of the Five-Year Defense Plan (FYDP) in January may not be concession enough. Deeper cuts are now rumored, with various percentages mentioned. Thus the pattern continues. The government, it might seem, cannot stick to any consensus whatever on the level of defense spending.

The Reagan rearmament program topped out in 1985. Between 1986 and 1989, defense budgets fell 11.4 percent behind inflation. At the "budget summit" in late 1987, amid calls for realism and reasonableness, the Administration yielded $230 billion from the FYDP and curtailed growth projections from five percent to two percent.

Accordingly, the last budget prepared by the Reagan Administration proposed two percent growth, after inflation, for defense. President Bush, however, promptly recalled that request and said he would ask instead for zero percent real growth, an inflation-adjusted freeze.

Almost immediately, the clamor began for further reductions. We should not be surprised. President Bush's January concessions will not establish a stable consensus any more than the budget summit did. If the Administration agreed today to a defense cut of ten percent, more reductions would be demanded within a year. The fact is that the federal government is caught in a financial box that it built for itself.

Over the past twenty-five years, the biggest growth in government spending has been for entitlement programs. In 1962, national defense accounted for 48.6 percent of gross federal outlays. Entitlements were 28.3 percent. By 1988, the positions had reversed. Defense was down to 25.9 percent, while entitlements had risen to 44.8 percent.

Congress has chosen to control entitlement programs indirectly, setting eligibility and benefit rules rather than voting on specific appropriations. Therefore, this huge section of the budget ($501.2 billion in 1988) is not really budgeted.

In reality, of course, entitlement benefits are only as automatic as politicians want them to be. For example, Budget Director Richard Darman proposes eliminating a cost-of-living allowance for military and federal retirees in 1990, although COLAs for other entitlement programs would be untouched.

The next wall of the box is the tax code. As a result of tax-reform legislation in recent years, a smaller percentage of GNP is now collected as general revenue. At the same time, Social Security taxes and collections for designated purposes have increased. This is not to say that current Social Security benefits are too generous or that the Social Security account is overfunded. The point is that the government has less flexibility than it once did in how it spends the total take from the taxpayers.

The main wall of the box is the Gramm-Rudman-Hollings Act. It requires the budget to be balanced by 1993. To ensure progress along the way, it sets annual deficit ceilings, each lower than the one before. In any year when the normal legislative process fails to reach the target (a $10 billion margin is allowed), automatic machinery takes over and allocates spending reductions by a predetermined formula. Entitlement programs are largely exempt, and half of the automatic cuts must come from defense.

The 1990 deficit ceiling is $100 billion, more difficult than the $136 billion limit in 1989, but nothing compared to what comes next. The ceiling will be $64 billion in 1991 and $28 billion in 1992. Forecasts of the 1990 deficit range from $126 billion to $141 billion. By any estimate, we are still a long way from zero, and the distance could widen, depending on how bad the savings-and-loan crisis turns out to be.

Public opinion opposes a cut in entitlement programs or an increase in taxes. It does, however, want the deficit eliminated. Congress and the Administration are struggling to satisfy that desire by chopping at the discretionary portion of federal outlays, which is only 41.7 percent of the total. There is no option about paying interest on the debt or—under the rules of the box—about funding of entitlements. Together, interest and entitlements account for 58.3 percent of the spending.

There will be much talk that the nation cannot afford so much defense, but that argument rings hollow. In times past, we allotted far greater shares of both GNP and the federal budget to defense without difficulty. The difference today is the box.

With the majority of government finances running on autopilot, the politicians keep returning to defense cuts as the deficit looms. A ten percent reduction of the defense budget would not make the deficit go away. Neither would a twenty percent reduction. It is not possible to solve the problem this way if we are to have any sort of meaningful defense left.

The box is about to get a lot tighter. The only way out of it is for leaders to lead and legislators to legislate. ■

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Airmail

The Commitment Gap

General Milton's article "The Commitment Gap" in the March '89 issue struck a raw nerve. I feel compelled to reinforce his argument that perhaps the Academy is making some mistakes in its admissions screening and later motivation.

The argument that a regular commission and a commitment to service has been replaced by a more selfish motivation begins with the first impression of the Air Force Academy and its admissions catalog. When you open the book, the first article you read is about the "career benefits and opportunities provided." The entire catalog reinforces the marketability [of an] individual [who has attended] USAFA. Sadly, the whole concept of service to country is summed up in a fourteen-line paragraph on p. 6. If we bill our Academy as an outstanding academic university, we will produce great scholars, but to produce warriors we must first and foremost ensure that all who apply understand that the Air Force Academy is a military institution whose sole charter is to forge career officers for the United States Air Force.

Capt. Michael R. Moeller, USAF
Washington, D. C.

Regarding General Milton's view that the worrisome rate of resignation of Academy graduates arises from a lack of commitment related to too high an aim at academic credentials: Underlying that possible, partial factor is one that is likely far more basic and significant. General Milton and all of us should, I believe, place the "pilot exodus" in the perspective of a culture that, increasingly in recent years, has inculcated a corrosive individualism of selfishness and greed throughout our lives. This has been accompanied by an incessant, self-serving drumbeat of "antigovernmentalism." In that light, perhaps, we should wonder why the resignation exodus isn't greater.

Even the *concept* of public service, in or out of uniform, has gone by the boards in recent years, hasn't it? (The USAF is part of "Government," we should remember.) After all, what has public service, duty, etc., got to do with "looking out for No. 1?"

Perhaps a thoroughgoing Academy education, under proper leadership, can help to counter that degenerative dimension of our culture and increase the graduate retention rate thereby.

Lt. Col. Charles Konigsberg, USAF (Ret.)
USAFA Faculty (1960–65)
Anchorage, Alaska

I usually agree with General Milton's views, but I must take exception to "The Commitment Gap." The crux of the General's argument is that the USAF Academy attracts intelligent candidates who use the Academy education and then pilot training as a springboard for an airline career. To stay this trend, the General suggests increasing the length of commitment graduates incur to discourage those who are not career-oriented. To quote the General, "If that were to reduce the pool of candidates and in the process the test scores of the entering class, the trade-off might be acceptable. . . ." If we follow this train of thought, we can logically deduce that an intelligent person will not select the military as a career; therefore, the military must make do with whomever it can get. I'm sure this is not what the General had in mind, but it serves to illustrate an important point: The USAF's historic pilot-retention problem cannot be blamed on the pilots.

General Milton too easily dismisses the effects of family separation, frequent moves, and uncertain hours by stating that the problem has always existed but that pilots have opted to stay anyway. In fact, the USAF has had retention problems during every airline hiring cycle in the last thirty years. The current problem is the greatest because the airlines are in the midst of an unprecedented expansion brought on by deregulation. The availability of an attractive alternative and dissatisfaction with the current Air Force system have driven huge numbers of pilots out of the service now and in the past. It is wrong and derogatory to suggest that men and women who spent nearly a decade of their lives serving our country in combat-ready positions lack commitment.

Increased graduate commitments will do nothing to stop the current exodus of pilots and will only delay the problem in the future. The real fix requires positive action by Congress and Air Force commanders immediately.

Sen. John Glenn is taking a step in the right direction by moving to increase pilot pay. To keep good people you must pay them what they're worth; even with the recent pilot bonus, Air Force remuneration is laughable compared to the airlines' [pay].

No one objects to being separated from his family for long periods during wartime when it's obviously necessary, but why does this practice continue in the form of remote tours in peacetime? Young pilots conclude that it is because Congress is unwilling to spend money to upgrade remote facilities and support military families there. Eliminate remote tours except for extreme cases and make those [tours] volunteer assignments.

Give pilots more control of their future by instituting a career pilot option so those not interested in management don't have to spend time out of the cockpit. Slash requirements for rated personnel in nonflying positions such as staff, air liaison officer, and field detachment officer.

Stabilize pilots at their flying as-

Do you have a comment about a current issue? Write to "Airmail," AIR FORCE Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Letters should be concise, timely, and preferably typed. We are sorry we cannot acknowledge receipt of letters to "Airmail." We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Photographs cannot be used or returned.—THE EDITORS

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signments for four years unless they volunteer to leave earlier to reduce the family disruption caused by frequent moves.

Why are college graduates with millions of dollars of flight training spending up to twelve hours a day on nonflying duties? Staff the squadrons with enough flight administration personnel to perform the clerical duties now being done by pilots, such as programming, training, mobility, and safety.

These are a few of the countless solutions available to Congress and upper-level commanders if they are willing to listen to the line pilots who are faced with the problems. The Air Force is a noble and worthwhile career, but it is the system's unresponsiveness, not the pilot's "lack of commitment," that leads so many of us to vote with our feet.

Edward R. Albers
St. Charles, Ill.

Three cheers for General Milton's article. . . . I am a USAFA grad about to close out five years of "coaching" cadets, three years at USAFA where I was an Air Officer Commanding my last year and the last two at West Point as the Air Force exchange "TAC."

I, too, have been alarmed at the number who question their commitment while cadets, not to mention after a few years of exposure to real hardships. They come in so pure and highly motivated, only to develop this attitude of "Just let me beat the Dean and not get found on a trivial honor violation, then I'll consider a career once I'm out in the 'real' Air Force."

I don't think the problem is so much with the admission screening as with the "later motivation." Academics consumes so much of their time and energy during the year that they give minimal effort to anything that isn't testable or fun. If they aren't fulfilling a graduation requirement, they are "charging up" for one.

The solution isn't easy, but General Milton's idea of upping the service commitment is the first of two crucial steps. This would require cadets to think a lot more about why they are attending an academy after the cheers of well-wishers have faded from memory.

The other thing we must do, concurrently, is reduce the academic pressures and clean up those things which so severely demotivate cadets. Too many courses place unrealistic demands on cadets' time. We also need to keep a close eye on Fourth Class System abuses, injustices in honor code administration, and inconsistencies in the discipline system. [Most] cadets yearn for leadership development, but come up disappointed because of the academic focus and misinformation or isolated problems with key developmental programs.

Certainly academics is important in the development of officers. So, too, are instruction and experience in the duty concept, ethical dilemmas, and looking out for the welfare of subordinates. Very little of this is found in the classroom. Yet these are the lessons that stand fast against those patented hardships of the military lifestyle.

Most important, cadets need more incentive to reflect on the moral and spiritual aspects of their officer training. These measures, accompanied by some easing of the academic work load, will enable us again to see a preponderance of graduates committed to service beyond self.

Maj. James R. Dart,
USAF
West Point, N. Y.

Defending the Defenders

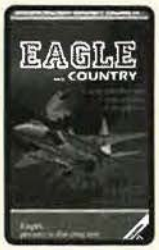
As a former security policeman, first sergeant, and medic, with two tours in Vietnam, I have never read a story with as much wrong information in it as Sergeant Coghlan's. *[See "Airmail," March '89 issue, p. 9.]* Where did he get his facts?

First, Tactical Air Command has medics assigned to accompany the air base ground defense flights to where they may be deployed, locally or otherwise. They are trained in tactical medical operations, but not in perimeter defense, which certainly is not their mission. Medics, upon receiving their orders to Vietnam, were given tactical training in the CONUS before leaving, then more training in-country after arriving. I can assure you, our medical personnel did miraculous, and often heroic, duty in Vietnam, and I'm mighty proud to have been in their number. When the need arises, the Air Force has a perfectly good system of augmenting medics into air base ground defense (ABGD) flights.

Second, the self-aid/buddy care system of first aid didn't come into existence until the 1960s. Prior to that time, we relied on the medics to render aid, and we did what we could if we remembered our first-aid classes. Since the inception of buddy care, it has saved countless lives. I'm sure it still does, and coupled with quick removal from the area of operations, survival in battle is enhanced for the

A 9G Ride

• EAGLE COUNTRY



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GENERAL DYNAMICS

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wounded. . . . If anything, I wish we could learn more buddy care, not less. Assigning more medics to a Security Police unit simply doesn't make sense, particularly as the ABGD mission is to the "wire" and not beyond, according to the MOA signed by the Chiefs of Staff of Army and Air Force. That means the medics will be in easy reach.

And last, but by no means least, I am sure my buddies who were assigned to the 377th SPS during Tet in 1968 would be deeply interested in knowing they got "wiped out"! If you ever have time and are in the area, please stop by and visit the USAF Security Police Museum at Lackland AFB. You will find a complete history of the accomplishments of the Air Force "Peacekeepers." Getting wiped out at Tan Son Nhut AB, Vietnam, was not one of them. As a matter of fact, if you read the report in the Office of Air Force History's book on the ABGD in Vietnam 1961–1973, by Roger P. Fox, you will see that there were nine US KIA and 151 WIA (p. 178). These figures include the entire population of Tan Son Nhut, the most populated base in Vietnam.

The fact is, not only did the 377th repulse the attacks, they did it with only a few casualties. The enemy paid a severe price for their folly. The medics did a grand job treating the wounded, but they did it primarily where they should have, namely at the 377th USAF Clinic or the US Army Hospital. Please don't get me wrong, I have the greatest admiration for the courage and skill of our Air Force medics, as they have saved my bacon on several occasions. I just think that they are properly trained and [employed] and that giving them infantry training would serve no useful purpose. Whenever we needed them, we always had our "docs" there, and I am positive they will be there in the future.

CMSgt. George H. Barrett, USAF
Covington, La.

Bashing the Advocates

Permit me to take issue with your editorial in the March '89 issue in which you describe the Grace Commission reports as "simplistic." We made a detailed study of the 1983 defense-related recommendations of the Grace Commission and found few that could be legitimately classified as antidefense. Our studies included comparisons of the Grace recommendations with the "Carlucci Initiatives." We found the Grace recommendations to be similar in many cases, but far more detailed and well-reasoned. The defense establishment enthusiastically endorsed Carlucci, but was hostile to Grace, a continuing syndrome confirmed by the editorial.

Anyone who has been deeply involved with the defense acquisition process, particularly those of us who have seen it evolve from relatively "lean and mean" in the 1950s to the bureaucratic nightmare that we have today, has to admit that *substantial* cuts could be made without reducing effectiveness. In fact, it can be argued that a less expensive system would actually increase effectiveness and shorten development cycles. The problem, of course, is that such changes require congressional action (as Grace made clear). Cost-saving measures also threaten the jobs of thousands of military and civilian managers and administrators. This aspect of the problem was made very clear to this writer by none other than

the then-Commander of ASD when we proposed a low-cost, commercial-practices approach to the Next Generation Trainer in 1981. Cost-effective approaches were unacceptable to the Air Force and the other services in the high-spending days of the early 1980s, setting the stage for the budget crunch of the 1990s.

DoD *could* do more with less, provided the services were willing to give up many of their pet "ilities" and Congress were willing to give up micromanagement. Unfortunately, neither is very likely to happen, so the popular—and simplistic—alternative is to bash the advocates of increased efficiency.

John C. Snedeker
President,
Synergistic Dynamics, Inc.
Savannah, Ga.

Desk-Bound Warriors

F. Clifton Berry's article, "Defense Procurement, European Style," *[see February '89 issue, p. 74]* is an accurate, objective assessment of the relative strengths and weaknesses of the defense acquisition systems of our European allies. However, I feel he has missed the crucial point in the debate over military as opposed to civilian control of the acquisition process. That point is the morale of the military personnel involved. The pertinent question is whether the US military has made a fundamental mistake by taking professionals who are, by definition, trained warriors and placing them into the "white collar" offices of an acquisition command.

All the commissioning programs emphasize the primary function of the military professional—being a warrior. Most cadets in ROTC and the service academies aren't even told about the acquisition branches of their services at their various "career fairs," yet the services continue to funnel more and more eager, young lieutenants into the desk-bound world of acquisition management. Why does a person who is trained (to varying degrees) in the art of warfare need to go to a job that is not much different from that of the average office worker? . . .

Many have argued that we need the military presence to ensure that the system meets the needs of the user, but almost every operational command already has an extensive staff to make sure program offices buy what the user needs. Besides, do junior acquisition officers straight out of college really have any idea what an operational user needs? Another common argument is that the old "just get it done" military ethic is needed in acquisition. It's a good ethic, but it doesn't do any good when it's the nonmilitary you're working with or the bureaucracy you're fighting. Beyond that, throwing waves of military acquisition "warriors" at an entrenched bureaucracy just covers up the problem of reforming the bureaucracy itself.

I don't believe anyone really joins the military with the intent of doing a job that could just as easily be done by a person with absolutely no military training. I would bet that the retention rate of acquisition officers is almost as bad as that for pilots, yet no one asks why. Could it be that junior acquisition officers don't really feel like they're in the military as they sit at their desks and answer the phone?

No one doubts that acquisition is a tough, arduous task that takes lots of hard work and experience. In addition, the government might not save any money by switching to a civilian acquisition agency, but the improvement in morale among its professional warriors would be enough to warrant the change. Let's use our warriors for the tasks of warriors and leave the acquisition to the civilians who are trained and experienced in the nuances of bureaucracy.

Capt. Stephen J. Wacker,
USAF
Hanscom AFB, Mass.

Zero/Zero Ejection

With reference to Bob Stevens's "There I Was . . ." in the March 1989 issue, the incident depicted actually happened. (This was the incident in Vietnam where a public information officer preparing for a ride in an OV-10 Bronco was ejected from the backseat while the aircraft was still on the ground.)

To set the record straight, the incident occurred at Da Nang AB sometime between August 1971 and March 1972. The fellow in question (no need to mention names in a national magazine) was a PIO assigned to Hq. Seventh Air Force. He was TDY to Da Nang and encountered an old friend who happened to be a Bronco pilot. After some discussion, the pilot agreed to take him for a ride. That's when the zero/zero (zero altitude/zero airspeed) ejection as depicted in the March issue took place. The ejection-seat rocket shot him about a hundred feet into the air. He said that one second he was in the Bronco—the next he was sailing through the air. Then the chute deployed, and he made one swing under the chute before hitting the ramp.

A side note on that incident: I understand that some of the aircrews flying the Bronco at Da Nang treated him to a steak dinner that night for being the first person to actually eject from an OV-10 in a zero/zero situation. His incident proved that a zero/zero ejection from a Bronco was survivable—something that had never actually been demonstrated in a real-life situation.

So, in retrospect, we have a strange twist of fate: For once it was the actions of a PIO in combat that helped Bronco aircrews feel safer.

By the way, this incident is one of my favorite "war" stories from Vietnam . . . because PIOs are sometimes rejected, and even occasionally dejected, but a PIO ejected is a rare occurrence—and he was my boss!

Lt. Col. Ken Gardner,
USAFR
Bloomington, Minn.

Roll Call

Please send any information regarding the whereabouts of 1983, '84, and '85 graduates of Alconbury American High School (DODDS: RAF Alconbury, England) to:

Melanie Regan
8755 52d Ave.
Elmhurst, N. Y. 11373
or
Susan Lehman
207 1/2 Union
Walla Walla, Wash. 99362

I am interested in contacting anyone who served with my uncle, MSgt. Robert G. Levi, 813th Bomb Squadron, 482d Bombardment Group, Eighth Air Force. Robert Levi served in the Air Corps from August 1941 until his death in the crash of B-17F #42-5793 near Eye, Suffolk, on November 10, 1943. He was first assigned to 325th Bomb Squadron, 92d Bombardment Group, stationed at Bovington and then Podington, before being transferred to the Pathfinder unit in August 1943.

The family would be interested in hearing from anyone who served with Robert, especially those who may have known him in the Pathfinder unit stationed at Alconbury.

Robert Morgan
105 North Wood Rd.
Freeville, N. Y. 13068

I would like any information regarding a pilot who flew in the Fourteenth Air Force in China for General Chennault. He was in the 76th Fighter

The first production tactical radar to incorporate gate arrays that meet very high speed integrated circuit (VHSIC) requirements is operational in U.S. aircraft. Hughes Aircraft Company's APG-70 radar system built with the new U-Series gate arrays has been installed in U.S. Air Force F-15 eagle aircraft. The HCMOS-II gate arrays have an effective channel length of 1.1 microns, a complexity of up to 40,000 gates, and can operate at 25 megahertz clock rate. Seventeen different designs of the U-Series gate arrays are used in 121 places on the standard avionics modules of the APG-70 programmable signal processor. The APG-70 is produced for later model F-15C/D and F-15E aircraft under contract from McDonnell Douglas Corporation.

An advanced targeting aid will allow pilots to launch multiple Maverick missiles and provide maximum combat effectiveness during low-altitude, high-speed attacks. The pod-compatible Automatic Target Recognizer, under development by Hughes, receives imagery from an advanced infrared sensor and then uses statistical pattern recognition algorithms, combined with high-speed digital processing, to automatically detect, classify, and prioritize targets in the field of view. If desired, the system can make target selection and automatically fire the missiles. Several missiles could be launched in seconds, enabling the pilot to complete the mission quickly, possibly in a single pass.

An advanced concept in helicopter dipping sonar will provide a significant increase in anti-submarine warfare (ASW) capability. Under development by Hughes for the U.S. Navy's Airborne Low Frequency Sonar (ALFS) program, the new sonar is designed to operate from both the LAMPS MKIII and the CV helicopters. This will enhance the Navy's Airborne ASW effectiveness in both inner and middle zones of battle group deployment. Hughes, and its teammate Thompson Sintra ASM, will demonstrate the performance of this new sonar in flight tests aboard an SH-60B helicopter in early 1989. The team's ALFS concept embodies leading-edge technologies in the areas of high gain acoustic arrays, electro-mechanical kinematics, fluid dynamics, signal processing and man-machine interfaces.

A new generation air-to-air missile is two-thirds more reliable than earlier versions. The AIM-54C+, a third generation Phoenix missile built by Hughes for the U.S. Navy, demonstrated its reliability in laboratory and flight tests which included subjecting the missiles to the extremes of temperature and vibration that would be encountered during extended duty on board aircraft. The Phoenix missile is the Navy's primary long-range fleet defense weapon used exclusively with the F-14 Tomcat aircraft and the Hughes AWG-9 weapon control system. The Phoenix was the first air-to-air missile that could be launched in multiple numbers, each one against a different target.

A new technique for packaging large-scale integrated circuit (IC) chips will permit much denser packaging on the substrate than previously possible. High-density multichip interconnect (HDMI) technology, being developed by Hughes, is designed to meet the needs of the next generation of VHSIC II hybrid circuits, which require dense packaging with no signal degradation at frequencies over 100 MHz. HDMI packaging achieves these results using a multi-layer substrate, a polymer dielectric highly suited to fine line metallization processing, and lithography techniques capable of producing 10-micron line widths. The technology is expected to be used in radar, sensing, tracking and guidance programs.

For more information write to: P.O. Box 45068, Los Angeles, CA 90045-0068

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Squadron, 23d Fighter Group. A Maj. Robert Costello, he was KIA in the latter part of 1943. This information is to do a profile on his life. Photos will be helpful or copies of same.

Also I would like to know of any AVG men who left China and went to the Philippines before the surrender there. This information is crucial to ascertain if a man named Mouleuko, Molenko, or Baluko (pronounced somewhat like that) was in the Philippines as a fighter pilot around that time.

William T. Cote
P. O. Box 123
Fall River, Mass. 02722
Phone: (508) 764-0313

I am trying to locate three men who were on the crew of the B-29 *Lancer,* based on Guam during World War II. Stanley A. Lapinski, Charles L. Hardin, and William P. Yarns were attached to the 62d Squadron, 39th Bomb Group, Twentieth Air Force.

Glen C. Durkin
109 Seneca Rd.
Rochester, N. Y. 14622
Phone: (716) 467-7698

Collectors' Corner

I am in possession of a complete set of technical manuals (still in the leather case) for a B-24A aircraft from World War II. They include airframe, electronics, engine, etc. I am looking for a worthy cause to donate these manuals to, be it a museum or an aircraft society. Contact me for more information.

Ernest L. Dunbar
Box 161
APO N. Y. 09127

I am a Turkish university student and interested in military aviation very much. I have a photograph collection about aircraft. I have also started a collection of squadron patches, belonging to both US and its allies. Any donations of patches from readers will be greatly appreciated. You can contact me at the address below.

Mete Alpaslan
Elazig Cimento Fabrikasi
Lojmanlari No: 4
Elazig, Turkey

B-26s at Monte Cassino

Your February Anniversaries states: "February 15, 1944: The Abbey of Monte Cassino, Italy, is destroyed by 254 American B-17s and B-25s attacking in two waves."

Approximately seventy-two of those aircraft were Martin B-26s of the 319th Bomb Group. I know because I was the flight engineer/top turret gunner on one of them.

H. A. Watson
Oklahoma City, Okla.

Bias and Myopia

Your March edition was excellent! You and your staff are to be commended.

I particularly enjoyed and learned from the articles by Thom Shanker and Harriet Fast Scott. Mrs. Scott is always instructive, and if you exist only to give her a forum for education, you accomplish a major task.

My only quibble, and it is just that, is your omission of sea-based forces from what otherwise appears to be a complete and excellent description of "Strategic Missiles" in John Taylor's "Gallery of Soviet Aerospace Weapons." This comment highlights my bias, but also points out your myopia.

Rear Adm. W. J. Holland, Jr.,
USN (Ret.)
Fairfax, Va.

Capitol Hill

By Brian Green, CONGRESSIONAL EDITOR

Washington, D. C.

ICBM Consensus?

A compromise that would fund both the rail-garrison Peacekeeper ICBM (in which two ten-warhead ICBMs would be carried on trains based at existing military facilities) and the Midgetman Small ICBM may be in the works. According to testimony before the House Armed Services Committee by Air Force Chief of Staff Gen. Larry D. Welch, if both programs continue at a normal pace (with initial operating capability for the rail-garrison Peacekeeper in 1992 and the SICBM in 1994 or 1995), current Air Force ICBM modernization budgets will fall only $50 million short in Fiscal Year 1990 and $4.1 billion short through FY '94.

According to General Welch, an additional 500 rail-garrison Peacekeeper warheads would cost $9.1 billion, while 500 SICBM warheads would cost $24.8 billion. The cost to move the fifty Peacekeepers now deployed in silos to rail-garrison basing would be $5.6 billion. A number of legislators have indicated the possibility of a congressional consensus on ICBM modernization this session.

General Welch also indicated that further Air Force budget cuts would mean stretch-outs of major acquisition programs, the six largest being the B-2, the F-16, the F-15E, the C-17, the Advanced Tactical Fighter, and the Milstar military satellite program. He voiced opposition to further cuts in the already-slashed B-2 Stealth bomber program, force structure, and readiness and sustainability.

General Welch opposed "carry-hard" basing for ICBMs, a basing mode recently resurrected by a panel that included the chairmen of the House and Senate Armed Services Committees (HASC and SASC), Rep. Les Aspin (D-Wis.) and Sen. Sam Nunn (D-Ga.). Carry-hard basing involves placing missiles in hardened canisters that can be hidden in a large number of relatively inexpensive silos. General Welch described carry-hard as more expensive (about $40 billion for 500 Small ICBM warheads), less able to withstand Soviet countermeasures, and less satisfactory operationally.

Welch, McGovern Testify

The Air Force will pursue a three-fold approach to "leverage" its investments in a constrained budget environment, according to testimony by Acting Air Force Secretary James McGovern and Gen. Larry Welch before the House Appropriations Defense Subcommittee. The three elements: ensuring the readiness of forces already fielded, improving existing systems with cost-effective modifications and upgrades, and developing new systems that take advantage of US technological superiority—but "only when the need clearly requires" exploitation of advanced technologies.

Secretary McGovern and General Welch said that the top Air Force priority is to recruit, train, motivate, and retain good people. The Secretary and the Chief both called for continued congressional support for a targeted pilot bonus, improved Aviation Career Incentive Pay, and the proposed 3.6 percent military pay raise. Air Force priorities within the overall task of building and maintaining forces are "to modernize strategic forces, maintain a high level of readiness and sustainability, increase airlift capability, modernize tactical forces, and integrate our improved ability to operate in space into every mission area."

Piotrowski on ASAT

Rep. Ron Dellums (D-Calif.), Chairman of the HASC Research and Development Subcommittee and in the past a staunch opponent of DoD's antisatellite (ASAT) effort, indicated that he will try to block a Pentagon reprogramming of funds to quickly develop a limited-capability laser ASAT. The reprogrammed funds would be used to modify a Mid-Infrared Advanced Chemical Laser (MIRACL) at White Sands, N. M., to provide it with the capability to damage sensitive parts of Soviet satellites.

The Soviet Union has a reliable, thoroughly tested antisatellite (ASAT) system capable of threatening satellites in low earth orbit, a robust launch and support infrastructure, and a "warfighting attitude in space"—all of which the US lacks, according to Gen. John Piotrowski, Commander in Chief of the US Space Command, in HASC testimony. At the same time, the Soviets are rapidly becoming more dependent on their space assets. General Piotrowski argued that these trends make development of a US ASAT system critical.

General Piotrowski contended that an arms-control agreement banning ASATs would be unverifiable because ASAT capabilities are inherent in many other space systems. Even if it were verifiable, he said, he would oppose a ban because Soviet reconnaissance satellites pose serious threats to US terrestrial forces.

Pay for SES

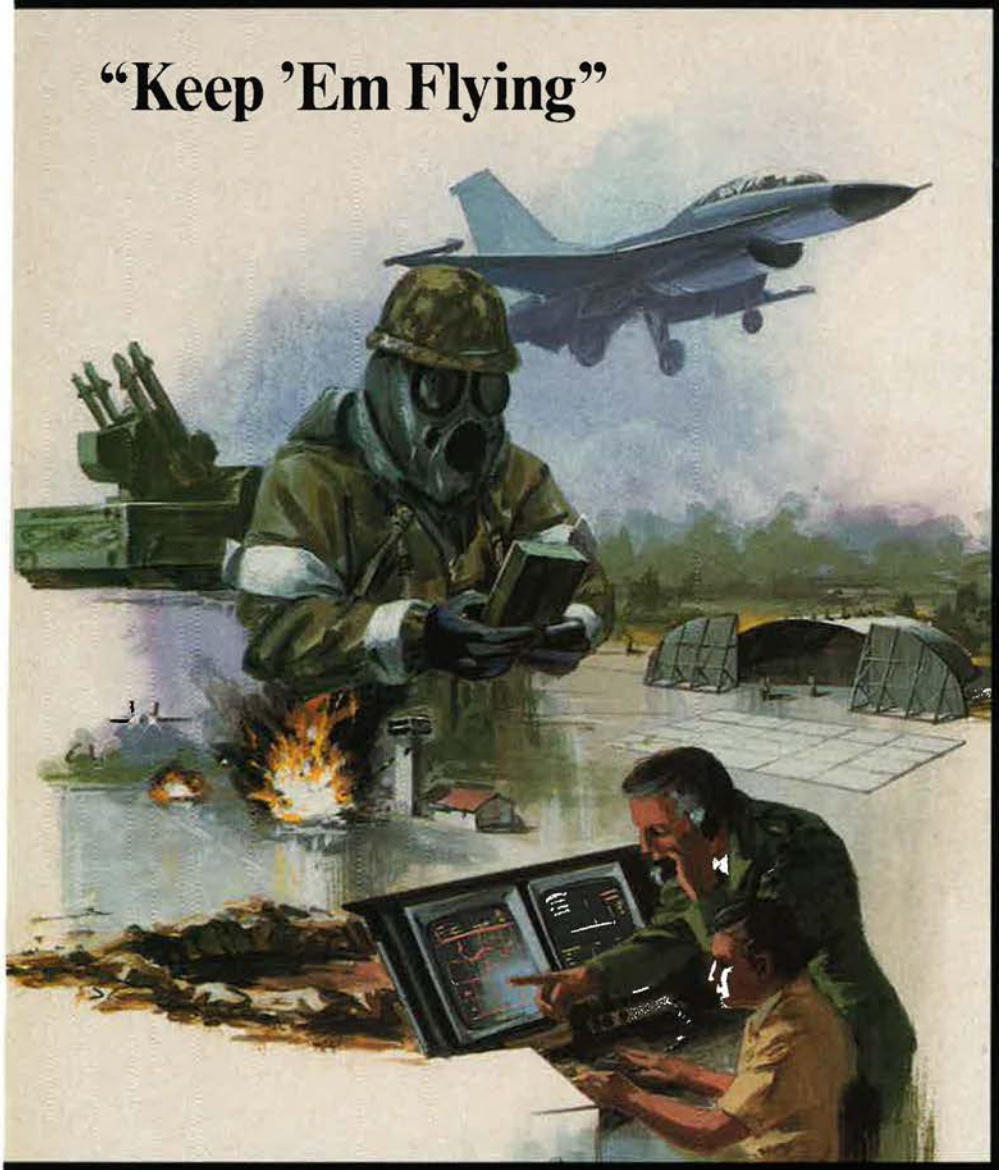
Representative Connie Morella (R-Md.) has introduced a bill to boost the Senior Executive Service pay by twenty percent, and Rep. Mary Rose Oakar (D-Ohio) is preparing a bill that would authorize a thirty percent increase. The measures are intended to restore the purchasing power of salaries for key people—including administrators, scientists, engineers, and senior civilians in the military departments—that have not kept pace with inflation and fall far short of comparable private sector pay. Further legislation would be required to provide for a general officer pay raise.

An effort to provide SES employees a fifty-one percent increase, linked with a congressional pay hike, was defeated by Congress in February. Efforts are also under way to increase the two percent FY '90 pay raise for Civil Service personnel to 3.6 percent, as proposed for the military.

Closings Move Forward

The House Armed Services Committee voted 43 to 4 to disapprove a resolution that would block the closures recommended by the Commission on Base Realignment and Closures. The Commission's recommendations will go into effect unless Congress votes to disapprove them. ■

"Keep 'Em Flying"



The Challenge

The Air Force's mission: provide superior air power to U.S. forces.

Today, with that mission faced by threats more numerous and potent than ever, early warning of attack is vital, and recovery more difficult. And through it all, the Air Force must keep its planes in the air.

The Task

Create an integrated, survivable system of sensors, communications and computers which links operations essential to Air Base Operability. Give base commanders the ability to assess damage, locate and mark chemically contaminated areas, and coordinate recovery activities to support sortie generation.

Two proposed Air Force programs, the Survivable BRAAT Communications System (SBCS), and the Fixed Site Detection and Warning System (FSDWS), are the first steps toward this integrated network.

The Response

TRW is committed to helping the Air Force gain SBCS and FSDWS capability. Our extensive experience with C^3 applications means unmatched ability to provide optimum systems at minimum cost. Key to the success of SBCS and FSDWS is a system which satisfies minimum requirements, yet has the flexibility to grow.

TRW is intimately familiar with the challenge. Our participation in past and future exercises focuses our attention on the wartime C^3 problem. We have invested heavily in the development of reusable C^3 systems and software tailored to users' needs. We have developed an SBCS testbed which is currently being used for Man-Machine Interface prototyping and software performance evaluation.

On the Enhanced Reconnaissance, Detection and Identification program, TRW developed the concept of operations and specifications for air base chemical warfare defense systems. The results supported planning for FSDWS, which will ultimately provide chemical detection and warning systems to air bases worldwide.

Our proprietary rapid prototyping and hardware simulation tools can model system displays and hardware configurations before actual systems are built. By visualizing a system before it is developed, users can choose hardware suites which will accept future technological refreshment while at the same time reducing development costs.

Software written in DoD-standard Ada provides the interoperability necessary to interface with other tactical systems. TRW is a world leader in this important language, and our commitment to Ada includes a company-sponsored education program which has trained nearly a thousand employees at a cost of over $2 million.

Affordable expertise. Big-system knowledge and the flexibility to start small. TRW is ready to help the Air Force meet the initial challenges of air base operability —and to "keep 'em flying."

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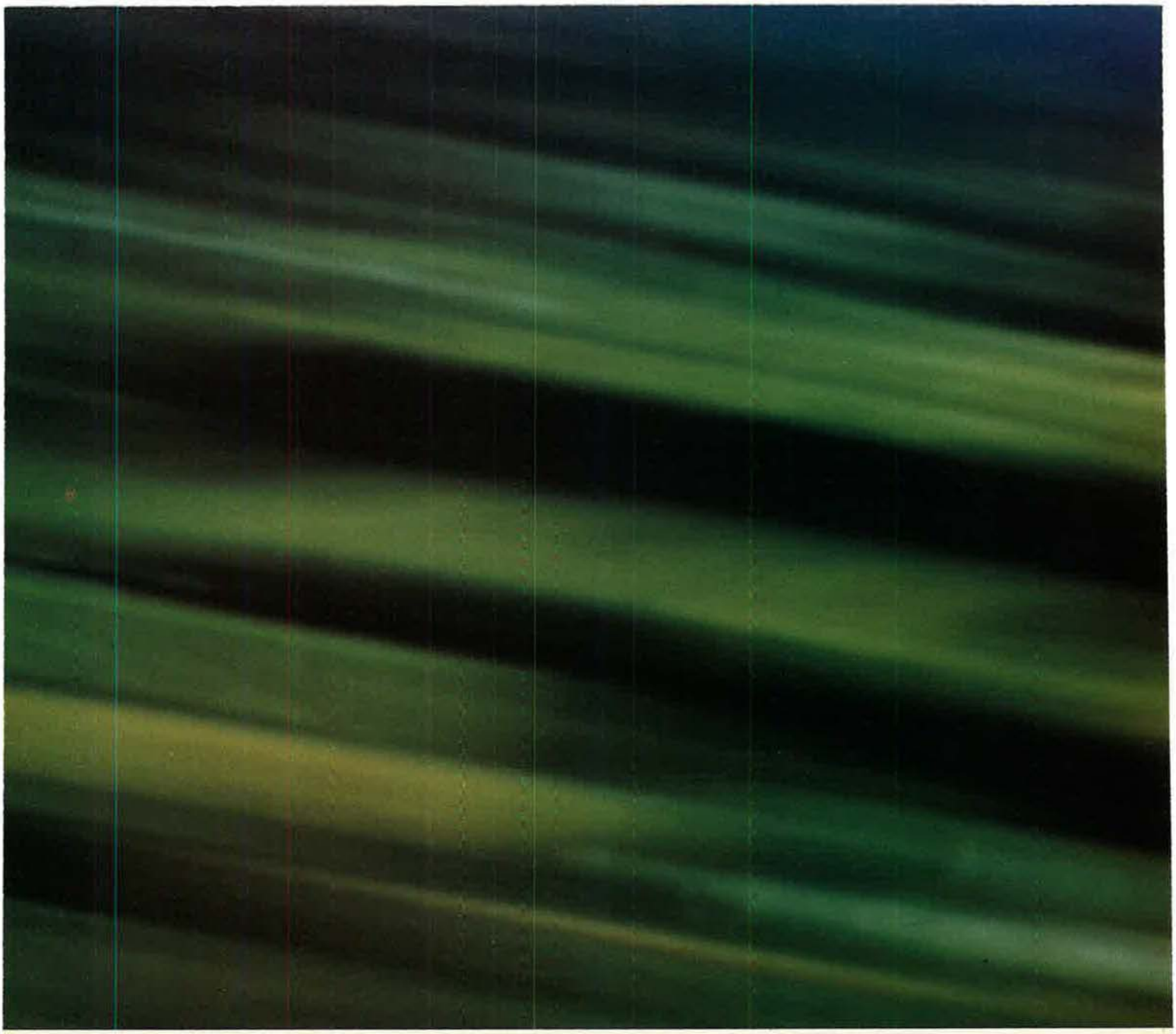

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The answer: Raytheon's ALQ-184. An update of an existing ECM jamming pod, the new system will enable aircraft to cope with any foreseeable radar-guided threat right through the 1990s.

The key to the ALQ-184 is Raytheon multibeam technology. Through its use, the older pod's single high-power transmitter tube was replaced by a bank of reliable mini-tubes that feed a high-gain antenna array.

Results: The new system has greater sensitivity, faster response time, and higher effective radiated power. It can detect threat signals and direct high-power jamming signals against multiple hostile radars.

And because the ALQ-184 uses multiple mini-tubes instead of a single big one, even the loss of several tubes will not disable the system.

Fully maintainable by Air Force personnel, the ALQ-184 and its support needs are now in production. It's another example of how Raytheon's

the ALQ-184.

long experience with system fundamentals can improve an older system's capabilities.

For more information, write Raytheon Company, Government Marketing, 141 Spring Street, Lexington, MA 02173.

The ALQ-184 jamming pod is being deployed on U.S. Air Force F-4s and F-16s.

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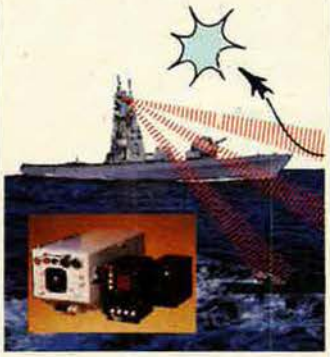

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For over four decades, Rafael's innovative systems have accumulated a track record of countless successful missions.

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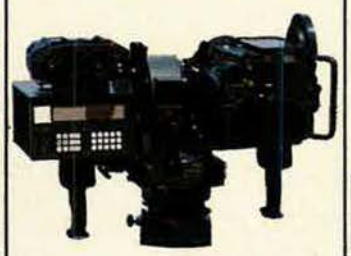

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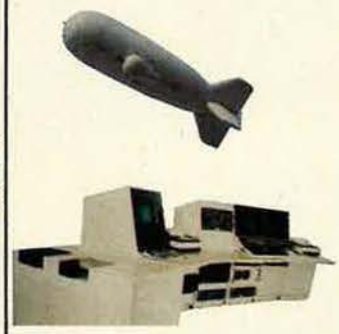

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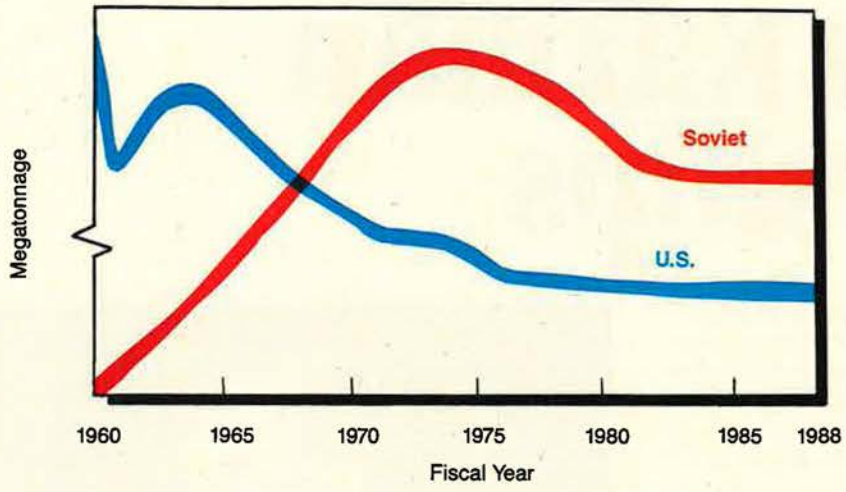
The Chart Page

Edited by Colleen A. Nash, STAFF EDITOR

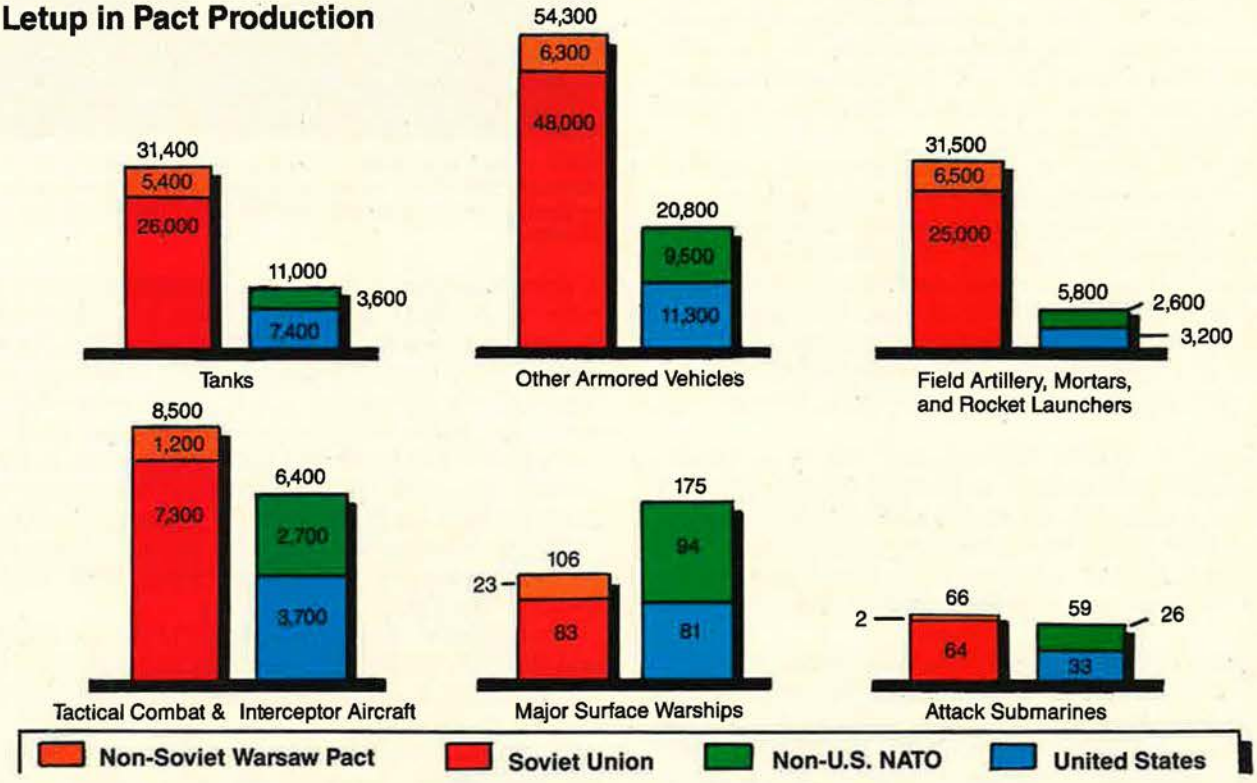


The Megatonnage Shift

Thirty years ago, Soviet nuclear forces had far less megatonnage in their weapons than US forces did. Today, the situation is reversed. One reason is that the United States has introduced safer and more effective systems while reducing the number of weapons and their total explosive power.

Source: DoD Annual Report to Congress, FY '90.

No Letup in Pact Production



This chart shows the production of selected weapons for NATO and Warsaw Pact forces from 1979 to 1988. According to the DoD Annual Report to Congress, the Warsaw Pact will maintain its quantitative advantage over NATO in most categories of weapon systems and is positioned to hold that advantage for at least the next five years—even if reductions proposed by Gorbachev are implemented.

The Aerospace Education Foundation will begin this new program in 1990 with ten awards to AFROTC graduates working toward advanced degrees.

The von Kármán Scholarships

BEGINNING next year, Air Force ROTC graduates working toward advanced degrees in science, mathematics, and engineering will be eligible for von Kármán scholarships, newly established by the Aerospace Education Foundation. Ten awards of $5,000 each will be made the first year, according to James E. Keck, President of the Foundation.

The scholarships are named for Dr. Theodore von Kármán, the renowned science advisor to the Army Air Forces in World War II, who was asked by Gen. H. H. "Hap" Arnold in 1944 to organize and chair a Scientific Advisory Group. This group published two classic reports, "Where We Stand" and "Toward New Horizons," and was later replaced by the Scientific Advisory Board, also chaired by von Kármán.

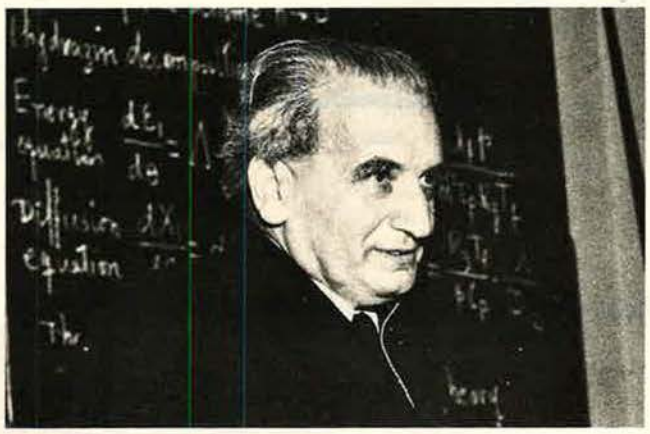
The first group of scholarship recipients will be chosen from the body of AFROTC cadets graduating in 1990. The grants will apply to graduate work they pursue before beginning active duty with the Air Force.

In subsequent years, the number of scholarships could increase, President Keck said. The Foundation has placed an initial sum of money in a special scholarship fund. It will now seek to build the endowment with contributions from AFA chapters and corporate support.

Gerald V. Hasler, Chairman of the Foundation's Scholarship Committee, explained the two plans by which donations can be made. Each "share" contribution of $200 will be held in the scholarship account until it can be combined with twenty-five other "share" donations to create one of the ten basic scholarships each year.

A contribution of $5,000, however, will add an additional scholarship to the number awarded. While donors may not designate the individual recipient of a scholarship thus created, they will be able to designate the state or the school from which the recipient is to be selected.

President Keck and Mr. Hasler emphasized that one hundred percent of the donations to the fund will be awarded in scholarships. None of the money will be used for administrative or fund-raising purposes.



AEF's newest scholarship is named for Dr. Theodore von Kármán (1881–1963), scientist, engineer, and teacher, who shaped Air Force and NATO science policy for nearly two decades.

Application forms and further information will be provided to AFROTC detachments this fall. Applications must be received by the Aerospace Education Foundation no later than February 1, 1990. A committee of Foundation trustees and advisors will select the winners, and awards will be announced in May 1990.

President Keck pointed out that the von Kármán scholarships will complement existing scholarships given by AFA chapters and state organizations. These programs raise and award about $50,000 a year. Most recipients are cadets in Junior or Senior AFROTC or in the Civil Air Patrol.

Susan Marler, Program Director of the Foundation, said that 190 Air Force Association chapters have indicated an interest in grants and scholarships, at both local and national levels.

According to the Department of Education, graduate school costs range from $6,500 to $15,500 per year at present and will probably rise by ten percent next year. A von Kármán scholarship alone will not finance a Master's degree—but it will provide a big step toward that goal for an enterprising young officer. ■

Aerospace World

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Washington, D. C.

★ President George Bush has quelled what was becoming a raging controversy in both the Administration and Congress over the proposed FSX fighter deal between the US and Japan. As a compromise, the President will let the deal go through but will apply safeguards that will prevent Japanese contractors from getting access to the most important technology involved with the fighter.

In late 1987, the Japanese Defense Agency decided to base its FSX (Fighter Support Experimental) on the General Dynamics F-16C Block 40 aircraft, rather than build an indigenous fighter. The Japanese want to build 130 to 150 aircraft at a cost of $8.3 billion.

Last November, the two countries signed a Memorandum of Understanding (MOU) that cleared the way for industry negotiations to begin in earnest on development work shares and equipment for the FSX, which the Japanese have designated SX-3. Japan will bear all development and production costs, and US firms will receive between thirty-five and forty percent of the work on the aircraft.

In mid-January, it was announced that General Dynamics would use Japanese composite material technology to build two wingsets for the prototypes that Mitsubishi Heavy Industries, Ltd., the lead Japanese contractor, will be building. Manufacturing two sets of wings would reportedly give GD a full understanding of the materials Japan will be using to build the FSX. This knowledge, plus the benefits to be gained from the FSX's active-element phased-array radar (a first for a fighter aircraft) being developed in Japan, would be the US's primary technology benefit from the deal.

The controversy came to a head in March when US Secretary of Commerce Robert Mosbacher asserted that the information the US would be giving to the Japanese would enable them to start a commercial aircraft industry (which the Japanese have stated they want to do) and would be unfair to US commercial aircraft builders. National Security Advisor Brent Scowcroft and Secretary of State James Baker argued that the deal should go through unchanged.

— Photo by Erik Simonsen

A great deal of controversy has sprung up over the proposed FSX fighter deal between the US and Japan. President Bush has reached a compromise decision over the new fighter, which is based on the General Dynamics F-16C Block 40 aircraft.

The President's compromise does not involve modifications to the MOU, but does request clarification of a few points. The President wants formal assurances that US firms will get forty percent of the production workshare. The White House also wants to exclude software source codes that integrate the radar, avionics, and weapons.

The compromise is seen as a major victory for Secretary Mosbacher, who also received a Presidential promise to include the Commerce Department in any future deals. The "clarifications" are seen as a concession to Congress. Once the proposed arrangement is formally presented to Congress, the legislators will have thirty days to approve or recommend rejection of the deal. Although the deal is expected to pass eventually, long, possibly bitter, discussions are expected in Congress. Another major controversy expected to rise with the deal is the export of engine technology to the Japanese.

★ It took a while to lift off, but once it got going, the year's first space shuttle mission was nearly flawless. The STS-29 mission overcame several delays and finally got under way from Pad 39B at the Kennedy Space Center in Florida at 9:57 a.m. on March 13.

The flight had been delayed for almost a month because technicians needed time to replace the high-speed turbopumps in the shuttle orbiter's main engines. The pumps were replaced while *Discovery* sat on the pad, marking the first time a major repair had been performed while the orbiter was vertical and out of the vehicle assembly building.

Mission specialists Robert Springer (a space rookie) and James Buchli, both Marine Corps colonels, launched the fourth Tracking and Data Relay Satellite System satellite (TDRSS-4) the first afternoon of the flight. TDRSS-4 was carried to geosynchronous orbit (22,300 miles) at a stationary point off the east coast of South America by the Air Force-developed inertial upper stage. The satellite launch, the major goal of the mission, completes the TDRSS constellation and will allow NASA to close six earth tracking stations.

TDRSS-4 replaces TDRSS-1, which now becomes the on-orbit spare.

Along with TDRSS-3 (in orbit over the Pacific), TDRSS-4 gives NASA the capability to be in contact with the space shuttle and other spacecraft more than eighty percent of the time, instead of fifty percent of the time as in the past. Because of the two satellites, the length of the communications blackout when *Discovery* reentered the atmosphere was greatly reduced. Contel operates the TRW-built TDRSS satellites for NASA.

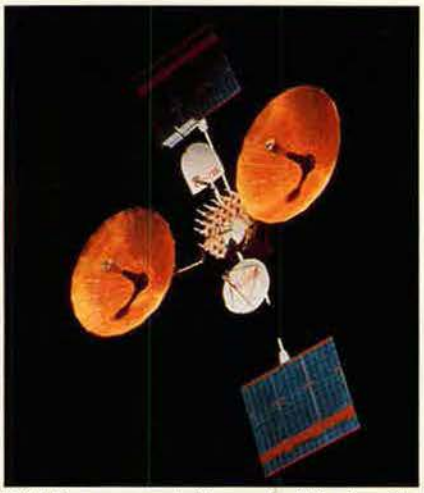
An electrical system problem threatened to shorten the flight, but the astronauts turned off some equipment on the orbiter to conserve power. The problem, fluctuations in the manifold pressure on one of three cryogenic hydrogen tanks, was really only faulty instrument readings, and the crew was allowed to return to full power.

The rest of the days in space were spent conducting experiments and making movies. The experiments included protein crystal growth, a study of the effects of weightlessness on chicken embryos, and a separate effort to see how weightlessness effects broken leg bones in rats. An experiment to test a potential cooling system for the space station *Freedom* was also conducted.

Dr. James Bagian, M.D., a civilian astronaut, conducted several medical experiments, including one in which blood flow was measured in Mission Commander Michael Coats's head. The experiment was televised, and Dr. Bagian noted with a smile that there was indeed blood flow in the Navy captain's head. *Discovery* pilot John Blaha, an Air Force colonel, was the principal operator of the 70-mm IMAX camera used to film pollution in the atmosphere for a feature film that will premiere next spring.

After seventy-nine orbits, the twenty-eighth shuttle flight concluded with a landing at Edwards AFB, Calif., at 9:36 a.m. on March 18. A near-record crowd of almost 500,000 people watched the landing on runway 22 at Edwards. The concrete runway was used to test the redesigned brakes on the shuttle orbiter.

Damage to *Discovery* was minimal. Eighty-two thermal protection tiles were slightly damaged, and only ten of the tiles will have to be replaced. Nearly 200 tiles were damaged on *Atlantis* after STS-27 last December when the insulation of the nose cap on the solid rocket booster (SRB) came off during launch. A new type of insulation bonded in a new way was used on STS-29, and this solved the problem. Other damage included a small leak in one of the shuttle's main engines, a cracked reinforcing ring frame on one SRB, and damage to the thrust vector control mechanisms on both SRBs at splashdown.



With the successful launch of the fourth Tracking and Data Relay Satellite System satellite on the last shuttle mission, the three-satellite constellation is now complete.

STS-29 was the first space mission during which a woman, Lisa Malone, acted as the "Voice of Shuttle Control" for TV. STS-28, a dedicated Department of Defense mission, will not be launched until July, after STS-30 is launched.

★ With more than $5 billion worth of prime contracts and $3 billion more to its divisions and subsidiaries in FY '88, McDonnell Douglas has retained the top spot in the Department of Defense's annual listing of its top 100 contractors. McDonnell Douglas, headquartered in St. Louis, Mo., garnered the top spot for the second consecutive year and has now been ranked first in four out of the last five listings.

The biggest mover at the top of the rankings was Tenneco Inc., which moved from thirteenth to third place ($2.05 billion in FY '87 to $5.06 billion in FY '88) on the strength of the aircraft carrier and *Los Angeles*-class attack submarine contracts it received last year. Grumman ($2.8 billion in FY '88 down from $3.4 billion in FY '87) was the only firm to fall out of the FY '88 top ten. Seven firms in the top ten of the latest rankings did a lower business dollar volume than they did in FY '87.

The top ten firms of FY '88, with dollar value of all contracts awarded to the parent company and its divisions and that firm's FY '87 rank, are shown in the accompanying box.

The total value of the FY '88 DoD contract awards was $137,049,236,000, or about four percent less than the $142,482,708,000 awarded in FY '87. Of that total, $90,129,842,000 was awarded to the top 100 concerns, or about six percent less than the $95,354,393,000 awarded to the top 100 in FY '87.

Twenty firms did more than $1 billion in business with DoD in FY '88, which was two fewer companies than were in the "billion dollar club" in both FY '86 and FY '87. Fourteen firms not listed in the FY '87 tally made the top 100 in FY '88. The 100th-ranked company, Figgie International Inc., received contracts that totaled $128,683,000.

★ The computer revolution has brought change to almost every area of modern life. Few fields of endeavor have felt the impact of the computer revolution so keenly as aeronautics has. In recognition of the changes the computer has brought, the Smithsonian Institution's National Air and Space Museum will open a new permanent gallery this month called "Beyond the Limits: Flight Enters the Computer Age."

This new gallery, which opens to the public May 12, will be organized in seven exhibit areas to illustrate the primary applications of the computer in aerospace—design, aerodynam-

The Top Ten

Firm	Contract Values (000s)	FY '87 Rank
1. McDonnell Douglas Corp.	$8,002,741	1
2. General Dynamics Corp.	6,522,124	2
3. General Electric Co.	5,700,635	3
4. Tenneco Inc.	5,057,922	13
5. Raytheon Co.	4,055,346	6
6. Martin Marietta Corp.	3,715,106	7
7. General Motors Corp.	3,550,180	5
8. Lockheed Corp.	3,537,656	4
9. United Technologies Corp.	3,508,055	8
10. The Boeing Corp.	3,017,839	9

ics, computer-aided manufacture, flight testing, air operations, flight simulators, and space operations.

Each exhibit area will include at least one interactive computer terminal so visitors can see for themselves the kinds of tasks that computers perform. One of the interactive terminals will allow visitors to design and "launch" rockets into space. This program was the winning entry in a nationwide software-writing contest cosponsored by the museum and Apple Computers.

The winning program was written by two juniors and a sophomore at the California Institute of Technology in Pasadena, Calif. This program, plus one or two others, will be on display later this year at the museum's booth in the US Pavilion at the Paris Air Show.

Other exhibits in the new gallery include a flight-ready backup to the Mariner 10 probe, which was the first man-made object to fly past more than one planet; a full-scale mockup of the Grumman X-29 Forward Swept Wing technology demonstrator, an aircraft so inherently unstable it could not fly without the aid of computers; and a Cray-1, one of the first production supercomputers. As an illustration of computer-aided manufacturing, a robot will "build" and fly paper airplanes.

★ **AWARDED—Col. Roger L. Grimsley,** Deputy Commander of the 67th Tactical Reconnaissance Wing at Bergstrom AFB, Tex., has been named the **winner of the Aviator Valor Award** for 1988. While he was flying a routine RF-4C training mission last spring, both of Colonel Grimsley's engines caught fire. Keeping the plane flying long enough to avoid populated areas, Colonel Grimsley ordered a bailout seconds before the aircraft hit the ground. The Aviator Valor Award is given for performing a conspicuous act of valor during an aerial flight.

TSgt. William A. Wray, a C-5 flight engineer with the 436th Military Airlift Wing at Dover AFB, Del., has been named as **winner of the Cheney Award** for 1988. Last spring, Sergeant Wray was performing ground duties before takeoff from Islamabad, Pakistan, when he noticed a fire in his aircraft's wheel well. Sergeant Wray single-handedly kept the fire under control until firefighters arrived. The Cheney Award is presented to an individual who performs an act of valor, extreme fortitude, or self-sacrifice in a humanitarian interest in connection with an aircraft.

Dr. Robert R. Barthelemy, Air Force Systems Command's senior civilian program director for the National Aerospace Plane Joint Program Office (NASP JPO) at Wright-Patterson AFB, Ohio, has been named the **winner of the Gen. Thomas D. White US Air Force Space Trophy** for 1988. Responsible for the direction and management of the program to build and test a hypersonic aircraft, Dr. Barthelemy, through his guidance and leadership, has made the NASP program so far a great achievement. The trophy is awarded for outstanding contributions to the nation's aerospace progress during the previous calendar year.

A **C-5 crew from** the 436th Military Airlift Wing at **Dover AFB, Del.,** has been named the **winner of the Mackay Trophy** for 1988. Flying out of Rhein-Main AB, West Germany, last spring, the crew carried highly sensitive Department of Energy equipment to the Soviet Union to monitor Soviet nuclear device testing. Under many restrictions and limitations, the crew used its training and experience to make the mission a success. The crew members were: Capt. Michael Eastman, Maj. John Cirafici, Capt. James Runk, Capt. Kelly Scott, SMSgt. Arthur Vogt, MSgt. Robert Downs, MSgt. Charles Finnegan, MSgt. James Maurer, MSgt. William Tobler, TSgt. William Nunn, Jr., SSgt. Timothy Hahn, Sgt. Andrew Benucci, Jr., and Sgt. Thomas Siler. The Mackay Trophy is given for the most meritorious flight of the year.

One of the **largest incentive award** checks ever presented by the Air Force **was given to Westinghouse Electric Corp.** in ceremonies on March 6. The $6.7 million award was given to Westinghouse for reliability improvements made by the company to the AN/APG-68 radar used in the General Dynamics F-16C/D aircraft. The improvements allow the radar to operate for more than 100 hours without any maintenance actions, which is a reliability increase of more than 150 percent in two years. These improvements will save the Air Force more than $60 million in radar spares and repairs.

A **bronze bust and plaque honoring Maj. Fernando Ribas-Dominicci,** whose F-111 was downed during Operation Eldorado Canyon, the 1986 attack on terrorist strongholds in Libya, **will be dedicated at Laughlin AFB, Tex.,** on May 26. *(See "Aerospace World," March '89 issue, p. 34.)* Major Ribas-Dominicci entered undergrad-

—Photo © Larry Chapman

Our front-cover "Portrait of the Force" was taken at Andrews AFB, Md., by Larry Chapman. The participants, representing 571,000 members of today's active-duty USAF plus their Air Force Reserve and Air National Guard counterparts, are (from left to right and front row to back): SSgt. Stephanie R. Watson, 27 years old, an in-flight passenger service specialist; Capt. Peter Q. Nyce, 30, Air National Guard F-4D pilot; SSgt. William L. Campbell, 27, electrician; 1st Lt. Chinran Chang, 31, operating-room nurse at the Malcolm Grow Medical Center; SSgt. Robbie L. Turner, 25, security policeman; SrA. Elizabeth Velazquez, 24, ground radio technician; CMSgt. Gary R. Mayner, 42, DCANG weapons specialist; SrA. Christopher T. Joe, 21, education specialist; Lt. Col. Darrel A. Massey, 42, 89th Military Airlift Wing navigator; SSgt. Wayne Sears, 32, SAAM cargo specialist; TSgt. Randall J. Morris, 32, C-141B crew chief; and Sgt. Jim Nunley, 26, jet engine mechanic.

May Anniversaries

• *May 5, 1914:* A patent for hinged inset trailing-edge ailerons is issued.

• *May 16–27, 1919:* Navy Lt. Cmdr. Albert C. "Putty" Read and a crew of five fly from Trespassy Bay, Newfoundland, to Lisbon, Portugal, via the Azores, in the Curtiss NC-4 flying boat. This is the first crossing of the Atlantic Ocean by air. Two other NCs started the trip, but did not complete the flight. The trip took fifty-three hours and fifty-eight minutes of actual flying.

• *May 2, 1924:* After Maj. Frederick Martin and Sgt. Alva Harvey, flying in the Douglas World Cruiser *Seattle*, crash into a mountain in Alaska on April 30, Lt. Lowell Smith is named commander of the Air Service's around-the-world flight. The three remaining DWCs take off May 3 to island-hop down the Aleutians. The *Chicago*, *New Orleans*, and *Boston* crews reach Japan by the end of the month. It takes Major Martin and Sergeant Harvey ten days to hike to safety.

• *May 16, 1929:* At the first Academy Award ceremonies in Los Angeles, Calif., the Paramount movie "Wings" wins the Oscar for Best Picture for the years 1927–28. The World War I flying epic starred Richard Arlen, Buddy Rogers, and Clara Bow. A very young Gary Cooper played a minor character who was killed off.

• *May 1, 1934:* Navy Lt. Frank Akers makes a blind landing in a Berliner-Joyce OJ-2 at College Park, Md., in a demonstration of a system intended for aircraft carrier use. In subsequent flights, he makes takeoffs and landings between NAS Anacostia, D. C., and College Park under a hood without assistance.

• *May 21, 1944:* Operation Chattanooga Choo-Choo—systematic Allied air attacks on trains in Germany and France—begins.

• *May 9, 1949:* The Republic XF-91 Thunderceptor jet/rocket hybrid successfully completes its first test flight at Muroc, Calif. This unusual aircraft has variable incidence wings of inverse taper design (wider at the tips than at the roots).

• *May 11, 1949:* President Harry S. Truman signs a bill providing for a 3,000-mile-long guided missile test range for the Air Force. The range is subsequently established at Cape Canaveral, Fla.

• *May 25, 1954:* A Navy ZPG-2 airship lands at NAS Key West, Fla., after staying aloft for 200.1 hours. Cmdr. M. H. Eppes, the airship captain, is later awarded the Distinguished Flying Cross.

• *May 28, 1959:* Astrochimps Able and Baker are recovered alive from the Atlantic after their flight to an altitude of 300 miles in the nose cone of a PGM-19 Jupiter missile launched from Cape Canaveral.

• *May 11, 1964:* The North American XB-70 Valkyrie is rolled out at Palmdale, Calif. Designed to fly at three times the speed of sound and at altitudes above 70,000 feet, the XB-70 was originally planned as a manned bomber, but funding limitations only allow for two aircraft, to be used strictly for testing and research.

• *May 18–26, 1969:* In the dress rehearsal for the moon landing, *Apollo-10* astronauts Tom Stafford and Eugene Cernan fly the lunar module, nicknamed *Snoopy*, to within nine miles of the lunar surface. Astronaut John Young remains in orbit aboard *Charlie Brown*, the command module. (John Young is today the Special Assistant for Engineering, Operations, and Safety at the Johnson Space Center in Houston, Tex.)

uate pilot training at Laughlin in June 1976. The Laughlin Heritage Foundation of Del Rio, Tex., decided to establish the memorial because of the pilot's ties to Laughlin and because his widow, the former Blanca Linda Berain, is from Del Rio's sister city of Ciudad Acuna, Mexico.

★ **PURCHASES**—The **Air Force made its sixth and final** Alternate Fighter Engine **(AFE) buy** on February 27, and for the third straight year, Pratt & Whitney emerged as the winner. P&W will build seventy engines (sixty-four percent of the buy) with sixteen F100-PW-220 engines to go into F-15s and fifty-four engines to power F-16s. General Electric will build thirty-nine F100-GE-100 engines for F-16s only.

Pratt & Whitney also emerged as the winner in the **first buy of** the Increased Performance Engines **(IPEs).** Each contractor will build four IPEs in FY '89 to support a field service evaluation. P&W will build sixty-four F100-PW-229 engines (fifty-six percent of the buy) in FY '90 for F-15s and F-16s, while GE will build fifty F100-GE-129 engines for F-16s only. P&W received contracts totaling $146.4 million, while GE received contracts totaling $126.8 million for the IPEs, which will be in the 29,000-pound thrust class.

The Army awarded **LTV** a $16.7 million contract to **begin production of** the Army's Tactical Missile System **(ATACMS).** The contract calls for the first sixty-six missiles plus equipment and spares. The thirteen-foot-long ATACMS missile has a range of more than sixty miles. Each of the missiles will contain 1,000 high-explosive bomblets in its warhead section. The missiles will be launched from the M270 Multiple Launch Rocket System (MLRS) vehicle. ATACMS has been in engineering development since 1986. The production ATACMS will be delivered in 1990.

Under a **new program called** the Integrated Maintenance Information System **(IMIS),** the Air Force wants **to develop a portable computer that an aircraft maintainer can use** as a primary source of information for technical data, maintenance instruction, troubleshooting, training, job reporting, and ordering parts. Contracts were awarded to McDonnell Douglas ($19,088,862) and General Dynamics ($15,304,756) in mid-February to analyze, design, develop, and test prototype systems. Next May, one contractor will be selected to continue the remainder of the fifty-six-month IMIS program. The IMIS system will consist of a workstation for use in the shop, a portable computer for flightline use, and an aircraft panel for interacting with aircraft systems.

★ **DELIVERIES**—British Aerospace handed over the **first Panavia Tornado ADV** (Air Defense Variant) **to Saudi Arabia** on February 9. The first of twenty-four ADVs was slated to arrive in Saudi Arabia by April. The Royal Saudi Air Force has 120 Tornados (in two versions) on order.

Raytheon delivered its first production AIM-120A Advanced Medium-Range Air-to-Air Missile **(AMRAAM)** in February 23 ceremonies at its plant in Lowell, Mass. This was the first of seventy-five missiles to be delivered under a $162 million Lot I contract. The company had previously delivered fifteen qualification missiles to the Air Force for testing. Hughes, the lead AMRAAM contractor, delivered its first production missile last fall. The 33d Tactical Fighter Wing at Eglin AFB, Fla., will be the first operational unit to receive AIM-120As later this year.

Sabreliner delivered the twenty-fourth and **final rebuilt T-33 Shooting Star to Ecuador** in late February. The rebuilt and modified aircraft, called AT-33s, have new Collins radio and avionics systems, a zero-time (rebuilt) Allison J33 engine, six hardpoints for 3,000 pounds of ordnance, and a strengthened fuselage and wing structure. The aircraft, sold to Ecuador through the Foreign Military Sales (FMS) program, had been stored at the Aerospace Maintenance and Regeneration Center at Davis-

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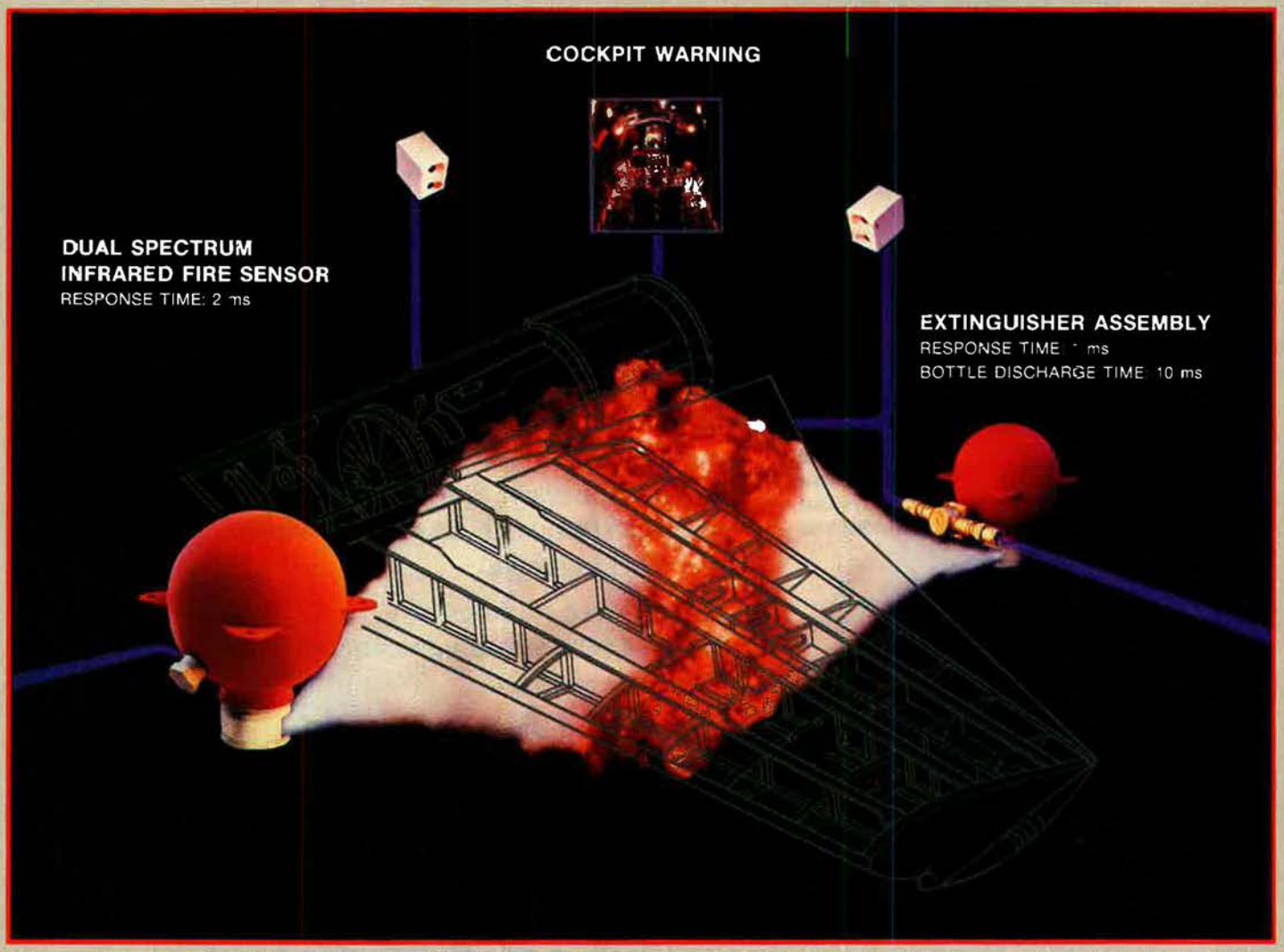

TOTAL SENSING AND SUPPRESSION TIME: APPROXIMATELY 40 MILLISECONDS

WHERE THE KNOWLEDGE OF THE SPECTRUM

IS THE TECHNOLOGY OF SURVIVAL

The Bell-Boeing V-22 Osprey tilt-rotor prototype made its first flight on March 19 at Bell Helicopter's Flight Research Facility in Arlington, Tex. The Osprey, which combines the vertical capabilities of the helicopter with the speed of a fixed-wing aircraft, will be used by the Marines, Navy, and the Air Force.

Senior Staff Changes

PROMOTIONS: To be **Lieutenant General:** Henry **Viccellio,** Jr.
To be **Major General:** George B. **Harrison.**
To be **Brigadier General:** Bruce L. **Fister.**
To be **ANG Major General:** Philip G. **Killey.**
To be **ANG Brigadier General:** Donald W. **Shepperd.**

RETIREMENTS: B/G Maralin K. **Coffinger;** M/G Elbert E. **Harbour;** Gen. William L. **Kirk;** M/G Donald L. **Lamberson.**

CHANGES: Col. (B/G selectee) Charles C. Barnhill, Jr., from DCS/Pers., Hq. MAC, Scott AFB, Ill., to Cmdr., US Forces Azores, USLANTCOM, and Cmdr., 1605th MASW, Twenty-First AF, MAC, Lajes Field, Azores, replacing B/G James C. McCombs . . . **M/G Edward P. Barry,** from Cmdr., Ballistic Sys. Div., and Prgm. Dir., SICBM Office, AFSC, Norton AFB, Calif., to Vice Cmdr., ASD, AFSC, Wright-Patterson AFB, Ohio, replacing retired M/G Elbert E. Harbour . . . **M/G Gaylord W. Clark,** from DCS/Plans, Hq. AFSPACECOM, Peterson AFB, Colo., to Vice Cmdr., Hq. AFSPACECOM, Peterson AFB, Colo., replacing retiring M/G Ralph E. Spraker . . . **AFRES B/G John J. Closner III,** from Cmdr., 10th AF, AFRES, Bergstrom AFB, Tex., to Dep. to Chief, AFRES, Washington, D. C., replacing AFRES B/G Shirley M. Carpenter . . . **Col. (B/G selectee) James L. Cole, Jr.,** from Spec. Ass't for Joint Matters, Joint Staff, OJCS, Washington, D. C., to IG, Hq. MAC, Scott AFB, Ill., replacing retiring B/G Floyd E. Hargrove . . . **Col. (B/G selectee) Robert E. Linhard,** from Spec. Ass't to the Pres., and Sr. Dir., Def. Prgms. & Arms Control, NSC, The White House, Washington, D. C., to Dep. Dir., Strategic P&P, J-5, OJCS, Washington, D. C. . . . **B/G Richard C. Milnes II,** from Vice Cmdr., Warner Robins ALC, AFLC, Robins AFB, Ga., to Dir., Inter-American Def. College, Ft. McNair, Washington, D. C.

B/G Ronald N. Running, from Ass't Dep. Dir., Int'l Negotiations, J-5, OJCS, Washington, D. C., to Dep. Dir., Int'l Negotiations, J-5, OJCS, Washington, D. C. . . . **ANG Col. (ANG B/G selectee) Donald W. Shepperd,** from Dep. Wg. Cmdr., 102d FIW, Otis ANGB, Mass., to Dep. Dir., ANG, Washington, D. C., replacing retiring ANG B/G John F. McMerty . . . **B/G Stanley O. Smith,** from Cmdr., 45th AD, SAC, Pease AFB, N. H., to C/S, Def. Mapping Agency, OSD, US Nav. Obs., Washington, D. C. . . . **Col. (B/G selectee) Michael J. Torma,** from Chief, Quality Assurance Div., AFOMS, Bolling AFB, D. C., to Dir., Prof. Affairs & Quality Assurance, AFOMS, Bolling AFB, D. C., replacing retiring B/G Rufus M. DeHart, Jr. . . . **Col. (B/G selectee) Ralph G. Tourino,** from IG, Hq. AFSC, Andrews AFB, Md., to Cmdr., Ballistic Sys. Div., and Prgm. Dir., SICBM Office, AFSC, Norton AFB, Calif., replacing M/G Edward P. Barry . . . **Col. (B/G selectee) Michael G. Vergamini,** from DCS/Pers., Hq. USAFE, Ramstein AB, Germany, to Dir., M&P, J-1, Joint Staff, OJCS, Washington, D. C. . . . **M/G (L/G selectee) Henry Viccellio, Jr.,** from DCS/Logistics, Hq. TAC, Langley AFB, Va., to Vice Cmdr., Hq. TAC, and Vice CINC, USAFLANT, USLANTCOM, Langley AFB, Va., replacing L/G Jimmie V. Adams. ■

Monthan AFB, Ariz., and were trucked to Perryville, Mo., where they were remanufactured. The refit effort cost approximately $1 million per aircraft.

★ **MILESTONES**—After a delay of almost eight months, the **Bell-Boeing V-22 Osprey** tilt-rotor prototype **made its first flight** at Bell Helicopter Textron's Flight Research Center at Arlington, Tex., on March 19. Bell test pilot Dorman Cannon served as the aircraft commander (who, in the V-22, will sit in the right seat), while Boeing test pilot Dick Balzer sat in the left seat during the fifteen-minute flight. The aircraft's engines and rotors remained in the upright, helicopter mode throughout the three takeoffs and landings the plane made. The V-22 attained an altitude of thirty feet and a top speed of twenty knots. The six V-22 aircraft test aircraft are all scheduled to be flying by the end of the year.

The **first captive carry flight of the** AGM-129A Advanced Cruise Missile **(ACM) over Canada was carried out** on March 2. A B-52 crew from the Air Force Flight Test Center at Edwards AFB, Calif., flew over the Beaufort Sea, along the Mackenzie River valley, and over the Primrose Lake Air Weapons Range in northern Alberta before returning to Edwards. The mission, performed to collect data with the Stealthy ACM, was the first test of the weapon outside the US. General Dynamics is the lead contractor for the ACM, while McDonnell Douglas is the second-source manufacturer.

Buck Rogers, look out! On February 23, the Navy's **MIRACL/SLBD** (Mid-Infrared Advanced Chemical Laser/Sea Lite Beam Director) **experimental high-energy laser system successfully engaged and destroyed a small supersonic target** for the first time. The test, conducted at the White Sands Missile Range in New Mexico, was designed to show that a laser system could acquire, track, and direct enough energy to a supersonic target (a modified RIM-8 Talos missile called a Vandal, flying in a cruise missile profile) to destroy it. The test was conducted under the Balanced Technology Initiative program to validate the lethality of a high-energy laser system against targets in flight. Tests against subsonic targets were completed in 1987.

Also on February 23, **the first guided launch of an AIM-7** Sparrow air-to-air missile **from an F-16 was successfully carried out** over the Pacific Missile Test Center at Point Mugu, Calif. The missile was shot

from a test F-16B to evaluate modifications made to the aircraft under the Air Force's Air Defense Fighter (ADF) program. The unarmed missile scored a direct hit on a Teledyne Ryan BQM-34S Firebee drone in a head-on aspect shot at a range of about twelve miles.

In a related note, the **first ADF F-16 was delivered** to the 114th Tactical Fighter Training Squadron at Kingsley Field, Ore., on March 1. The Air Force plans to modify up to 270 F-16A/B aircraft to the ADF standard. Eleven Air National Guard units and the "schoolhouse" at Kingsley Field are scheduled to receive the upgraded aircraft.

The **Air National Guard's Academy of Military Science** (AMS) at McGhee Tyson Airport, near Knoxville, Tenn., **graduated its 6,000th student** on February 16. The milestone commissioning certificate went to 2d Lt. John S. Williams of the 186th Tactical Reconnaissance Group at Key Field, Meridian, Miss. AMS, established in 1971, is the only precommissioning program in the Guard, and it provides approximately forty percent of the Air Guard's annual officer accession.

The **Air Reserve Personnel Center** (ARPC) at Lowry AFB, Colo., **celebrated its thirty-fifth anniversary** during the month of March. Created as the Air Reserve Records Center in 1954, ARPC now houses the personnel records of more than 250,000 members of the Air National Guard and the Air Force Reserve. Included in that figure are more than 13,000 individual mobilization augmentees (IMAs).

★ **NEWS NOTES—Canada's Human Rights Commission ruled** on February 20 that **women must be integrated into combat units** of the Canadian Armed Forces. The three-member commission ruled that "full integration is to take place with all due speed, as a matter of principle, and a matter of practice, for both active and reserve forces." The Canadian military has been conducting trials with women in combat units over the past year. Women are now slotted in noncombat roles and make up nine percent of the 85,000-member Canadian Armed Forces.

After three-and-a-half years in storage at Air Force Plant 4 in Fort Worth, Tex., **the General Dynamics F-16XL technology demonstrator was flown** on March 9. The aircraft was flown the next day to NASA's Dryden Flight Research Facility at Edwards AFB, Calif., where **it will be modified for a test program** to evaluate concepts designed to improve sustained high-speed flight. The aircraft will be fitted with an experimental wing glove perforated with thousands of tiny laser-cut holes connected to an air pump in the fuselage. The setup is expected to promote smooth, uninterrupted airflow over the wings in supersonic flight, decreasing drag and turbulence and consequently reducing fuel consumption. The test program will last three or four years.

The **Navy has designated the USS *Memphis* (SSN-691) to become a research and development platform** for advanced submarine technology. This is the first time an operational sub has been detailed as a research vessel. While the *Memphis* will retain its full combat capability, the nuclear-

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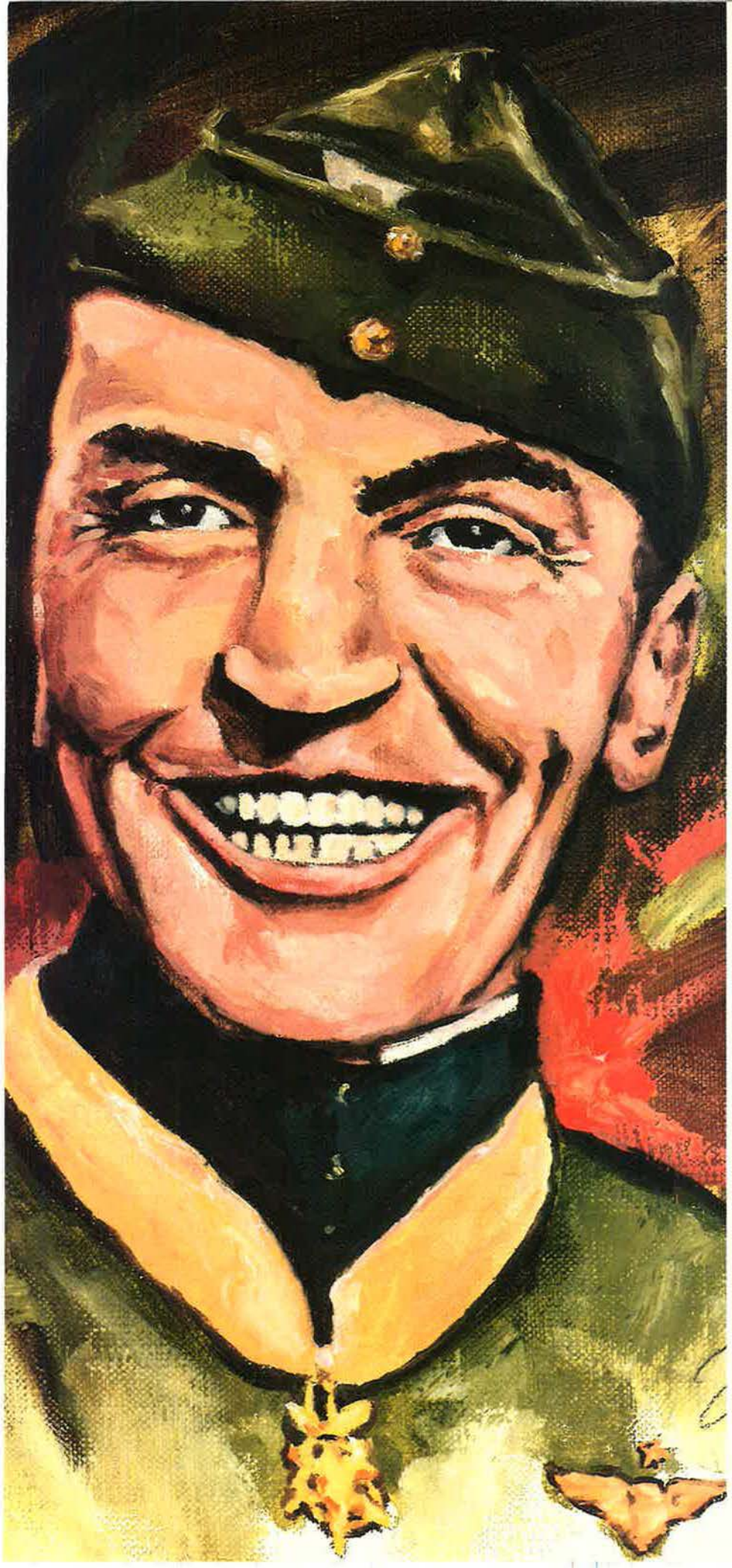

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Eddie Rickenbacker
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Cessna Silverwings

powered, *Los Angeles*-class attack submarine will be withdrawn from active service later this year. A dedicated research submarine increases the Navy's flexibility to test new concepts. Current R&D projects are carried out on whatever submarine is handy.

In its continuing effort **to assure quality in spare parts acquisition,** Air Force Logistics Command **(AFLC) has created a program called "Blue Ribbon Contracting"** that is designed for spare parts contract awards of less than $1 million. "Blue Ribbon" contractors are those firms that have a proven record of delivering parts on time and with a minimum of quality deficiencies. Under the program, AFLC is permitted to award contracts to "Blue Ribbon" firms that may not have tendered the lowest bid, but nonetheless represent the best overall value to the government. A "Blue Ribbon" contractor can be paid up to ten percent more than the low bidder's proposal, although AFLC finds it often gets a proven contractor offering the lowest price. Forty-eight firms are on the "Blue Ribbon" list.

The **first undersea test launch** of the Lockheed UGM-133A **Trident II,** or D5, sea-launched ballistic missile on March 21 **was unsuccessful.** The missile was launched from the USS *Tennessee* (SSBN-734) off the coast near Cape Canaveral AFS, Fla. The missile performed normally until it broke the surface and its first stage ignited. The D5 then veered off course, cartwheeled, and was destroyed after four seconds of flight. The Navy will study telemetry data to determine the cause of the failure. Counting land tests, this was the third failure in twenty tests of the Trident II.

Under a self-defense program initiated by Pacific Air Forces Commander in Chief Gen. Merrill A. McPeak, **the 2,700 officers of PACAF not currently armed will be issued a .38-caliber revolver.** The sidearms will permit the officers to perform their duties unhampered by a shoulder weapon in time of crisis. The pistols are to be kept at the officer's workplace and are not to be taken off base or into certain facilities on base. The PACAF security police force has made the transition to the new M9 9-mm automatic pistol, so there are 1,850 .38s available in the command. Additional pistols are in storage at the Warner Robins Air Logistics Center in Georgia. Chaplains and medical officers will be exempt from carrying the .38s.

A small number of Lockheed C-130s are going to be converted into bombers. They won't be used for dropping bombs, though. **Seven surplus Air Force C-130As are being modified** by the Hemet Valley (Calif.) Flying Service **as dedicated "flying fire trucks"** for the US Forest Service. In contrast to the Modular Aerial Firefighting Systems (MAFFS), which are on removable pallets, used on Air National Guard and Air Force Reserve C-130s, the Forest Service's new aircraft will have an eight-compartment, 4,000-gallon retardant tank permanently installed, as well as eight hydraulically operated doors on the belly of the fuselage. The C-130 bombers will have a crew of three and will replace several C-119s in the firefighting role.

★ **DIED—Kermit Beahan,** the bombardier on the B-29 *Bockscar,* which dropped the atomic bomb on Nagasaki, Japan, in 1945, of a heart attack on March 9 in a hospital in Nassau Bay, Tex. He was seventy. Regarded as one of the best bombardiers in the 509th Composite Group, Captain Beahan was chosen to go to London to get the specifications for the hook-type bomb release mechanism used in the RAF's Lancaster aircraft so it could be adapted to hold the atomic bombs. He flew on one of the chase planes on the Hiroshima raid and dropped instruments to measure the blast. On August 9, 1945, it was Captain Beahan who spotted the break in the clouds over Nagasaki that allowed the raid with the plutonium-based "Fat Man" bomb to be carried out.

Retired Air Force **Lt. Gen. Harold W. Grant,** communications expert and deputy administrator of the Federal Aviation Administration from 1962 to 1965, of a heart attack at Malcolm Grow Medical Center at Andrews AFB, Md., on March 17. He was eighty-two. During World War II, he was chosen to equip Lord Louis Mountbatten's command post aircraft with communications and electronic gear. General Grant helped establish the Air Force's air communications and electronics staff officers' course in 1948. He was deputy commander of Fifth Air Force during the Korean War and was later commander of Air Force Communications Service. He then served as the Air Force's telecommunications policy director as a civilian until 1970. ■

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GENERAL DYNAMICS

The X-30 National Aerospace Plane is out front in a broad jump to new technologies—but there is one problem in the way.

Technology Hits the Cost Barrier

BY JAMES W. CANAN
SENIOR EDITOR

"A major challenge for us lies in finding ways to acquire the capabilities that we will need without incurring the very high costs that we have today. That isn't asking for magic. It's just recognizing that cost has become a major part of the technology equation.

"As our cost dilemma becomes stronger and stronger, we are being forced to become more creative in coping with it. Technology itself is going to have to provide some solutions. We are coming to understand that we have to reshape the way we work technology."

So says Dr. Robert W. Selden, Chief Scientist of the Air Force, in sizing up the service's state of affairs in science and technology. Ranging in his discussion through such R&D arenas as aircraft, spacecraft, computers, lasers, radars, and electronic combat, Dr. Selden sees high promise for future Air Force systems.

He warns, however, that R&D may be robbed of its potential by the prohibitive expense of bringing it to fruition. The costs of the technologies and of the systems for which they are destined may turn out to be unacceptably high unless the Air Force does a better job of restraining them, the Chief Scientist says.

Dr. Selden cites the National Aerospace Plane (NASP) as a good example of a future system that "offers great capabilities but involves complex technologies that likely will be very expensive." Those technologies "challenge us, as we think through the capabilities that they will bring, to devise ways of doing them that are smarter than we've done before."

The Chief Scientist wryly adds: "We can't be under any illusions that we're going to find out how to make a Piper Cub do the jobs that we want the NASP to do."

In the NASP program, directed by USAF and involving NASA, the Navy, and the Defense Advanced Research Projects Agency (DARPA), General Dynamics, McDonnell Douglas, and Rockwell International are in competition to develop technologies for the X-30 experimental aircraft that is expected to be ready for flight in the early to mid-1990s.

Rocketdyne and Pratt & Whitney are developing the highly advanced engines that the X-30 will require

for flight at speeds ranging from subsonic to hypersonic.

The overarching purpose of the NASP project is to develop so-called "single-stage-to-orbit" flying machines capable of taking off from runways, climbing into space, flying there and in the air, and landing on runways. Many military and civilian uses are foreseen for such aircraft/spacecraft.

Tough technological challenges must be mastered in such developmental arenas as flight dynamics, propulsion, materials, and in integrating the X-30 system. "A major part of the whole process of doing the engineering for large, complex systems like the National Aerospace Plane is looking really hard at how to accomplish it with the resources that are expected to be available over a given period of time," Dr. Selden says.

"We are dealing with systems and technologies that are easy to envision but, because of their cost and expense, very difficult to realize."

The Cost of Technology

In this context, he sees the US military science and technology community as having arrived at a crossroads.

"We have come to the place where we are dealing with systems and technologies that are easy to envision but, because of their complexities and expense, very difficult to realize."

Several years ago, Norman R. Augustine, now the chairman and chief executive officer of Martin Marietta Corp., predicted only somewhat facetiously that in another fifty years or so the Pentagon would be able to afford only one airplane per year if defense budgets and costs of airplanes continued to grow at the sharply diverging respective rates of recent times.

Of this, Dr. Selden says, "We know that we'll never get to that point—to where one airplane costs ten billion dollars—because we also know that we'd change the way we do business long before we ever got there. Our whole acquisition system would change. It would have to."

He points out that the Air Force's Advanced Tactical Fighter program presents "a major technology challenge and a major problem of cost containment" and is "an example of where costs and technical capabilities are really coming to the crunch stage."

But the ATF program is not wholly germane to Dr. Selden's espousal of new ways of approaching technology to restrain its costs, he says, because "it is too far along" and "will likely not be as different as some of our future systems will have to be.

"The ATF isn't in the same technology-development position that the NASP is in," he claims. "NASP needs a set of major breakthroughs in a whole variety of different technologies, whereas a very capable ATF is much closer to being realizable."

Even so, Dr. Selden sees the ATF program as forcing the Air Force to "exercise a great deal of discipline to try to work through the problems" of integrating top-of-the-line technologies in a fighter to make it do what it will need to do at an affordable price.

In this regard, the ATF program serves as "a stepping-stone" for USAF's science and engineering communities as they move to cope with the much tougher cost-cum-technology conundrums to be expected in developing systems well beyond the ATF.

Meanwhile, Dr. Selden asserts, "I'm optimistic that all the problems and challenges of the ATF program will work themselves out."

As Chief Scientist of the Air Force, Dr. Selden reports directly to Chief of Staff Gen. Larry D. Welch and is his advisor on matters relating to Air Force science and technology. Dr. Selden is a member of the steering committee of the Air Force Scientific Advisory Board. He meets regularly with Gen. Bernard P. Randolph, Commander of Air Force Systems Command, which operates Air Force laboratories, and with John J. Welch, Assistant Secretary of the Air Force for Acquisition, who in 1969–70 held the position that Dr. Selden now occupies.

A graduate of Pomona College, Calif., and holder of a master of science degree and a doctorate in physics, both from the University of Wisconsin, Dr. Selden worked at the Lawrence Livermore National Laboratory from 1965 to 1979 on projects ranging from the development of nuclear warheads to the physics of nuclear weapons.

He left the Livermore laboratory

to become leader of the Applied Theoretical Physics Division at Los Alamos National Laboratory, N. M. He subsequently served at Los Alamos as deputy associate director for strategic defense research and as associate director for theoretical and computational physics, managing four laboratory divisions.

In 1986, Dr. Selden became the first director of the newly established Los Alamos National Laboratory Center for National Security Studies. It was created to conduct research in broad areas relevant to national security, with emphasis on the relationship between policy and technology.

The Challenge of Space

Dr. Selden sees space and hypersonic flight, both of which the NASP program involves, as "areas of great potential and of major technological challenge for USAF."

He declares: "In our use of space today, and in our thoughts about how we'll use it, we are in about the same stage as we were with aircraft before World War II. Our space technology and uses of space are going to develop in many, many ways that we don't envision in detail today. The technologies represented by the NASP development are ones that, over time, will contribute to revolutionizing our thoughts about how we use space.

"The ability to fly from the ground directly into space—and relatively cheaply—is going to change our whole concept about space. In part, it will continue to be a corridor that we'll pass through. But it will also be a place where, if we can get there much more easily and less expensively, we will go much more often."

From the NASP program, Dr. Selden declares, "single-stage-to-orbit flight will be the real payoff, the thing that will revolutionize our use of space."

Here again, though, the Chief Scientist emphasizes that the going will be difficult. "We wouldn't need a big research program if we knew we could build a propulsion system that could do the job."

He describes the NASP-to-be as "an engine with wings on it," and adds: "The airplane that will fly into space will not look anything like the space shuttle. The shuttle does come back from space and flies in the atmosphere at hypersonic speeds. So we have the benefit of a number of actual trials at such speeds.

"But we know that the shuttle will not take off from a runway and go into space. It can't fly up there by itself. That's the really hard part. That's the big problem. The shuttle has a big slingshot. So the key thing for us now is to develop the slingshot as part of the airplane, the NASP."

A crucial element of the NASP program has to do with the development of scramjets—supersonic combustion ramjets—envisioned as the craft's means of hypersonic flight at up to twenty-five times the speed of sound. Such work is having its ups and downs, but remains encouraging, Dr. Selden says.

This is true of the entire NASP program, he adds. "We're pushing the state of the art, and we absolutely cannot have all successes. But there are excellent teams in Air Force laboratories and in industry that are developing some exciting new technologies, and they will ultimately succeed."

Quite apart from its promise of wondrous flying machines, "NASP is one of our more important science and technology programs because it's pulling along so many technologies that will be really important by the middle of the next century or, with good luck, long before that," Dr. Selden asserts.

Hide-and-Seek

The NASP program aside, among technologies that he identifies as currently crucial are those for avoiding or foiling detection, as in stealth aircraft, missiles, and electronic countermeasures, and those for detection, as in radar and other sorts of sensors.

Stealth and countermeasures technologies are in a continuous race with sensor technologies, the Chief Scientist says. In any game of hide-and-seek, he notes, "the advantage at first goes to the person who is hiding, who gets to choose the time and place and camouflage." This will be the case in the stealth-sensors race "for some time, maybe a decade or two, depending on the investment in detection technology," he predicts.

It seems obvious that crews of stealth aircraft need to be careful about using active radar, which could give away the game if its signals are detected. It is said that no surface-to-air missile radar in use anywhere in the world today is capable of spotting the Air Force's B-2 Stealth bomber until it is too late to do anything about it.

In view of these impacts that low-observable technologies have on both offensive and defensive radars, is it possible that stealthy flying machines will make radar obsolete?

"Not at all," Dr. Selden asserts, "but radar systems will become much more sophisticated. To avoid electronic countermeasures, we're already into systems where we don't just turn on a continuous, single-frequency radar beam and have it do its thing. We turn it on in a pulsed fashion—on and off, perhaps irregularly.

"We also have it hop around at various frequencies so there will be blips all over the map, and we do this in accordance with patterns that require large-scale computing for us to know what we're going to send out and what we expect to receive back [from the radar]."

How can such radar be thwarted? "If you want to interfere with that process, then you have to build machinery that listens to it, figures out what's going on, and decides how to counter it—all in real time.

"If anybody wonders why we're having so much trouble today in the arena of electronic combat, that ought to explain it. Electronic combat has entered a new era. . . . The technology of computing and the technology of the electronic systems that generate these signals and receive them is changing faster today than we can put systems into production. It's a revolution."

Dr. Selden says that it takes "about five years for full generational changes" in electronics technologies today—"and since when have we been able to design, build, produce, and put into the field any kind of system within five years?"

Increasing Complexity

The Chief Scientist also claims that the problems of developing, fielding, and countering modern military technologies are more complex than they used to be. They are

expanding, in effect, geometrically rather than arithmetically.

For example: "We're getting to the place where it isn't enough just to make airplanes fly faster than the other side's, because the other airplane has now changed its capabilities, perhaps with longer-range detection systems and weapons, or in the way it flies.

"A very different kind of thing is happening now. We have to use high-speed computing, and we have to design systems that will be responsive to what we're seeing and will see in this electromagnetic world. And to be able to change the capabilities of systems after they're built. *That's* the real challenge.

"We're moving into an electromagnetic environment now that is way beyond what was envisioned two decades ago."

Dr. Selden makes the point that military science and technology is still more a matter of step-by-step progress than of dramatic breakthroughs. Nonetheless, such progress these days is the stuff of several revolutions in R&D.

For example, he says, "the laser revolution has been several decades in the making and is now upon us. The revolution isn't in the 'death ray' aspect of lasers, it's in communications and sensors."

Take laser radar, for instance. The Chief Scientist explains that it "is hard to do, but it's coming. Its resolution of images will be very different, very high."

In the atmosphere, laser radar will have problems common to all optical systems: seeing through clouds, water vapor, smoke, and anything else that confounds eyesight. But laser radar should be in its element in space.

Out there, says Dr. Selden, laser radar "will be a very big deal. It will be able to look out over long distances and resolve very small images." He also sees laser radar's extraordinarily narrow beams as highly advantageous "for tactical applications, where you're below the weather and are able to use automated systems to look up at, home in on, and get high resolution on particular kinds of things."

Unlike the more futuristic laser radars, laser communications systems are already upon us, Dr. Selden says. "They're impressive just because of the greatly increased data rates they are capable of providing. In space or in optical fibers, they're highly directional and harder to interfere with—to jam—than anything in the radio and microwave regimes."

"We're moving into an electromagnetic environment now that is way beyond what was envisioned two decades ago."

The Heart of the Revolution

Dr. Selden claims that computational prowess, provided by computers that now operate at prodigious speeds and that will get even faster, is the key to all kingdoms in the world of modern military technologies and systems.

Computers are at the heart of a technology revolution in military electronics that has been taking place for two decades or so, and that has by no means run its course, he contends.

Dr. Selden positions this revolution "in an intermediate time period before aerospace planes, space stations, flights to Mars, and things like that occur."

The Chief Scientist points out that high-speed computers pervade "all technologies for the propagation of electromagnetic energy in command control communications and intelligence [C^3I], electronic combat, sensors, the whole spectrum.

"There isn't a modern radar system that doesn't have computation built into it. There isn't a sensor system today that doesn't have a computer program for doing data analysis and [image] reconstruction. Almost all our high-speed communications systems involve computer processing, from simple concepts, like multiplexing, to data compression."

Then there are the farther-out scientific fancies, such as antimatter propulsion. Dr. Selden regards research on antimatter by the Air Force, other government agencies, and the private sector as "a very exciting effort of basic physics that relates to the nature of matter itself—how it's put together and how it works."

But the Chief Scientist parts company with researchers who claim that breakthroughs in antimatter propulsion, as in space travel, may be relatively near.

"We're a long, long way from thinking about practical application of antimatter as a propulsion system, death ray, or anything else," Dr. Selden says. "But the potential is certainly there. Antimatter could eventually be a very big energy source."

Regardless of whether or when antimatter research pays off, the Air Force should stay with it, Dr. Selden claims. "I think it's very important that the Air Force is involved in some cutting-edge research activities in areas that are relevant to long-term Air Force needs. A very small investment keeps us involved with some of the best people in the academic research community," he said.

Fundamental to the Future

Dr. Selden claims that USAF's leadership has no reservations about the importance of research and exploratory development and has its heart in fostering science and technology as fundamental to the service's future.

"The Air Force is historically the service that depends the most on

technology," he asserts. "Flying is itself a technological invention. Everything that happens in the Air Force has something to do with technology.

"This is widely recognized by every one of the senior leaders of the Air Force. There is a long-term understanding of, and commitment to, science and technology on the part of the Air Force.

"So the issue today isn't really one of the importance of science and technology. The issue is how to make the hard decisions about increments in the science and technology budget, one way or the other.

"Those are really hard decisions. We have to make them as we go."

He continues: "In times of tight budgets, there is, historically, a dilemma for those programs that are longer-term and that don't have direct day-to-day relevance. Sure, there is a lot of budget pressure on the science and technology base, and, as this increases, [the base] will take some hits. But there is also the recognition that, as we move into a period when we must reduce the size of our forces, the technological edge will become even more important.

"Even though the science and technology base is only a very small fraction—one to two percent—of the Air Force budget, it is the most visible and important element of its size in the budget. So there's no disposition to mistreat it just because it's small."

"The Air Force is historically the service that depends the most on technology. Flying is itself a technological invention."

Science and the Air Force

Dr. Selden became Chief Scientist of the Air Force last August. He is the latest in a long line of scientists who have come to the post, from outside the Air Force for the most part, since it was created in 1956.

The average tenure of each Chief Scientist has been about three years. The Air Force's intention in setting up the senior management position was that it be filled "on a temporary basis of a few years" by each occupant, Dr. Selden says.

The post had its origins in the Scientific Advisory Group created by Gen. Henry H. "Hap" Arnold, Chief of the US Army Air Forces, and Theodore von Kármán, its first director, after World War II. On December 15, 1945, that group, which later evolved into the Air Force Scientific Advisory Board, issued a report called "Toward New Horizons," which laid the foundation for the separate US Air Force and for the scientific and technological directions that the service would take.

The report was the forerunner of Air Force Systems Command's 1964 Project Forecast report and 1986 Project Forecast II report on choice technologies and systems foreseen for USAF at those times.

"Toward New Horizons" was pegged in great measure to an axiom that General Arnold had expressed in a letter to Dr. von Kármán more than a year earlier, as follows:

"It is a fundamental principle of American democracy that personnel casualties are distasteful. We will continue to fight mechanical rather than manpower wars."

This set the stage for USAF's never-ending pursuit of technological advantage over adversaries, Dr. Selden says.

"A Marvelous Job"

The scientists and engineers who worked on the "Toward New Horizons" study "did a marvelous job of looking at major technology issues out in time," in Dr. Selden's opinion. He recalls the study having dealt with such then-futuristic concepts as supersonic aircraft, unmanned aircraft, G-loadings that would tax human tolerance, and global navigation and communications systems, all of which and more have come to pass.

Dr. Selden tips his cap to the Air Force laboratories, which are operated by Air Force Systems Command, as being "centers of excellence on a variety of topics" and "keepers of the corporate [Air Force] sense of long-term direction in science and technology."

The Chief Scientist claims that "the Air Force laboratory system is better than it gets credit for in some external views of it" but acknowledges "some problems" that USAF has identified, is analyzing, and is intent on solving.

He regularly visits and works with the Air Force laboratories and spends as much time as he can in the US and overseas with the operational commands. "I need to have an understanding of how the operational Air Force works and a sense of how technology is actually used—of what it looks like out there—not just theory."

Dr. Selden cautions that "not everything we do has an end application as a piece of hardware. There are 'people' priorities too."

He sees himself as "a part of the relationship between the Air Force and the academic world at large. That's what the whole Air Force laboratory system does, and the Air Force Office of Scientific Research, but I do it too, often in the role of spokesman for the Chief of Staff.

"It is important for the Air Force to stay in touch with people in the academic world who are outside of the Air Force community. We're all in this together. Having some of the preeminent technical people in the world concerned with problems that the Air Force has to work on and solve within the next few decades requires that we recognize some work in basic science that now seems unrelated, at face value, to the Air Force." ■

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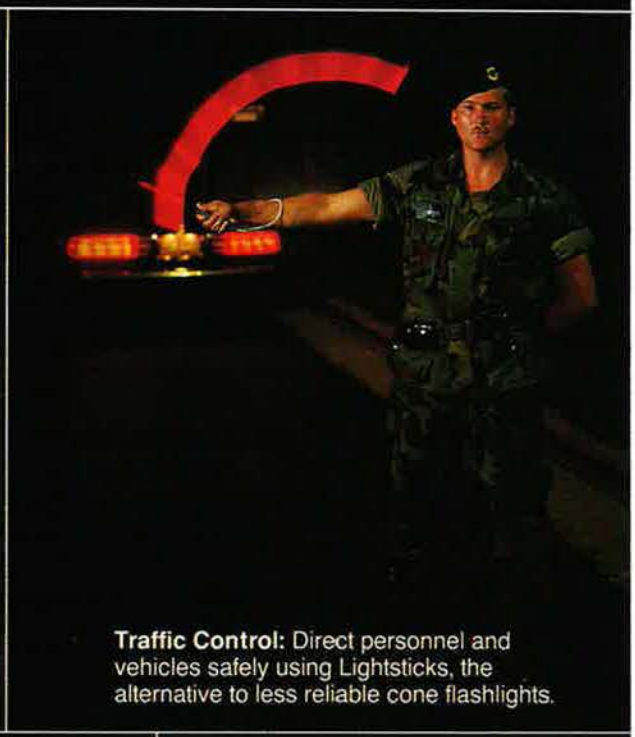

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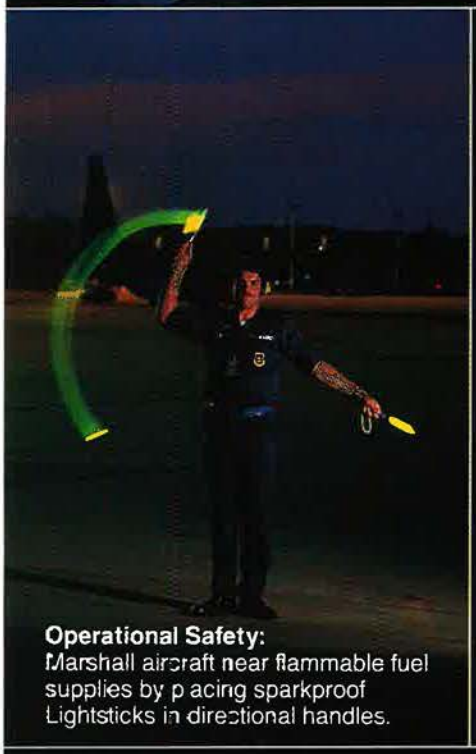

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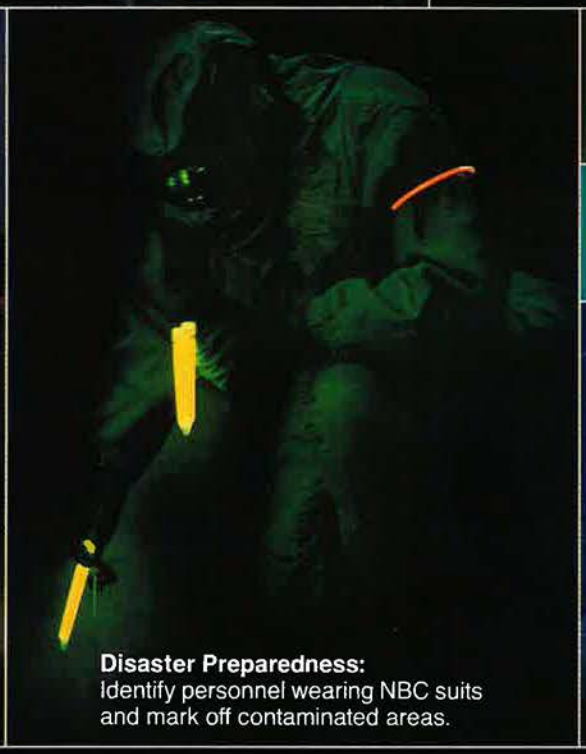

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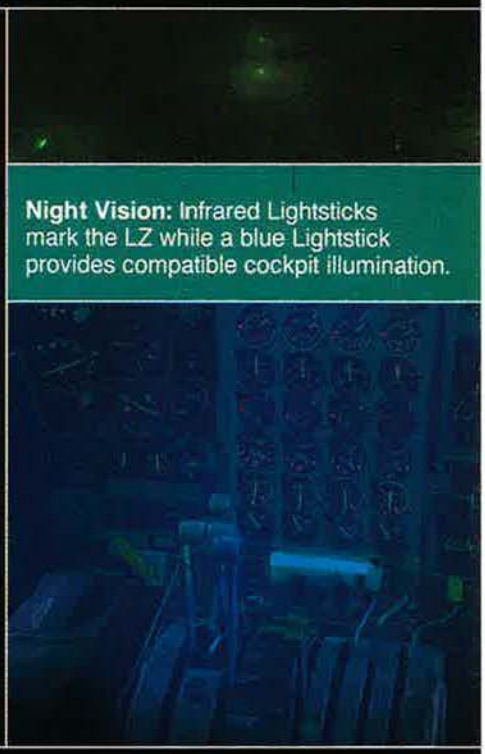

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THE UNITED STATES AIR FORCE IN FACTS AND FIGURES

An Air Force Almanac

On the following pages appears a variety of information and statistical material about the US Air Force—its people, organization, equipment, funding, activities, bases, and heroes. This "Almanac" section was compiled by the staff of AIR FORCE Magazine. We especially acknowledge the help of the Secretary of the Air Force Office of Public Affairs in its role as liaison with Air Staff agencies in bringing up to date the comparable data from last year's "Almanac."

A word of caution: Personnel figures that appear in this section in different forms will not agree (nor will they always agree with figures in command, separate operating agency, and direct reporting unit reports or in the "Guide to Major USAF Installations Worldwide") because of different cutoff dates, rounding, differing methods of reporting, or categories of personnel that are excluded in some cases. These figures do illustrate trends, however, and may be helpful in placing force fluctuations in perspective.

—THE EDITORS

USAF—EVOLUTION OF THE NAME AND THE SERVICE'S LEADERS[1]

DESIGNATION	FROM	TO	COMMANDER (at highest rank)	TITLE	FROM	TO
Aeronautical Div., US Signal Corps	Aug. 1, 1907	July 18, 1914	Brig. Gen. James Allen	Chief Signal Officer	Aug. 1, 1907	Feb. 13, 1913
			Brig. Gen. George P. Scriven	Chief Signal Officer	Feb. 13, 1913	July 18, 1914
Aviation Section, US Signal Corps	July 18, 1914	May 24, 1918	Brig. Gen. George P. Scriven	Chief Signal Officer	July 18, 1914	Feb. 13, 1917
			Maj. Gen. George O. Squier	Chief Signal Officer	Feb. 14, 1917	May 20, 1918
Army Air Service (AAS)	May 24, 1918	July 2, 1926	Maj. Gen. William L. Kenly	Chief, Div. of Military Aeronautics	May 20, 1918	Dec. 22, 1918
			Maj. Gen. Charles T. Menoher	Chief of the Air Service	Dec. 23, 1918	Oct. 4, 1921
			Maj. Gen. Mason M. Patrick	Chief of the Air Service	Oct. 5, 1921	July 1, 1926
Army Air Corps (AAC)	July 2, 1926	June 20, 1941	Maj. Gen. Mason M. Patrick	Chief of the Air Corps	July 2, 1926	Dec. 12, 1927
			Maj. Gen. James E. Fechet	Chief of the Air Corps	Dec. 13, 1927	Dec. 18, 1931
			Maj. Gen. Benjamin D. Foulois	Chief of the Air Corps	Dec. 19, 1931	Dec. 21, 1935
			Maj. Gen. Oscar Westover	Chief of the Air Corps	Dec. 22, 1935	Sept. 21, 1938
			Gen. H. H. Arnold	Chief of the Air Corps	Sept. 29, 1938	June 29, 1941
Army Air Forces (AAF)	June 20, 1941	Sept. 18, 1947	Gen. H. H. Arnold	Chief of the AAF	June 30, 1941	Mar. 8, 1942
			Gen. of the Army H.H. Arnold	Commanding General, AAF	Mar. 9, 1942	Feb. 9, 1946
			Gen. Carl A. Spaatz	Commanding General, AAF	Feb. 10, 1946	Sept. 25, 1947
United States Air Force (USAF)[1]	Sept. 18, 1947		Gen. Carl A. Spaatz	Chief of Staff, USAF	Sept. 26, 1947	Apr. 29, 1948

[1]For USAF leaders since 1948, see "USAF Leaders Through the Years."

UNITED STATES AIR FORCE PERSONNEL STRENGTH—1907 THROUGH 1990

YEAR	STRENGTH	YEAR	STRENGTH
1907	3	1949	419,347
1908	13	1950	411,277
1909	27	1951	788,381
1910	11	1952	973,474
1911	23	1953	977,593
1912	51	1954	947,918
1913	114	1955	959,946
1914	122	1956	909,958
1915	208	1957	919,835
1916	311	1958	871,156
1917	1,218	1959	840,028
1918	195,023	1960	814,213
1919	25,603	1961	820,490
1920	9,050	1962	883,330
1921	11,649	1963	868,644
1922	9,642	1964	855,802
1923	9,441	1965	823,633
1924	10,547	1966	886,350
1925	9,670	1967	897,426
1926	9,674	1968	904,759
1927	10,078	1969	862,062
1928	10,549	1970	791,078
1929	12,131	1971	755,107
1930	13,531	1972	725,635
1931	14,780	1973	690,999
1932	15,028	1974	643,795
1933	15,099	1975	612,551
1934	15,861	1976	585,207
1935	16,247	1977	570,479
1936	17,233	1978	569,491
1937	19,147	1979	559,450
1938	21,089	1980	557,969
1939	23,455	1981	570,302
1940	51,165	1982	582,845
1941	152,125	1983	592,044
1942	764,415	1984	597,125
1943	2,197,114	1985	601,515
1944	2,372,292	1986	608,199
1945	2,282,259	1987	607,035
1946	455,515	1988	576,446
1947	305,827	1989	570,965[1]
1948	387,730	1990	571,100[1]

[1]Programmed

USAF TOTAL ACTIVE-DUTY STRENGTH BY GRADE

(As of September 30, 1988)

OFFICERS

GRADE	NUMBER
GENERAL	13
LIEUTENANT GENERAL	37
MAJOR GENERAL	117
BRIGADIER GENERAL	167
COLONEL	5,508
LIEUTENANT COLONEL	12,426
MAJOR	19,616
CAPTAIN	43,045
FIRST LIEUTENANT	14,602
SECOND LIEUTENANT	9,595
TOTAL	**105,126**

AIRMEN

GRADE	NUMBER
CHIEF MASTER SERGEANT	4,858
SENIOR MASTER SERGEANT	9,677
MASTER SERGEANT	38,853
TECHNICAL SERGEANT	58,942
STAFF SERGEANT	111,799
SERGEANT/SENIOR AIRMAN	116,935
AIRMAN FIRST CLASS	84,749
AIRMAN	27,987
AIRMAN BASIC	13,056
TOTAL	**466,856**

OFFICERS	105,126
CADETS	4,464
AIRMEN	466,856
TOTAL STRENGTH	**576,446**

USAF AND AIR RESERVE FORCES PERSONNEL BY CATEGORIES

CATEGORY	FY '84	FY '85	FY '86	FY '87	FY '88	FY '89	FY '90[1]
AIR FORCE MILITARY							
Officers	106,200	108,400	109,000	107,300	105,126	104,600	102,300
Airmen	486,400	488,600	494,700	495,200	466,856	462,000	464,400
Cadets	4,500	4,500	4,500	4,400	4,446	4,400	4,400
TOTAL, AIR FORCE MILITARY	**597,100**	**601,500**	**608,200**	**606,900**	**576,428**	**571,000**	**571,100**
Career Reenlistments (Second Term)	38,000	36,000	38,900	41,500	51,600	36,500	39,000
Rate	90%	89%	88%	89%	88%	89%	89%
First-Term Reenlistments	24,700	25,700	23,500	25,700	26,600	19,500	22,500
Rate	62%	54%	58%	58%	55%	60%	60%
CIVILIAN PERSONNEL							
Direct Hire (including Technicians)	239,800	250,400	249,604	251,771	241,120	249,728	249,044
Indirect Hire—Foreign Nationals	13,000	13,468	13,644	12,559	12,041	13,215	13,399
TOTAL, CIVILIAN PERSONNEL	**252,800**	**263,868**	**263,248**	**264,330**	**253,161**	**262,943**	**262,443**
TOTAL, MILITARY AND CIVILIAN[2]	**849,900**	**865,368**	**871,448**	**871,230**	**829,589**	**833,943**	**833,543**
Technicians (included above as Direct Hire Civilians)							
AFRES Technicians	7,973	8,064	8,348	8,772	9,111	10,061	10,124
ANG Technicians	22,160	22,671	22,497	23,221	23,409	23,644	23,948
AIR RESERVE FORCES							
Air National Guard, Selected Reserve	105,012	109,398	112,592	114,600	115,221	114,975	116,300
Air Force Reserve, Paid	70,318	75,214	78,519	80,415	82,116	83,615	84,800
Air Force Reserve, Nonpaid[3]	37,230	42,317	44,568	43,783	51,658	43,900	43,900
TOTAL, READY RESERVE[3]	**212,560**	**226,929**	**235,679**	**238,798**	**248,995**	**242,490**	**245,000**
Standby	29,543	28,321	25,823	24,479	21,772	26,200	26,200
TOTAL, AIR RESERVE FORCES[4]	**242,103**	**255,250**	**261,502**	**263,277**	**270,767**	**268,690**	**271,200**

[1]President's Budget Request.
[2]FYs '84–88 are actual figures; FYs '89–90 are estimates; excludes nonchargeable personnel.
[3]Excludes training/pay categories J, K, and L.
[4]Excludes Retired Air Force Reserve.

NOTE: Numbers are rounded and may not sum to totals.

NUMBER OF OFFICERS IN EACH MAJOR CAREER FIELD[1]

CODE	UTILIZATION FIELD TITLE	ASSIGNED
00[2]	Commanders and Directors	3,079
02	International-Politico-Military Affairs	311
05	Disaster Preparedness	194
09	Special Duty	1,767
10–14	Pilot	20,338
15, 22	Navigator	8,552
16	Air Traffic Control	384
17	Air Weapons Director	2,182
18	Missile Operations	2,832
19	Operations Management	1,090
20	Space Operations	1,507
23	Visual Information	103
25	Weather	1,342
26	Scientific	1,579
27	Acquisition Program Management	2,778
28	Development Engineering	5,751
31	Missile Maintenance	383
40	Aircraft Maintenance & Munitions	3,783
49	Communications-Computer Systems	6,621
55	Civil Engineering	2,143
57	Cartography	96
60	Transportation	965
62	Services	431
64	Supply Management	1,169
65	Acquisition Contracting/Manufacturing	1,569
66	Logistics Plans & Programs	1,032
67	Financial	1,488
70	Administration	2,163
73	Personnel	1,617
74	Manpower Management	537
75	Education & Training	494
79	Public Affairs	536
80	Intelligence	3,329
81	Security Police	1,099
82	Special Investigations	587
87	Band	31
88	Legal	1,319
89	Chaplain	810
90	Health Services Management	1,248
91, 92, 99	Biomedical Sciences	2,382
93–96	Physician	3,952
97	Nurse	5,295
98	Dental	1,506

[1]These figures do not include general officers or UPT/UNT/medical/law students.
[2]Includes specialties in various career fields, *e.g.*, operations, logistics, programming, etc.

NUMBER OF ENLISTED IN EACH MAJOR CAREER FIELD

CODE	CAREER FIELD TITLE	ASSIGNED
10	First Sergeant	1,799
11	Aircrew Operations	8,976
12	Aircrew Protection	2,791
20	Intelligence	12,604
22	Photomapping	112
23	Audiovisual	2,830
24	Safety	1,459
25	Weather	3,103
27	Command Control Systems Operations	15,817
30	Communications-Electronics Systems	23,801
31	Missile Electronic Maintenance	580
32	Avionics Systems	14,462
34	Training Devices	693
36	Wire Communications Systems Maintenance	4,050
39	Maintenance Management Systems	3,118
40	Intricate Equipment Maintenance	291
41	Missile Systems Maintenance	5,406
42	Aircraft Systems Maintenance	28,824
43	Aircraft Maintenance	42,180
45	Manned Aerospace Maintenance	30,313
46	Munitions & Weapons Maintenance	25,349
47	Vehicle Maintenance	5,477
49	Information Systems	19,722
54	Mechanical/Electrical	9,770
55	Structural/Pavements	11,423
56	Sanitation	1,557
57	Fire Protection	6,147
59	Marine	50
60	Transportation	13,268
61	Supply Services	955
62	Food Services	6,055
63	Fuels	6,442
64	Supply	24,199
65	Procurement	1,665
66	Logistics Plans	1,129
67	Accounting & Finance and Auditing	5,927
70	Administration	23,304
73	Personnel	14,026
74	Morale, Welfare, & Recreation	1,601
75	Education & Training	3,701
79	Public Affairs	1,284
81	Security Police	38,987
82	Special Investigations & Counterintelligence	908
87	Band	1,120
90–92	Medical	24,626
98	Dental	3,392
99	Miscellaneous (Special Duty, Patients, Unclassified, etc.)	11,563

AIR FORCE MILITARY PERSONNEL DISTRIBUTION BY GEOGRAPHIC AREA

(As of September 30, 1988)

TOTAL MILITARY PERSONNEL	**576,446**
US TERRITORY AND SPECIAL LOCATIONS	**446,503**
TOTAL IN FOREIGN COUNTRIES	**129,943**

Western and Southern Europe (Major concentrations in Germany—40,272 UK—25,461 Italy—5,721 Spain—4,836 Turkey—3,624)	88,774
East Asia and Pacific (Major concentrations in Japan/Okinawa—16,543 South Korea—11,619 Philippines—9,194)	37,718
Africa, Near East, S. Asia (Major concentrations in Saudi Arabia—209 Egypt—50)	375
Western Hemisphere (Major concentrations in Panama—2,837 Canada—125)	3,058
Eastern Europe	18

USAF PERSONNEL STRENGTH BY COMMANDS, SOAs, AND DRUs

MAJOR COMMANDS	MILITARY	CIVILIAN	TOTAL
Air Force Communications Command (AFCC)	47,071	7,659	54,730
Air Force Logistics Command (AFLC)	11,681	80,276	91,957
Air Force Space Command (AFSPACECOM)	6,204	1,718	7,922
Air Force Systems Command (AFSC)	23,679	27,518	51,197
Air Training Command (ATC)	58,059	12,711	70,770
Air University (AU)	5,836	1,503	7,339
Alaskan Air Command (AAC)	7,512	1,278	8,790
Electronic Security Command (ESC)	12,523	1,216	13,739
Military Airlift Command (MAC)	75,251	14,252	89,503
Pacific Air Forces (PACAF)	28,856	10,004	38,860
Strategic Air Command (SAC)	105,023	11,782	116,805
Tactical Air Command (TAC)	96,406	11,462	107,868
United States Air Forces in Europe (USAFE)	62,728	10,042	72,770
TOTAL	**540,829**	**191,421**	**732,250**
SEPARATE OPERATING AGENCIES (SOAs)			
Air Force Accounting and Finance Center (AFAFC)	225	2,114	2,339
Air Force Audit Agency (AFAA)	221	712	933
Air Force Commissary Service (AFCOMS)	1,040	8,795	9,835
Air Force Engineering and Services Center (AFESC)	391	554	945
Air Force Inspection and Safety Center (AFISC)	351	127	478
Air Force Intelligence Agency (AFIA)	660	218	878
Air Force Legal Services Center (AFLSC)	456	142	598
Air Force Management Engineering Agency (AFMEA)	201	89	290
Air Force Military Personnel Center (AFMPC)	1,514	517	2,031
Air Force Office of Medical Support (AFOMS)	107	129	236
Air Force Office of Security Police (AFOSP)	68	60	128
Air Force Office of Special Investigations (AFOSI)	1,939	503	2,442
Air Force Operational Test and Evaluation Center (AFOTEC)	505	171	676
Air Force Reserve (AFRES)	296	13,567	13,863
Air Force Service Information and News Center (AFSINC)	675	173	848
Air Reserve Personnel Center (ARPC)	126	598	724
DIRECT REPORTING UNITS (DRUs)			
Air Force Civilian Personnel Management Center (AFCPMC)	4	1,377[1]	1,381
Air Force Cost Center	23	22	45
Air Force District of Washington (AFDW)	1,468	961	2,429
Air Force Technical Applications Center (AFTAC)	1,228	89	1,317
Office of the Secretary of the Air Force/Air Staff/ Air National Guard Support Center	1,543	1,290	2,833
United States Air Force Academy (USAFA)[2]	2,679	1,596	4,275
USAF Historical Research Center (USAFHRC)	21	78	99
Other Direct Reporting Units			
Air Force Center for Studies and Analyses (AFCSA)	93	35	128
Air Force Combat Operations Staff (AFCOS)	260	21	281
Air Force Review Boards Office (AFRBO)	18	62	80
Other	15,041	27,740	42,781
TOTAL, SOAs and DRUs	**31,153**	**61,740**	**92,893**
TOTAL, COMMANDS, SOAs, and DRUs	**571,982**	**253,161**	**825,143**

[1]Includes Palace Acquire interns assigned to various major commands.
[2]4,464 cadets not included.

USAF PERSONNEL BY GRADE, RACE, AND SEX

(As of September 30, 1988)

OFFICERS

GRADE	FORCE	BLACK[1]	OTHER[2]	WOMEN[3]
GENERAL	334	4	1	2
COLONEL	5,509	124	90	126
LIEUTENANT COLONEL	12,426	235	186	502
MAJOR	19,615	952	290	1,725
CAPTAIN	43,046	3,146	941	5,923
FIRST LIEUTENANT	14,601	755	450	2,708
SECOND LIEUTENANT	9,595	541	399	1,913
TOTAL	**105,126**	**5,757**	**2,357**	**12,899**

AIRMEN

GRADE	FORCE	BLACK[1]	OTHER[2]	WOMEN[3]
CHIEF MASTER SERGEANT	4,858	662	65	29
SENIOR MASTER SERGEANT	9,677	1,402	163	195
MASTER SERGEANT	38,853	6,927	990	1,702
TECHNICAL SERGEANT	58,942	10,973	1,866	5,129
STAFF SERGEANT	111,799	21,382	4,302	14,543
SERGEANT/SENIOR AIRMAN	116,935	22,266	5,652	17,321
AIRMAN FIRST CLASS	84,749	13,498	4,396	14,462
AIRMAN	27,987	3,565	1,141	5,282
AIRMAN BASIC	13,056	1,694	536	2,318
TOTAL	**466,856**	**82,369**	**19,111**	**60,981**
TOTAL USAF PERSONNEL	**571,982**	**88,126**	**21,468**	**73,880**

[1]Includes 16,212 women.
[2]Includes 3,021 women.
[3]Includes women from "Black" and "Other" categories.

AVERAGE AGES OF MILITARY PERSONNEL

(As of September 30, 1988)

Officers	Average 34 years of age
Airmen	Average 27 years of age

BUDGET DETAILS DELAYED

Details of the Bush Administration's revised defense budget proposal had not been made public as the 1989 Air Force Almanac went to press. Consequently, accurate information was not available to develop some of the charts that usually appear in this section. Those charts will be published in a later issue of AIR FORCE Magazine.

MONTHLY MILITARY BASIC RATES OF PAY

(Effective January 1, 1989)

PAY GRADE	YEARS OF SERVICE: UNDER 2	2	3	4	6	8	10	12	14	16	18	20	22	26
COMMISSIONED OFFICERS[1]														
O-10	$5,711	$5,912	$5,912	$5,912	$5,912	$6,138	$6,138	$6,479	$6,479	$6,875	$6,875	$7,115	$7,115	$7,559
O-9	5,061	5,194	5,304	5,304	5,304	5,439	5,439	5,666	5,666	6,138	6,138	6,479	6,479	6,875
O-8	4,584	4,721	4,834	4,834	4,834	5,194	5,194	5,439	5,439	5,666	5,912	6,138	6,290	6,290
O-7	3,809	4,068	4,068	4,068	4,250	4,250	4,497	4,497	4,721	5,194	5,551	5,551	5,551	5,551
O-6	2,823	3,102	3,305	3,305	3,305	3,305	3,305	3,305	3,417	3,958	4,160	4,250	4,497	4,877
O-5	2,258	2,651	2,835	2,835	2,835	2,835	2,921	3,077	3,284	3,530	3,732	3,845	3,979	3,979
O-4	1,904	2,318	2,472	2,472	2,518	2,629	2,809	2,966	3,102	3,238	3,328	3,328	3,328	3,328
O-3	1,769	1,978	2,114	2,339	2,451	2,539	2,676	2,809	2,878	2,878	2,878	2,878	2,878	2,878
O-2	1,542	1,685	2,024	2,092	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135
O-1	1,339	1,394	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685	1,685
COMMISSIONED OFFICERS WITH MORE THAN 4 YEARS OF ACTIVE ENLISTED OR WARRANT OFFICER SERVICE														
O-3E	–	–	–	2,339	2,451	2,539	2,676	2,809	2,921	2,921	2,921	2,921	2,921	2,921
O-2E	–	–	–	2,092	2,135	2,203	2,318	2,406	2,472	2,472	2,472	2,472	2,472	2,472
O-1E	–	–	–	1,685	1,799	1,866	1,933	2,001	2,092	2,092	2,092	2,092	2,092	2,092
ENLISTED MEMBERS														
E-9	–	–	–	–	–	–	2,096	2,144	2,192	2,242	2,292	2,337	2,460	2,699
E-8	–	–	–	–	–	1,758	1,808	1,856	1,904	1,954	1,999	2,048	2,169	2,410
E-7	1,227	1,325	1,374	1,422	1,471	1,517	1,566	1,615	1,688	1,736	1,784	1,807	1,929	2,169
E-6	1,056	1,151	1,199	1,250	1,296	1,343	1,393	1,465	1,511	1,559	1,583	1,583	1,583	1,583
E-5	927	1,009	1,058	1,104	1,176	1,224	1,273	1,319	1,343	1,343	1,343	1,343	1,343	1,343
E-4	864	913	966	1,041	1,082	1,082	1,082	1,082	1,082	1,082	1,082	1,082	1,082	1,082
E-3	814	859	893	929	929	929	929	929	929	929	929	929	929	929
E-2	784	784	784	784	784	784	784	784	784	784	784	784	784	784
E-1[2]	699	699	699	699	699	699	699	699	699	699	699	699	699	699

NOTES: Amounts have been rounded to the nearest dollar.
Basic pay while serving as Chairman of the Joint Chiefs of Staff or as Chief of Staff of the Air Force is $6,291.60, regardless of cumulative years of service.
Basic pay while serving as Chief Master Sergeant of the Air Force is $3,280.50, regardless of cumulative years of service.

[1]Basic pay is limited to $6,291.60, regardless of cumulative years of service.
[2]Basic pay for E-1s with less than four months of service is $646.20.

MONTHLY BASIC ALLOWANCE FOR QUARTERS (BAQ)

(Effective January 1, 1989)

PAY GRADE	WITHOUT DEPENDENTS		WITH DEPENDENTS
	FULL[1]	PARTIAL[2]	
O-10	$613.20	$50.70	$754.50
O-9	613.20	50.70	754.50
O-8	613.20	50.70	754.50
O-7	613.20	50.70	754.50
O-6	562.50	39.60	679.80
O-5	541.80	33.00	654.90
O-4	502.20	26.70	577.80
O-3	402.60	22.20	478.20
O-2	319.50	17.70	408.00
O-1	268.80	13.20	364.50
E-9	372.00	18.60	490.50
E-8	342.00	15.30	452.10
E-7	291.90	12.00	420.30
E-6	264.00	9.90	387.90
E-5	243.60	8.70	348.90
E-4	212.10	8.10	303.60
E-3	208.20	7.80	282.30
E-2	169.20	7.20	268.80
E-1	150.30	6.90	268.80

[1]Payment of the full rate of basic allowance for quarters at these rates to members of the uniformed services without dependents is authorized by 37 USC 403 and Part IV of Executive Order 12622, as amended.

[2]Payment of the partial rate of basic allowance for quarters at these rates to members of the uniformed services without dependents who, under 37 USC 403(b) or 403(c), are not entitled to the full rate of basic allowance for quarters is authorized by 37 USC 1009(c)(2) and Part IV of Executive Order 11157, as amended.

AVIATION CAREER INCENTIVE PAY RATES[1]

PHASE I

MONTHLY RATE	YEARS OF AVIATION SERVICE AS AN OFFICER[2]
$125	2 or less
156	more than 2
188	more than 3
206	more than 4
400	more than 6

PHASE II

$370	more than 18
340	more than 20
310	more than 22
280	more than 24
250	more than 25[3]

NOTE: An officer in pay grade O-7 may not be paid at a rate greater than $200 a month. An officer in pay grade O-8 or above may not be paid at a rate greater than $206 a month. Officers with more than 18 years of commissioned service and less than 6 years of aviation service are entitled to Phase I rates.

[1]For rated officers, flight surgeons, and other designated medical officers, except as noted.

[2]Including flight training.

[3]O-6 and below.

BASIC ALLOWANCE FOR SUBSISTENCE (BAS)

Officers (Monthly)	Enlisted (Daily)		
	Separate Rations	Rations in Kind Not Available	Emergency Rations
$119.61	$5.70	$6.44	$8.53
	5.27[1]	5.95[1]	7.89[1]

[1]Applies to E-1s with less than four months of active-duty service.

EDUCATIONAL LEVELS—USAF LINE OFFICERS

LEVEL	END OF SEPTEMBER 1988 NUMBER	PERCENT
Below baccalaureate/unknown	105	0.1
Baccalaureate, no master's degree	48,048	55.2
Master's degree, no doctorate	37,625	43.2
Doctoral and professional degrees	1,278	1.5
TOTAL	**87,056**	**100.0**

HAZARDOUS DUTY INCENTIVE PAY (HDIP)[1]

PAY GRADE	MONTHLY RATE	PAY GRADE	MONTHLY RATE
O-10	$110	E-9	$200
O-9	110	E-8	200
O-8	110	E-7	200
O-7	110	E-6	175
O-6	250	E-5	150
O-5	250	E-4	125
O-4	225	E-3	110
O-3	175	E-2	110
O-2	150	E-1	110
O-1	125		

NOTE: Hazardous duty incentive pay for noncrew members is $110 a month.

[1]Excepting AWACS crew members.

EDUCATIONAL LEVELS—USAF ENLISTED FORCE

LEVEL	END OF SEPTEMBER 1988 NUMBER	PERCENT[1]
Below high school	315	0.1
High school	193,851	41.5
Some college (less than two years)	184,175	39.5
AA/AS degree	33,997	7.3
Two to three years of college	39,122	8.4
Baccalaureate, no master's	14,015	3.0
Master's or higher	1,381	0.3
TOTAL	**466,856**	**100.0**

[1]Percentages have been rounded.

FEDERAL CIVILIAN PAY SCALE

General Schedule

(Effective January 1, 1989)

GRADE	1	2	3	4	5	6	7	8	9	10
GS-1	$10,213	$10,555	$10,894	$11,233	$11,573	$11,773	$12,108	$12,445	$12,461	$12,780
GS-2	11,484	11,757	12,137	12,461	12,601	12,972	13,343	13,714	14,085	14,956
GS-3	12,531	12,949	13,367	13,785	14,203	14,621	15,039	15,457	15,875	16,293
GS-4	14,067	14,536	15,005	15,474	15,943	16,412	16,881	17,350	17,819	18,288
GS-5	15,738	16,263	16,788	17,313	17,838	18,363	18,888	19,413	19,938	20,463
GS-6	17,542	18,127	18,712	19,297	19,882	20,467	21,052	21,637	22,222	22,807
GS-7	19,493	20,143	20,793	21,443	22,093	22,743	23,393	24,043	24,693	25,343
GS-8	21,590	22,310	23,030	23,750	24,410	25,190	25,910	26,630	27,350	28,070
GS-9	23,846	24,641	25,436	26,231	27,026	27,821	28,616	29,411	30,206	31,001
GS-10	26,261	27,136	28,011	28,886	29,761	30,636	31,511	32,386	33,261	34,136
GS-11	28,852	29,814	30,776	31,738	32,700	33,662	34,624	35,586	36,548	37,510
GS-12	34,580	35,733	36,866	38,039	39,192	40,345	41,498	42,651	43,804	44,957
GS-13	41,121	42,492	43,863	45,234	46,605	47,976	49,347	50,718	52,089	53,460
GS-14	48,592	50,212	51,832	53,452	55,072	56,692	58,312	59,932	61,552	63,172
GS-15	57,158	59,063	60,968	62,873	64,778	66,683	68,588	70,493	72,398	74,303
GS-16	67,038	69,273	71,508	73,743	75,473[1]	76,678[1]	78,869[1]	81,060[1]	82,500[1]	
GS-17	76,990[1]	79,556[1]	82,122[1]	82,500[1]	83,818[1]					
GS-18	86,682[1]									

Senior Executive Service[2]

LEVEL	1	2	3	4	5	6
	$65,994	$68,952	$71,910	$73,400	$75,500	$77,500

[1]Pay limited to Level V of the Executive Schedule, $72,500.
[2]Basic pay for employees at these rates is limited to $77,500, in accordance with Title 5, USC 5382(b).

AIR FORCE FULL-TIME CIVILIAN EMPLOYMENT BY GRADE

(As of September 30, 1988)

GENERAL SCHEDULE/ OTHER		WAGE GRADE POSITIONS		WAGE GRADE LEADER POSITIONS		WAGE GRADE SUPERVISORY POSITIONS	
GRADE	POPULATION	GRADE	POPULATION	GRADE	POPULATION	GRADE	POPULATION
1	155	1	137	1	1	1	39
2	400	2	1,139	2	45	2	40
3	3,511	3	698	3	2	3	126
4	13,900	4	1,165	4	41	4	187
5	23,356	5	3,846	5	53	5	387
6	10,304	6	4,180	6	42	6	490
7	14,475	7	5,839	7	101	7	1,072
8	2,916	8	6,593	8	97	8	1,049
9	20,729	9	7,048	9	235	9	2,013
10	1,184	10	24,543	10	929	10	2,481
11	20,499	11	7,573	11	130	11	673
12	20,438	12	4,333	12	16	12	436
13	9,885	13	430	13	2	13	359
14	3,831	14	142	14	1	14	389
15	1,224	15	2	15	0	15	204
16	0					16	126
17	0					17	50
18	1					18	9
ST	16						
SES	231						
TOTAL	**147,055**		**67,668**		**1,695**		**10,130**

NOTE: Table does not include ANG technicians, local national employees, or nonappropriated fund employees.

ST = Scientific and Professional
SES = Senior Executive Service

AIR FORCE CIVILIAN PERSONNEL AVERAGE AGE AND LENGTH OF SERVICE

(As of September 30, 1988)

Average age	43 years
Average length of service (overall)	14 years
General Schedule	14 years
Federal Wage System	15 years

DoD BUDGET AUTHORITY BY COMPONENT FOR FY 1987–90

COMPONENT	FY 1987 $ BILLION	FY 1987 % SHARE	FY 1988 $ BILLION	FY 1988 % SHARE	FY 1989 $ BILLION	FY 1989 % SHARE	FY 1990 $ BILLION	FY 1990 % SHARE
Army	74.0	26.5	75.8	26.7	78.2	26.9	80.5	26.3
Navy/Marine Corps	93.5	33.5	100.3	35.3	97.4	33.6	101.7	33.3
Air Force	91.6	32.8	88.3	31.1	94.6	32.6	100.5	32.9
Defense Agencies/DoD-wide	20.4	7.2	19.3	6.8	20.0	6.9	23.0	7.5
TOTAL	**279.5**		**283.8**		**290.2**		**305.6**	

NOTE: Numbers are rounded and may not sum to totals.

DoD BUDGET BY MISSION CATEGORIES FOR FY 1986–90

MILITARY PROGRAM	TOTAL BUDGET AUTHORITY IN BILLIONS OF DOLLARS[1] 1986	1987	1988	1989	1990
Strategic Forces[2]	24.2	21.1	19.8	21.2	23.4
General-Purpose Forces	116.2	114.9	114.9	112.8	117.8
Intelligence and Communications	26.4	27.7	28.3	29.6	31.7
Airlift and Sealift	7.6	7.1	4.4	5.4	6.3
Guard and Reserve Forces	15.6	15.7	16.9	17.2	17.2
Research and Development[3]	25.7	27.5	28.4	29.1	32.1
Central Supply and Maintenance	24.4	22.7	24.3	25.3	27.0
Training, Medical, and Other General Personnel Activities	33.6	35.5	37.3	38.5	40.0
Administrative and Associated Activities	7.1	6.6	6.7	6.9	5.9
Special Operations Forces	–	–	2.0	3.2	3.1
Support of Other Nations	0.5	0.7	0.8	1.0	1.1
TOTAL BUDGET AUTHORITY	**281.4**	**279.5**	**283.8**	**290.2**	**305.6**
Prior-year funds and other financial adjustments	−0.9	4.0	4.8	2.5	1.0
TOTAL OBLIGATIONAL AUTHORITY	**280.5**	**283.5**	**288.6**	**292.7**	**306.6**

NOTE: Numbers are rounded and may not sum to totals.

[1]1986–87 figures actual; 1988–90 estimates.
[2]Excludes strategic systems development included in the research and development category.
[3]Excludes research and development in other program areas on systems approved for production.

INSTALLATIONS OF THE US AIR FORCE

Major Installations, including Air Force Bases, Air Bases, Air Reserves Bases, and Air Guard Bases, are self-supporting centers of operations for actions of importance to Air Force combat, combat support, or training. Each is operated by an Active, Reserve, or Guard unit of group size or larger with all land, facilities, and organic support needed to accomplish the unit mission. A major installation must have real property accountability through ownership, lease, permit, or other written agreement for all real estate and facilities. Agreements with foreign governments giving USAF jurisdiction over real property meet this requirement. Shared-use agreements (as opposed to joint-use agreements, wherein USAF owns the runway), do not meet this requirement. **Minor Installations** (Air Force Stations, Air Stations, Air Reserve Stations, and Air Guard Stations) are operated by active, Reserve, or Guard units of at least squadron size but do not otherwise satisfy the criteria for a major installation. Examples: Reserve and Guard flying operations located at civilian-owned airports. **Support sites** are facilities operated by active, Reserve, or Guard units that provide general support to the Air Force mission and do not satisfy the criteria for a major or minor installation. Examples: missile tracking sites; radar bomb scoring sites; USAF-owned, contractor-operated plants; radio relay sites. **Other Activities** include USAF units or activities that have little or no real property accountability for the real estate they occupy. Examples: active, Guard, or Reserve Air Force units located on installations belonging to other services; leased office space supporting recruiting detachments or Civil Air Patrol.

Major Installations	
US and Possessions[1]	102
Foreign	39
Worldwide	**141**
Minor Installations	
US and Possessions[1]	107
Foreign	13
Worldwide	**120**
Support Sites	
US and Possessions[1]	130
Foreign	120
Worldwide	**250**
Other Activities	
US and Possessions[2]	425
Foreign	402
Worldwide	**827**

[1]Includes Air Force Reserve and Air National Guard.
[2]Includes USAF presence at non-USAF installations and other sites.

USAF'S AIRCRAFT—HOW MANY OF EACH TYPE AND HOW OLD?

(Current as of September 30, 1988)

	0–3 YRS.	3–6 YRS.	6–9 YRS.	9–12 YRS.	12–15 YRS.	15–18 YRS.	18–21 YRS.	21–24 YRS.	24+ YRS.	TOTAL NUMBER	AVERAGE AGE (YRS.)
A-7	–	–	2	–	2	15	10	–	–	29	16.8
A-10	–	65	271	104	12	–	–	–	–	452	7.9
A-37	–	–	–	–	13	2	1	–	–	16	13.8
B-1	96	2	–	–	–	–	–	–	–	98	1.3
B-52	–	–	–	–	–	–	–	–	262	262	28.0
FB-111	–	–	–	–	–	38	24	–	–	62	17.9
C-5	39	–	–	–	–	38	4	–	–	79	8.9
C-9	–	–	–	–	3	9	11	–	–	23	17.5
C-10	23	24	11	–	–	–	–	–	–	58	3.8
C-12	–	46	–	7	20	–	–	–	–	73	7.1
C-18	–	–	7	–	–	–	–	–	–	7	6.4
C-20	10	3	–	–	–	–	–	–	–	13	2.1
C-21	4	75	–	–	–	–	–	–	–	79	3.7
C-22	–	1	–	–	–	–	–	–	–	1	4.6
C-23	2	16	–	–	–	–	–	–	–	18	3.4
C-130	18	3	–	8	56	26	39	82	133	365	19.8
C-131	–	–	–	–	–	–	–	–	1	1	33.5
C-135	–	–	–	–	–	–	–	34	563	597	27.1
C-137	1	1	–	–	–	1	–	–	4	7	19.3
C-140	–	–	–	–	–	–	–	–	5	5	25.7
C-141	–	–	–	–	–	–	26	222	7	255	22.0
E-3	–	5	9	15	5	–	–	–	–	34	6.9
E-4	–	–	–	–	2	2	–	–	–	4	14.3
F-4	–	–	–	7	105	110	253	464	10	949	17.9
F-5	–	6	–	8	41	15	–	–	–	70	12.4
F-15	103	110	207	263	32	3	–	–	–	718	7.5
F-16	451	319	212	33	–	–	–	–	–	1,015	3.8
F-100	–	–	–	–	–	–	–	–	4	4	31.2
F-106	–	–	–	–	–	–	–	–	6	6	28.9
F-111	–	–	2	–	20	175	133	–	–	330	17.4
G-4	1	–	–	–	–	–	–	–	–	1	.4
G-7	4	6	–	–	–	–	–	–	–	10	3.2
G-9	5	–	–	–	–	–	–	–	–	5	1.7
H-1	–	–	–	–	–	83	10	–	–	93	17.1
H-3	–	–	–	–	–	3	19	12	5	39	21.0
H-53	8	–	–	–	3	12	21	5	–	49	15.4
H-60	9	10	–	–	–	–	–	–	–	19	3.2
TR-1	11	9	2	–	–	–	–	–	–	22	3.1
T-33	–	–	–	–	–	–	–	–	1	1	36.9
T-37	–	–	–	–	–	–	132	62	414	608	26.3
T-38	–	–	–	–	–	45	208	282	273	808	22.5
T-39	–	–	–	–	–	–	–	–	14	14	26.7
T-41	–	–	–	–	–	–	50	50	–	100	21.3
T-43	–	–	–	–	12	2	–	–	–	14	14.6
U-6	–	–	1	–	–	–	–	–	–	1	8.0
U-26	–	1	–	–	–	–	–	–	–	1	5.0
OV-10	2	–	–	–	–	–	76	–	–	78	19.5
UV-18	1	–	–	2	–	–	–	–	–	3	7.6
TOTALS	**788**	**702**	**724**	**447**	**326**	**577**	**1,017**	**1,213**	**1,702**	**7,496**	**15.9**
PERCENT[1]	**11**	**9**	**10**	**6**	**4**	**8**	**14**	**16**	**23**		

NOTE: ARF not included in calendar age.
Less than 9 years old: 2,214 aircraft (29.5%).
More than 9 years old: 5,282 aircraft (70.5%).

[1]Percentages have been rounded.

AIR NATIONAL GUARD AIRCRAFT—HOW MANY, HOW OLD?

(Current as of September 30, 1988)

	0–3 YRS.	3–6 YRS.	6–9 YRS.	9–12 YRS.	12–15 YRS.	15–18 YRS.	18–21 YRS.	21–24 YRS.	24+ YRS.	TOTAL NUMBER	AVERAGE AGE (YRS.)
A-7	–	6	22	5	62	233	12	–	–	340	15.1
A-10	–	–	51	51	–	–	–	–	–	102	9.0
OA-37	–	–	–	–	25	22	20	–	–	67	16.0
C-5	–	–	–	–	1	5	4	–	–	10	17.6
C-12	10	2	–	–	1	–	–	–	–	13	2.7
C-21	4	–	–	–	–	–	–	–	–	4	1.0
C-22	–	4	–	–	–	–	–	–	–	4	3.7
C-130	24	17	16	8	–	–	–	10	139	214	20.9
C-131	–	–	–	–	–	–	–	–	12	12	33.2
KC-135	–	–	–	–	–	–	–	–	114	114	29.6
C-141	–	–	–	–	–	–	–	8	–	8	22.3
F-4	–	–	–	–	–	–	140	360	15	515	21.3
F-15	–	–	–	36	63	–	–	–	–	99	12.3
F-16	–	77	129	8	–	–	–	–	–	214	6.6
H-3	–	–	–	–	–	–	3	6	–	9	21.1
T-33	–	–	–	–	–	–	–	–	1	1	33.0
T-43	–	–	–	–	4	–	–	–	–	4	14.5
TOTALS	**38**	**106**	**218**	**108**	**156**	**260**	**179**	**384**	**281**	**1,730**	**17.1**
PERCENT[1]	**2**	**6**	**13**	**6**	**9**	**15**	**10**	**22**	**16**		

NOTE: Less than 9 years old: 362 aircraft (21%).
More than 9 years old: 1,368 aircraft (79%).

[1]Percentages have been rounded.

AIR FORCE RESERVE AIRCRAFT—HOW MANY, HOW OLD?

(Current as of December 15, 1988)

	0–3 YRS.	3–6 YRS.	6–9 YRS.	9–12 YRS.	12–15 YRS.	15–18 YRS.	18–21 YRS.	21–24 YRS.	24+ YRS.	TOTAL NUMBER	AVERAGE AGE (YRS.)
A-10	–	–	–	97	–	–	–	–	–	97	10.0
AC-130A	–	–	–	–	–	–	–	–	10	10	33.0
C-130A	–	–	–	–	–	–	–	–	8	8	32.0
C-130B	–	–	–	–	–	–	–	–	36	36	28.0
C-130E	–	–	–	–	–	–	–	1	41	42	26.0
C-130H	24	2	6	–	–	–	–	–	–	32	3.0
HC-130H	–	–	–	–	–	–	–	10	–	10	24.0
HC-130N	–	–	–	–	–	–	4	–	–	4	19.0
HC-130P	–	–	–	–	–	–	–	–	1	1	24.0
WC-130E	–	–	–	–	–	–	–	–	2	2	27.0
WC-130H[1]	–	–	–	–	–	–	–	4	–	4	23.0
C-141B	–	–	–	–	–	–	–	8	–	8	23.0
C-5A	–	–	–	–	–	3	21	3	–	27	20.0
KC-135E	–	–	–	–	–	–	–	–	24	24	30.0
F-4	–	–	–	–	–	–	26	79	–	105	21.0
F-16	26	–	7	25	–	–	–	–	–	58	6.0
H-1	–	–	–	–	–	5	–	–	–	5	18.0
H-3	–	–	–	–	–	–	6	12	1	19	22.0
TOTAL	**50**	**2**	**13**	**122**	**0**	**8**	**57**	**117**	**123**	**492**	**17.2**
PERCENT[2]	**10**	**1**	**2**	**25**	**0**	**2**	**12**	**23**	**25**		

NOTE: Less than 9 years old: 65 aircraft (13%).
More than 9 years old: 427 aircraft (87%).

[1]Five WC-130Hs (not included here) are being reconfigured and will be assigned back to AFRES as C-130Es.
[2]Percentages have been rounded.

ACTIVE-DUTY MILITARY PERSONNEL, RESERVE COMPONENT MILITARY PERSONNEL, AND CIVILIAN PERSONNEL STRENGTH

(Figures in thousands)

	FY '83	FY '84	FY '85	FY '86	FY '87	FY '88	FY '89[1]	FY '90[1]
ACTIVE-DUTY MILITARY								
Army	780	780	781	781	781	772	772	772
Navy	558	565	571	581	587	593	593	598
Marine Corps	194	196	198	199	200	197	197	197
Air Force	592	597	602	608	607	576	571	571
TOTAL	**2,123**	**2,138**	**2,151**	**2,169**	**2,174**	**2,138**	**2,133**	**2,138**
RESERVE COMPONENTS (SELECTED RESERVE)								
Army National Guard	417	434	440	446	453	455	457	458
Army Reserve	266	275	292	310	319	313	319	322
Naval Reserve	109	121	130	142	149	149	153	153
Marine Corps Reserve	43	41	42	42	43	44	44	44
Air National Guard	102	105	109	113	113	115	115	116
Air Force Reserve	67	70	75	79	80	82	83	85
TOTAL	**1,005**	**1,046**	**1,088**	**1,130**	**1,157**	**1,158**	**1,171**	**1,178**
DIRECT HIRE CIVILIAN								
Army[2]	332	344	359	354	358	337	342	345
Navy	328	332	342	332	343	336	335	329
Air Force[2]	238	240	250	250	252	241	249	249
Defense Agencies	81	85	91	92	96	95	97	96
TOTAL[2]	**980**	**1,000**	**1,043**	**1,027**	**1,049**	**1,010**	**1,023**	**1,019**

NOTE: Numbers are rounded and may not sum to totals.

[1]Programmed.
[2]Includes Army and Air National Guard Technicians, who were converted from State to Federal employees in FY '69.

USAF FLYING SQUADRONS BY MISSION TYPE[1]

ACTIVE FORCES	FY '84	FY '85	FY '86	FY '87	FY '88	FY '89[2]
Strategic Bomber	22	22	20	22	24	25
Air Refueling	35	35	36	36	35	35
Strategic Command and Control	6	6	6	6	6	6
Intelligence	3	3	3	3	3	3
Strategic Reconnaissance	1	1	1	1	1	1
Strategic Interceptor	5	4	4	3	2	2
Fighter	77	78	78	81	79	79
Tactical Reconnaissance	8	8	8	7	5	5
Tactical Electronic Warfare	3	3	3	4	4	4
Special Operations Forces	5	5	5	5	7	5
Tactical Air Command Control Systems[3]	3	3	3	3	3	3
Tactical Air Control Systems[3]	7	7	7	7	7	7
Weather	2	2	2	2	1	1
Rescue	8	8	9	9	6	7
Tactical Airlift	14	14	14	13	13	12
Strategic Airlift	17	17	17	17	19	18
Special Mission	1	1	1	1	1	1
Aeromedical Airlift	3	3	3	3	3	3
GLCM[4]	2	3	4	6	5	*
ICBM	24	23	22	20	20	20
TOTAL	**246**	**246**	**246**	**249**	**244**	**237**
RESERVE FORCES						
ANG Selected Reserve	91	91	91	91	91	91
Air Force Reserve[5]	56	56	57	57	58	58
TOTAL	**147**	**147**	**148**	**148**	**149**	**149**
GRAND TOTAL	**393**	**393**	**394**	**397**	**393**	**386**

[1]Excludes training, support, and OT&E units.
[2]Estimated.
[3]Includes consolidation of certain functional groups.
[4]GLCM Tactical Missile Wings. GLCMs are assigned by flights, not by squadrons.
[5]Includes Associate Squadrons.
*Decision pending INF Treaty ratification.

NUMBER OF AIRCRAFT PER ACTIVE-DUTY USAF SQUADRON

(End FY '88)

AIRCRAFT TYPE	NUMBER[1]
A-10	18 or 24
B-1	16
B-52	13, 14, 15, 16, or 19
C-5	17 or 18[2]
C-9	3 or 11
C-130	8, 10, 16, or 19
AC-130	10
KC-10	19
KC-135	13 to 25
C-141	12 to 17
E-3	4 or 9
F-4	12 or 24
RF-4	18
F-5	20
F-15	15, 18, or 24
F-16	18 or 24
F-111	12, 18, or 24
FB-111	8 or 11

[1]For some types of aircraft, squadrons vary in size as shown here. HC-130, WC-130, T-39, and T-38 aircraft are counted as Total Unit Equipment, not by squadrons.
[2]Reflects ongoing transfer of assets to Air Reserve Forces.

NUMBER OF ACTIVE AIRCRAFT AND FLYING HOURS

TYPE OF AIRCRAFT	FY '83	FY '84	FY '85	FY '86	FY '87	FY '88	FY '89
Bomber, Strategic	338	328	330	346	393	422	420
Tanker	546	556	559	572	576	567	566
Fighter/Interceptor/Attack	2,997	3,019	3,057	3,046	3,033	2,978	2,998
Reconnaissance/Electronic Warfare	385	404	418	394	432	424	438
Cargo/Transport	827	863	859	855	848	857	852
Search & Rescue (Fixed Wing)	35	35	37	37	35	33	31
Helicopter (includes Rescue)	236	237	234	232	191	200	171
Trainer	1,624	1,622	1,613	1,643	1,595	1,543	1,515
Utility/Observation/Other	206	191	180	120	110	120	112
TOTAL, USAF	**7,194**	**7,255**	**7,287**	**7,245**	**7,213**	**7,144**	**7,103**
Air National Guard total	1,703	1,688	1,688	1,782	1,732	1,730	1,736
Air Force Reserve total	458	458	468	467	502	493	514
TOTAL, ACTIVE AIRCRAFT, USAF, ANG, AFRES	**9,355**	**9,401**	**9,443**	**9,494**	**9,447**	**9,367**	**9,353**
Active aircraft including foreign government owned	9,445	9,489	9,529	9,578	9,501	9,451	9,437
FLYING HOURS (000)							
USAF	2,843	2,870	2,914	2,888	2,837	2,737	2,770
Air National Guard	414	416	423	412	435	445	447
Air Force Reserve	132	136	140	141	153	150	156
TOTAL FLYING HOURS	**3,389**	**3,422**	**3,477**	**3,441**	**3,425**	**3,332**	**3,373**

NOTE: FY '83–88 numbers are actual; FY '89 numbers are estimated.

USAF AIRCRAFT TAIL MARKINGS

Code	Aircraft	Unit, location, and command
AD	Various	Armament Division, Eglin AFB, Fla. (AFSC)
AK	F-15	21st TFW, Elmendorf AFB, Alaska (AAC)
AK	A-10A	343d TFW, Eielson AFB, Alaska (AAC)
AL	F-16	187th TFG, Dannelly Field, Ala. (ANG)
AR	F-5E, A-10A	10th TFW, RAF Alconbury, UK (USAFE)
AZ	A-7D, F-16	162d TFG, Tucson IAP, Ariz. (ANG)
BA	RF-4C	67th TRW, Bergstrom AFB, Tex. (TAC)
BC	OA-37	110th TASG, Battle Creek ANGB, Mich. (ANG)
BD	A-10A	917th TFG, Barksdale AFB, La. (AFRES)
BT	F-15	36th TFW, Bitburg AB, Germany (USAFE)
CC	F-111D	27th TFW, Cannon AFB, N. M. (TAC)
CM	F-15	159th TFG, NAS New Orleans, La. (ANG)
CO	A-7D	140th TFW, Buckley ANGB, Colo. (ANG)
CR	F-15	32d TFS, Soesterberg AB, Netherlands (USAFE)
CT	A-10A	103d TFG, Bradley ANGB, Conn. (ANG)
DC	F-4D	113th TFW, Andrews AFB, Md. (ANG)
DM	A-10A	355th TTW, Davis-Monthan AFB, Ariz. (TAC)
DO	F-4D	906th TFG, Wright-Patterson AFB, Ohio (AFRES)
ED	Various	Air Force Flight Test Center, Edwards AFB, Calif. (AFSC)
EG	F-15	33d TFW, Eglin AFB, Fla. (TAC)
EL	A-10A	23d TFW, England AFB, La. (TAC)
FF	F-15	1st TFW, Langley AFB, Va. (TAC)
FL	OV-10	549th TASTG, Patrick AFB, Fla. (TAC)
FM	F-4D	482d TFW, Homestead AFB, Fla. (AFRES)
FS	F-16	188th TFW, Fort Smith MAP, Ark. (ANG)
FW	F-4E	122d TFW, Fort Wayne MAP, Ind. (ANG)
GA	F-4E	35th TFW, George AFB, Calif. (TAC)
GU	F-4E	497th TFS, Taegu AB, Korea (PACAF)
HA	A-7D	185th TFG, Sioux City, Iowa (ANG)
HF	F-4E	181st TFG, Hulman RAP, Ind. (ANG)
HI	F-16	419th TFW, Hill AFB, Utah (AFRES)
HL	F-16	388th TFW, Hill AFB, Utah (TAC)
HM	AT-38A	479th TTW, Holloman AFB, N. M. (TAC)
HO	F-15	49th TFW, Holloman AFB, N. M. (TAC)
HR	F-16	50th TFW, Hahn AB, Germany (USAFE)
HS	F-16	31st TTW, Homestead AFB, Fla. (TAC)
HW	OA-37	24th COMPW, Howard AFB, Panama (TAC)
IA	A-7D	132d TFW, Des Moines MAP, Iowa (ANG)
ID	A-10A	46th TFS, Grissom AFB, Ind. (AFRES)
IL	OA-37	182d TASG, Greater Peoria Airport, Ill. (ANG)
IN	A-10A	434th TFW, Grissom AFB, Ind. (AFRES)
IS	F-15	57th FIS, NAS Keflavik, Iceland (TAC)
KC	A-10A	442d TFW, Richards-Gebaur AFB, Mo. (AFRES)
KE	RF-4C	186th TRG, Key Field, Miss. (ANG)
KS	EC-130	7th ACCS, Keesler AFB, Miss. (TAC)
KY	C-130	123d TAW, Standiford Field, Ky. (ANG)
LA	F-15	405th TTW, Luke AFB, Ariz. (TAC)
LF	F-16	58th TTW, Luke AFB, Ariz. (TAC)
LH	CH-3	302d SOS, Luke AFB, Ariz. (AFRES)
LN	F-111F	48th TFW, RAF Lakenheath, UK (USAFE)
LR	F-16	944th TFG, Luke AFB, Ariz. (AFRES)
LV	A-7D	4450th TACG, Nellis AFB, Nev. (TAC)
MA	A-10A	104th TFG, Barnes MAP, Mass. (ANG)
MB	A-10A	354th TFW, Myrtle Beach AFB, S. C. (TAC)
MC	F-16	56th TTW, MacDill AFB, Fla. (TAC)
MD	A-10A	175th TFG, Martin Airport, Md. (ANG)
MI	A-7D	127th TFW, Selfridge ANGB, Mich. (ANG)
MJ	F-16	432d TFW, Misawa AB, Japan (PACAF)
MO	F-111A, EF-111A	366th TFW, Mountain Home AFB, Idaho (TAC)
MY	F-16	347th TFW, Moody AFB, Ga. (TAC)
NA	F-16	474th TFW, Nellis AFB, Nev. (TAC)
NF	OA-37	602d TAIRCW, Davis-Monthan AFB, Ariz. (TAC)
NJ	F-4E	108th TFW, McGuire AFB, N. J. (ANG)
NM	A-7D	150th TFG, Kirtland AFB, N. M. (ANG)
NO	A-10A	926th TFG, NAS New Orleans, La. (AFRES)
NY	F-16	174th TFW, Hancock Field, N. Y. (ANG)
OH	A-7D	121st TFW, Rickenbacker ANGB; 178th TFG, Springfield; 180th TFG, Toledo, Ohio (ANG)
OK	A-7D	138th TFG, Tulsa IAP, Okla. (ANG)
OS	F-16, OV-10	51st TFW, Osan AB, Korea (PACAF)
OT	Various	TAWC, Eglin AFB, Fla. (TAC)
PA	OA-10	111th TASG, Willow Grove ARF, Pa. (ANG)
PA	EC-130H	193d SOG, Harrisburg IAP, Pa. (ANG)
PN	F-4E/G, F-5	3d TFW, Clark AB, Philippines (PACAF)
PR	A-7D	156th TFG, Muniz ANGB, Puerto Rico (ANG)
PT	A-7D	112th TFG, Greater Pittsburgh IAP, Pa. (ANG)
RG	Various	Warner Robins ALC, Robins AFB, Ga. (AFLC)
RS	F-16	86th TFW, Ramstein AB, Germany (USAFE)
SA	F-16	149th TFG, Kelly AFB, Tex. (ANG)
SC	F-16	169th TFG, McEntire ANGB, S. C. (ANG)
SD	A-7D	114th TFG, Joe Foss Field, S. D. (ANG)
SH	F-4D	507th TFG, Tinker AFB, Okla. (AFRES)
SI	F-4D	183d TFG, Capitol MAP, Ill. (ANG)
SJ	F-4E	4th TFW, Seymour Johnson AFB, N. C. (TAC)
SL	F-4E	131st TFW, Bridgeton, Mo. (ANG)
SP	F-4E/G	52d TFW, Spangdahlem AB, Germany (USAFE)
SU	A-10A	51st TFW, Suwon AB, Korea (PACAF)
SW	F-16, RF-4C	363d TFW, Shaw AFB, S. C. (TAC)
TH	F-4E	301st TFW, Carswell AFB, Tex. (AFRES)
TJ	F-16	401st TFW, Torrejon AB, Spain (USAFE)
TX	F-4D	924th TFG, Bergstrom AFB, Tex. (AFRES)
TY	F-15	325th TTW, Tyndall AFB, Fla. (TAC)
UH	F-111E, EF-111A	20th TFW, RAF Upper Heyford, UK (USAFE)
VA	A-7D	192d TFG, Byrd Field, Va. (ANG)
VT	F-16	158th FIG, Burlington IAP, Vt. (ANG)
VV	OV-10	27th TASS, George AFB, Calif. (TAC)
WA	Various	57th FWW, Nellis AFB, Nev. (TAC)
WI	A-10A	128th TFW, Truax ANGB, Wis. (ANG)
WP	F-16	8th TFW, Kunsan AB, Korea (PACAF)
WR	A-10A	81st TFW, RAF Bentwaters, UK (USAFE)
WW	F-4E/G	37th TFW, George AFB, Calif. (TAC)
ZR	RF-4C	26th TRW, Zweibrücken AB, Germany (USAFE)
ZZ	F-15, RF-4C	18th TFW, Kadena AB, Okinawa (PACAF)

AIR DEFENSE UNIT FIN FLASHES

Color code	Aircraft	Unit and location
Active Duty[1]		
Gold lightning bolt on dark-blue border	F-15	5th FIS, Minot AFB, N. D.
Blue/white stripes	F-15	48th FIS, Langley AFB, Va.
Dark blue/light blue/white star	F-15	318th FIS, McChord AFB, Wash.
Air National Guard Units		
Sea-blue wedge	F-15A	102d FIW, Otis ANGB, Mass.
Rainbow	F-4D	107th FIG, Niagara Falls IAP, N. Y.
Red stripe with "Happy Hooligans" logo	F-4D	119th FIG, Hector Field, N. D.
Blue triangle and two blue stripes bearing "Montana" and "Big Sky Country" logos	F-16	120th FIG, Great Falls IAP, Mont.
Red hawk	F-4C	123d FIS (142d FIG), Portland IAP, Ore.
Blue/white lightning bolt	F-16	125th FIG, Jacksonville IAP, Fla.
Blue stripe with "California" logo	F-4D	144th FIW, Fresno Air Terminal, Calif.
Texas star on red/white jagged stripes	F-4D	147th FIG, Ellington ANGB, Tex.
Stars of Little Dipper constellation	F-4D	148th FIG, Duluth IAP, Minn.
Red dart	F-16	177th FIG, Atlantic City Airport, N. J.
Yellow and black checkerboard	F-4D	191st FIG, Selfridge ANGB, Mich.
Air Defense Training Units (ANG)		
Black hawk	F-16	114th TFTS (142d FIG), Kingsley Field, Ore.

[1]The F-15 aircraft assigned to the 57th FIS, NAS Keflavik, Iceland, carries the letter tail code IS and is listed in the chart above.

USAF Leaders Through The Years

SECRETARIES OF THE AIR FORCE

Stuart Symington	Sept. 18, 1947	Apr. 24, 1950
Thomas K. Finletter	Apr. 24, 1950	Jan. 20, 1953
Harold E. Talbott	Feb. 4, 1953	Aug. 13, 1955
Donald A. Quarles	Aug. 15, 1955	Apr. 30, 1957
James H. Douglas, Jr.	May 1, 1957	Dec. 10, 1959
Dudley C. Sharp	Dec. 11, 1959	Jan. 20, 1961
Eugene M. Zuckert	Jan. 24, 1961	Sept. 30, 1965
Harold Brown	Oct. 1, 1965	Feb. 15, 1969
Robert C. Seamans, Jr.	Feb. 15, 1969	May 14, 1973
John L. McLucas	July 18, 1973	Nov. 23, 1975
James W. Plummer (acting)	Nov. 24, 1975	Jan. 1, 1976
Thomas C. Reed	Jan. 2, 1976	Apr. 6, 1977
John C. Stetson	Apr. 6, 1977	May 18, 1979
Hans Mark	July 26, 1979	Feb. 9, 1981
Verne Orr	Feb. 9, 1981	Nov. 30, 1985
Russell A. Rourke	Dec. 9, 1985	Apr. 7, 1986
Edward C. Aldridge, Jr.	June 9, 1986	Dec. 16, 1988
James F. McGovern (acting)	Dec. 17, 1988	

USAF CHIEFS OF STAFF

Gen. Carl A. Spaatz	Sept. 26, 1947	Apr. 29, 1948
Gen. Hoyt S. Vandenberg	Apr. 30, 1948	June 29, 1953
Gen. Nathan F. Twining	June 30, 1953	June 30, 1957
Gen. Thomas D. White	July 1, 1957	June 30, 1961
Gen. Curtis E. LeMay	June 30, 1961	Jan. 31, 1965
Gen. John P. McConnell	Feb. 1, 1965	July 31, 1969
Gen. John D. Ryan	Aug. 1, 1969	July 31, 1973
Gen. George S. Brown	Aug. 1, 1973	June 30, 1974
Gen. David C. Jones	July 1, 1974	June 20, 1978
Gen. Lew Allen, Jr.	July 1, 1978	June 30, 1982
Gen. Charles A. Gabriel	July 1, 1982	June 30, 1986
Gen. Larry D. Welch	July 1, 1986	

CHIEF MASTER SERGEANTS OF THE AIR FORCE

CMSAF Paul W. Airey	Apr. 3, 1967	Aug. 1, 1969
CMSAF Donald L. Harlow	Aug. 1, 1969	Oct. 1, 1971
CMSAF Richard D. Kisling	Oct. 1, 1971	Oct. 1, 1973
CMSAF Thomas N. Barnes	Oct. 1, 1973	Aug. 1, 1977
CMSAF Robert D. Gaylor	Aug. 1, 1977	Aug. 1, 1979
CMSAF James M. McCoy	Aug. 1, 1979	July 1, 1981
CMSAF Arthur L. Andrews	Aug. 1, 1981	Aug. 1, 1983
CMSAF Sam E. Parish	Aug. 1, 1983	June 30, 1986
CMSAF James C. Binnicker	July 1, 1986	

AIR FORCE COMMUNICATIONS COMMAND

Maj. Gen. Harold W. Grant	July 1, 1961	Feb. 15, 1962
Maj. Gen. Kenneth P. Bergquist	Feb. 16, 1962	June 30, 1965
Maj. Gen. J. Francis Taylor, Jr.	July 1, 1965	Oct. 31, 1965
Maj. Gen. Richard P. Klocko	Nov. 1, 1965	July 2, 1967
Maj. Gen. Robert W. Paulson	July 15, 1967	Aug. 1, 1969
Maj. Gen. Paul R. Stoney	Aug. 1, 1969	Oct. 31, 1973
Maj. Gen. Donald L. Werbeck	Nov. 1, 1973	Aug. 24, 1975
Maj. Gen. Rupert H. Burris	Aug. 25, 1975	Oct. 31, 1977
Maj. Gen. Robert E. Sadler	Nov. 1, 1977	July 1, 1979
Maj. Gen. Robert T. Herres	July 1, 1979	July 27, 1981
Maj. Gen. Robert F. McCarthy	July 27, 1981	June 1, 1984
Maj. Gen. Gerald L. Prather	June 1, 1984	Aug. 28, 1986
Maj. Gen. John T. Stihl	Aug. 28, 1986	Mar. 29, 1988
Maj. Gen. James S. Cassity, Jr.	Mar. 29, 1988	

Formerly Air Force Communications Service.
Redesignated Air Force Communications Command Nov. 15, 1979.

AIR FORCE LOGISTICS COMMAND

Gen. Joseph T. McNarney	Oct. 14, 1947	Aug. 31, 1949
Lt. Gen. Benjamin W. Chidlaw	Sept. 1, 1949	Aug. 20, 1951
Gen. Edwin W. Rawlings	Aug. 21, 1951	Feb. 28, 1959
Lt. Gen. William F. McKee	Mar. 1, 1959	Mar. 14, 1959
Gen. Samuel E. Anderson	Mar. 15, 1959	July 31, 1961
Gen. William F. McKee	Aug. 1, 1961	June 30, 1962
Gen. Mark E. Bradley, Jr.	July 1, 1962	July 31, 1965
Gen. Kenneth B. Hobson	Aug. 1, 1965	July 31, 1967
Gen. Thomas P. Gerrity	Aug. 1, 1967	Feb. 24, 1968
Lt. Gen. Lewis L. Mundell (acting)	Feb. 24, 1968	Mar. 28, 1968
Gen. Jack G. Merrell	Mar. 29, 1968	Sept. 11, 1972
Gen. Jack J. Catton	Sept. 12, 1972	Aug. 31, 1974
Gen. William V. McBride	Sept. 1, 1974	Aug. 31, 1975
Gen. F. Michael Rogers	Sept. 1, 1975	Jan. 27, 1978
Gen. Bryce Poe II	Jan. 28, 1978	July 31, 1981
Gen. James P. Mullins	Aug. 1, 1981	Nov. 1, 1984
Gen. Earl T. O'Loughlin	Nov. 1, 1984	July 31, 1987
Gen. Alfred G. Hansen	July 31, 1987	

Formerly Air Materiel Command.
Redesignated Air Force Logistics Command Apr. 1, 1961.

AIR FORCE SPACE COMMAND

Gen. James V. Hartinger	Sept. 1, 1982	Aug. 1, 1984
Gen. Robert T. Herres	Aug. 1, 1984	Oct. 1, 1986
Maj. Gen. Maurice C. Padden	Oct. 1, 1986	Nov. 1, 1987
Lt. Gen. Donald J. Kutyna	Nov. 1, 1987	

AIR FORCE SYSTEMS COMMAND

Maj. Gen. David M. Schlatter	Feb. 1, 1950	June 24, 1951
Lt. Gen. Earle E. Partridge	June 24, 1951	June 20, 1953
Lt. Gen. Donald L. Putt	June 30, 1953	Apr. 14, 1954
Lt. Gen. Thomas S. Power	Apr. 15, 1954	June 30, 1957
Maj. Gen. John W. Sessums, Jr.	July 1, 1957	July 31, 1957
Lt. Gen. Samuel E. Anderson	Aug. 1, 1957	Mar. 9, 1959
Maj. Gen. John W. Sessums, Jr.	Mar. 10, 1959	Apr. 24, 1959
Gen. Bernard A. Schriever	Apr. 25, 1959	Aug. 31, 1966
Gen. James Ferguson	Sept. 1, 1966	Aug. 30, 1970
Gen. George S. Brown	Sept. 1, 1970	July 31, 1973
Gen. Samuel C. Phillips	Aug. 1, 1973	Aug. 31, 1975
Gen. William J. Evans	Sept. 1, 1975	July 31, 1977
Gen. Lew Allen, Jr.	Aug. 1, 1977	Mar. 13, 1978
Gen. Alton D. Slay	Mar. 14, 1978	Feb. 1, 1981
Gen. Robert T. Marsh	Feb. 1, 1981	Aug. 1, 1984
Gen. Lawrence A. Skantze	Aug. 1, 1984	July 17, 1987
Gen. Bernard P. Randolph	July 17, 1987	

Formerly Air Research and Development Command.
Redesignated Air Force Systems Command Apr. 1, 1961.

AIR TRAINING COMMAND

Lt. Gen. John K. Cannon	Apr. 15, 1946	Oct. 15, 1948
Lt. Gen. Robert W. Harper	Oct. 14, 1948	June 30, 1954
Maj. Gen. Glenn O. Barcus	July 1, 1954	July 25, 1954
Lt. Gen. Charles T. Myers	July 26, 1954	July 31, 1958
Lt. Gen. Frederic H. Smith, Jr.	Aug. 1, 1958	July 31, 1959
Lt. Gen. James E. Briggs	Aug. 1, 1959	July 31, 1963
Lt. Gen. Robert W. Burns	Aug. 1, 1963	Aug. 10, 1964
Lt. Gen. William W. Momyer	Aug. 11, 1964	June 30, 1966
Lt. Gen. Sam Maddux, Jr.	July 1, 1966	Aug. 30, 1970
Lt. Gen. George B. Simler	Sept. 1, 1970	Sept. 9, 1972
Lt. Gen. William V. McBride	Sept. 9, 1972	Aug. 31, 1974
Lt. Gen. George H. McKee	Sept. 1, 1974	Aug. 31, 1975
Gen. John W. Roberts	Sept. 1, 1975	Apr. 1, 1979
Gen. B. L. Davis	Apr. 1, 1979	July 29, 1981
Gen. Thomas M. Ryan, Jr.	July 29, 1981	June 30, 1983
Gen. Andrew P. Iosue	July 1, 1983	Aug. 28, 1986
Gen. John A. Shaud	Aug. 28, 1986	June 6, 1988
Lt. Gen. Robert C. Oaks	June 6, 1988	

AIR UNIVERSITY

Maj. Gen. Muir S. Fairchild	Mar. 15, 1946	May 17, 1948
Maj. Gen. Robert W. Harper	May 17, 1948	Oct. 15, 1948
Gen. George C. Kenney	Oct. 16, 1948	July 27, 1951
Lt. Gen. Idwal H. Edwards	July 28, 1951	Feb. 28, 1953
Lt. Gen. Laurence S. Kuter	Apr. 15, 1953	May 31, 1955
Lt. Gen. Dean C. Strother	June 1, 1955	June 30, 1958
Lt. Gen. Walter E. Todd	July 15, 1958	July 31, 1961
Lt. Gen. Troup Miller, Jr.	Aug. 1, 1961	Dec. 31, 1963
Lt. Gen. Ralph P. Swofford, Jr.	Jan. 1, 1964	July 31, 1965
Lt. Gen. John W. Carpenter III	Aug. 1, 1965	July 31, 1968
Lt. Gen. Albert P. Clark	Aug. 1, 1968	July 31, 1970
Lt. Gen. Alvan C. Gillem II	Aug. 1, 1970	Oct. 31, 1973
Lt. Gen. F. Michael Rogers	Nov. 1, 1973	Aug. 31, 1975
Lt. Gen. Raymond B. Furlong	Sept. 1, 1975	July 1, 1979
Lt. Gen. Stanley M. Umstead	July 1, 1979	July 24, 1981
Lt. Gen. Charles G. Cleveland	July 24, 1981	Aug. 1, 1984
Lt. Gen. Thomas C. Richards	Aug. 1, 1984	Nov. 6, 1986
Lt. Gen. Truman Spangrud	Nov. 6, 1986	July 12, 1988
Lt. Gen. Ralph E. Havens	July 12, 1988	

Air University was part of Air Training Command between May 1978 and July 1983.

ALASKAN AIR COMMAND

Brig. Gen. Joseph H. Atkinson	Oct. 1, 1946	Feb. 25, 1949
Brig. Gen. Frank A. Armstrong, Jr.	Feb. 26, 1949	Dec. 27, 1950
Maj. Gen. William D. Old	Dec. 27, 1950	Oct. 14, 1952
Brig. Gen. W. R. Agee	Oct. 27, 1952	Feb. 26, 1953
Maj. Gen. George R. Acheson	Feb. 26, 1953	Feb. 1, 1956
Lt. Gen. Joseph H. Atkinson	Feb. 24, 1956	July 16, 1956
Maj. Gen. Frank A. Armstrong, Jr.	July 17, 1956	Oct. 23, 1956
Maj. Gen. James H. Davies	Oct. 24, 1956	June 27, 1957
Lt. Gen. Frank A. Armstrong, Jr.	June 28, 1957	Aug. 18, 1957
Brig. Gen. Kenneth H. Gibson	Aug. 19, 1957	Aug. 13, 1958
Maj. Gen. C. F. Necrason	Aug. 14, 1958	July 19, 1961
Maj. Gen. Wendell W. Bowman	July 26, 1961	Aug. 8, 1963
Maj. Gen. James C. Jensen	Aug. 15, 1963	Nov. 14, 1966
Maj. Gen. Thomas E. Moore	Nov. 15, 1966	July 24, 1969
Maj. Gen. Joseph A. Cunningham	July 25, 1969	July 31, 1972
Maj. Gen. Donavon F. Smith	Aug. 1, 1972	June 5, 1973
Maj. Gen. Charles W. Carson, Jr.	June 18, 1973	Mar. 2, 1974
Maj. Gen. Jack K. Gamble	Mar. 19, 1974	June 30, 1975
Lt. Gen. James E. Hill	July 1, 1975	Oct. 14, 1976
Lt. Gen. M. L. Boswell	Oct. 15, 1976	June 30, 1978
Lt. Gen. Winfield W. Scott, Jr.	July 1, 1978	Apr. 1, 1981
Lt. Gen. Lynwood E. Clark	Apr. 1, 1981	Aug. 31, 1983
Lt. Gen. Bruce K. Brown	Sept. 1, 1983	Sept. 26, 1985
Lt. Gen. David L. Nichols	Sept. 27, 1985	May 22, 1988
Lt. Gen. Thomas G. McInerney	May 22, 1988	

ELECTRONIC SECURITY COMMAND

Col. Roy H. Lynn	Oct. 26, 1948	July 5, 1949
Col. Travis M. Hetherington	July 6, 1949	Feb. 21, 1951
Maj. Gen. Roy H. Lynn	Feb. 22, 1951	Feb. 13, 1953
Maj. Gen. Harold H. Bassett	Feb. 14, 1953	Jan. 3, 1957
Maj. Gen. Gordon L. Blake	Jan. 4, 1957	Aug. 5, 1959
Maj. Gen. John B. Ackerman	Aug. 6, 1959	Sept. 20, 1959
Maj. Gen. Millard Lewis	Sept. 21, 1959	Aug. 31, 1962
Maj. Gen. Richard P. Klocko	Sept. 1, 1962	Oct. 15, 1965
Maj. Gen. Louis E. Coira	Oct. 16, 1965	July 18, 1969
Maj. Gen. Carl W. Stapleton	July 19, 1969	Feb. 23, 1973
Maj. Gen. Walter T. Galligan	Feb. 24, 1973	May 16, 1974
Maj. Gen. Howard P. Smith	May 17, 1974	July 31, 1975
Maj. Gen. K. D. Burns	Aug. 1, 1975	Jan. 18, 1979
Maj. Gen. Doyle E. Larson	Jan. 19, 1979	July 31, 1983
Maj. Gen. John B. Marks	Aug. 1, 1983	Apr. 16, 1985
Maj. Gen. Paul H. Martin	Apr. 17, 1985	

Formerly USAF Security Service.
Redesignated Electronic Security Command Aug. 1, 1979.

MILITARY AIRLIFT COMMAND

Lt. Gen. Laurence S. Kuter	June 1, 1948	Oct. 28, 1951
Lt. Gen. Joseph Smith	Nov. 15, 1951	June 30, 1958
Lt. Gen. William H. Tunner	July 1, 1958	May 31, 1960
Gen. Joe W. Kelly, Jr.	June 1, 1960	July 18, 1964
Gen. Howell M. Estes, Jr.	July 19, 1964	July 31, 1969
Gen. Jack J. Catton	Aug. 1, 1969	Sept. 12, 1972
Gen. Paul K. Carlton	Sept. 20, 1972	Mar. 31, 1977
Gen. William G. Moore, Jr.	Apr. 1, 1977	June 30, 1979
Gen. Robert E. Huyser	July 1, 1979	June 26, 1981
Gen. James R. Allen	June 26, 1981	June 30, 1983
Gen. Thomas M. Ryan, Jr.	July 1, 1983	Sept. 19, 1985
Gen. Duane H. Cassidy	Sept. 20, 1985	

Formerly Military Air Transport Service.
Redesignated Military Airlift Command Jan. 1, 1966.

PACIFIC AIR FORCES

Lt. Gen. Ennis C. Whitehead	Dec. 30, 1945	Apr. 25, 1949
Lt. Gen. George E. Stratemeyer	Apr. 26, 1949	May 20, 1951
Lt. Gen. Earle E. Partridge (acting)	May 21, 1951	June 9, 1951
Gen. O. P. Weyland	June 10, 1951	Mar. 25, 1954
Gen. Earle E. Partridge	Mar. 26, 1954	May 31, 1955
Gen. Laurence S. Kuter	June 1, 1955	July 31, 1959
Gen. Emmett O'Donnell, Jr.	Aug. 1, 1959	July 31, 1963
Gen. Jacob E. Smart	Aug. 1, 1963	July 31, 1964
Gen. Hunter Harris, Jr.	Aug. 1, 1964	Jan. 31, 1967
Gen. John D. Ryan	Feb. 1, 1967	July 31, 1968
Gen. Joseph J. Nazzaro	Aug. 1, 1968	July 31, 1971
Gen. Lucius D. Clay, Jr.	Aug. 1, 1971	Sept. 30, 1973
Gen. John W. Vogt	Oct. 1, 1973	June 30, 1974
Gen. Louis L. Wilson, Jr.	July 1, 1974	May 31, 1977
Lt. Gen. James A. Hill	June 1, 1977	June 14, 1978
Lt. Gen. James D. Hughes	June 15, 1978	July 1, 1981
Lt. Gen. Arnold W. Braswell	July 1, 1981	Sept. 30, 1983
Gen. Jerome F. O'Malley	Oct. 8, 1983	Nov. 1, 1984
Gen. Robert W. Bazley	Nov. 1, 1984	Dec. 16, 1986
Gen. Jack I. Gregory	Dec. 16, 1986	July 22, 1988
Gen. Merrill A. McPeak	July 22, 1988	

Formerly Far East Air Forces.
Redesignated Pacific Air Forces July 1, 1957.

STRATEGIC AIR COMMAND

Gen. George C. Kenney	Mar. 21, 1946	Oct. 15, 1948
Gen. Curtis E. LeMay	Oct. 16, 1948	June 30, 1957
Gen. Thomas S. Power	July 1, 1957	Nov. 30, 1964
Gen. John D. Ryan	Dec. 1, 1964	Jan. 31, 1967
Gen. Joseph J. Nazzaro	Feb. 1, 1967	July 31, 1968
Gen. Bruce K. Holloway	Aug. 1, 1968	Apr. 30, 1972
Gen. John C. Meyer	May 1, 1972	July 31, 1974
Gen. Russell E. Dougherty	Aug. 1, 1974	July 31, 1977
Gen. Richard H. Ellis	Aug. 1, 1977	Aug. 1, 1981
Gen. B. L. Davis	Aug. 1, 1981	Aug. 1, 1985
Gen. Larry D. Welch	Aug. 1, 1985	June 30, 1986
Gen. John T. Chain	July 1, 1986	

TACTICAL AIR COMMAND

Lt. Gen. E. R. Quesada	Mar. 21, 1946	Nov. 23, 1948
Maj. Gen. Robert M. Lee	Dec. 24, 1948	June 20, 1950
Maj. Gen. Glenn O. Barcus	July 17, 1950	Jan. 25, 1951
Gen. John K. Cannon	Jan. 25, 1951	Mar. 31, 1954
Gen. O. P. Weyland	Apr. 1, 1954	July 31, 1959
Gen. Frank F. Everest	Aug. 1, 1959	Sept. 30, 1961
Gen. Walter C. Sweeney, Jr.	Oct. 1, 1961	July 31, 1965
Gen. Gabriel P. Disosway	Aug. 1, 1965	July 31, 1968
Gen. William W. Momyer	Aug. 1, 1968	Sept. 30, 1973
Gen. Robert J. Dixon	Oct. 1, 1973	Apr. 30, 1978
Gen. W. L. Creech	May 1, 1978	Nov. 1, 1984
Gen. Jerome F. O'Malley	Nov. 1, 1984	Apr. 20, 1985
Gen. Robert D. Russ	May 22, 1985	

US AIR FORCES IN EUROPE

Brig. Gen. John F. McBain	Aug. 15, 1947	Oct. 20, 1947
Lt. Gen. Curtis E. LeMay	Oct. 20, 1947	Oct. 15, 1948
Lt. Gen. John K. Cannon	Oct. 16, 1948	Jan. 20, 1951
Gen. Lauris Norstad	Jan. 21, 1951	July 26, 1953
Lt. Gen. William H. Tunner	July 27, 1953	June 30, 1957
Gen. Frank F. Everest	July 1, 1957	July 31, 1959
Gen. Frederic H. Smith, Jr.	Aug. 1, 1959	June 30, 1961
Gen. Truman H. Landon	July 1, 1961	July 31, 1963
Gen. Gabriel P. Disosway	Aug. 1, 1963	July 31, 1965
Gen. Bruce K. Holloway	Aug. 1, 1965	July 31, 1966
Gen. Maurice A. Preston	Aug. 1, 1966	July 31, 1968
Gen. Horace M. Wade	Aug. 1, 1968	Jan. 31, 1969
Gen. Joseph R. Holzapple	Feb. 1, 1969	Aug. 31, 1971
Gen. David C. Jones	Sept. 1, 1971	June 30, 1974
Gen. John W. Vogt	July 1, 1974	Aug. 31, 1975
Gen. Richard H. Ellis	Sept. 1, 1975	July 31, 1977
Gen. William J. Evans	Aug. 1, 1977	Aug. 1, 1978
Gen. John W. Pauly	Aug. 1, 1978	Aug. 1, 1980
Gen. Charles A. Gabriel	Aug. 1, 1980	June 30, 1982
Gen. Billy M. Minter	July 1, 1982	Nov. 1, 1984
Gen. Charles L. Donnelly, Jr.	Nov. 1, 1984	May 1, 1987
Gen. William L. Kirk	May 1, 1987	Apr. 17, 1989
Gen. Michael J. Dugan	Apr. 17, 1989	

USAF ACADEMY SUPERINTENDENTS

Lt. Gen. Hubert R. Harmon	July 27, 1954	July 27, 1956
Maj. Gen. James E. Briggs	July 28, 1956	Aug. 16, 1959
Maj. Gen. William S. Stone	Aug. 17, 1959	June 30, 1962
Maj. Gen. Robert H. Warren	July 1, 1962	June 30, 1965
Lt. Gen. Thomas S. Moorman	July 1, 1965	July 31, 1970
Lt. Gen. Albert P. Clark	Aug. 1, 1970	July 31, 1974
Lt. Gen. James R. Allen	Aug. 1, 1974	July 31, 1977
Lt. Gen. Kenneth L. Tallman	Aug. 1, 1977	June 16, 1981
Maj. Gen. Robert E. Kelley	June 16, 1981	July 4, 1983
Lt. Gen. Winfield W. Scott, Jr.	July 5, 1983	June 26, 1987
Lt. Gen. Charles R. Hamm	June 26, 1987	

AIR FORCE RESERVE

Maj. Gen. Rollin B. Moore, Jr.	Aug. 1, 1968	Jan. 26, 1972
Brig. Gen. Alfred Verhulst (acting)	Jan. 27, 1972	Mar. 15, 1972
Maj. Gen. Homer I. Lewis	Mar. 16, 1972	Apr. 8, 1975
Maj. Gen. William Lyon	Apr. 16, 1975	Apr. 16, 1979
Maj. Gen. Richard Bodycombe	Apr. 17, 1979	Oct. 31, 1982
Maj. Gen. Sloan R. Gill	Nov. 1, 1982	Oct. 31, 1986
Maj. Gen. Roger P. Scheer	Nov. 1, 1986	

Since Mar. 16, 1972, the Chief of Air Force Reserve has been dual-hatted as Commander, Hq. Air Force Reserve (AFRES). The earlier chief of Hq. Air Force Reserve was Maj. Gen. Tom E. Marchbanks, Jr., from Jan. 18, 1968, to Feb. 1, 1971.

AIR NATIONAL GUARD

Col. William A. R. Robertson	Nov. 28, 1945	Oct. 1948
Maj. Gen. George G. Finch	Oct. 1948	Sept. 25, 1950
Maj. Gen. Earl T. Ricks	Oct. 13, 1950	Jan. 4, 1954
Maj. Gen. Winston P. Wilson	Jan. 26, 1954	Aug. 5, 1962
Maj. Gen. I. G. Brown	Aug. 6, 1962	Apr. 19, 1974
Maj. Gen. John J. Pesch	Apr. 20, 1974	Jan. 31, 1977
Maj. Gen. John T. Guice	Feb. 1, 1977	Apr. 1, 1981
Maj. Gen. John B. Conaway	Apr. 1, 1981	Nov. 1, 1988
Maj. Gen. Philip G. Killey	Nov. 1, 1988	

The head of the Air National Guard was Chief, Aviation Group, National Guard Bureau until 1948, when the title changed to Chief, Air Force Division, NGB. In Dec. 1969 the title was changed to the present Director, Air National Guard.

Air Force Magazine's Guide to Aces

In compiling this list of aces who flew with USAF and its predecessor organizations (the Air Service and the Army Air Forces), AIR FORCE Magazine has relied on USAF's official accounting of aerial victory credits, which is the responsibility of the USAF Historical Research Center at Maxwell AFB, Ala.

As this issue went to press, the Historical Research Center was preparing a revised list of aerial victory credits. The revised list will combine World War I, World War II, Korea, and Southeast Asia (Vietnam) in one volume and is expected to be published soon.

The USAF Historical Research Center is not authorized and has never attempted to verify aerial victory credits claimed by American pilots who flew with the air forces of other nations. Readers should note that this criterion applies to all of the listings here with the exception of the "Leading American Aces of World War I" box. That listing includes American aces who flew with the Air Service and with the British and French as well. Also, some World War I totals (notably Frank Luke's) include victories for balloons. All other credits are for air-to-air victories as defined and verified by the Historical Research Center.

—THE EDITORS

LEADING AMERICAN ACES OF WORLD WAR I

(Ten or more victories)

Rickenbacker, Capt. Edward V. (AEF)	26	Luke, 2d Lt. Frank, Jr. (AEF)	18	Bennett, 1st Lt. Louis B. (RFC)	12
Lambert, Capt. William C. (RFC)	22	Lufbery, Maj. Raoul G. (FFC/LE)	17	Kindley, Capt. Field E. (AEF)	12
Gillette, Capt. Frederick W. (RFC)	20	Kullberg, Lt. Harold A. (RFC)	16	Putnam, 1st Lt. David E. (LE/AEF)	12
Malone, Capt. John J. (RN)	20	Rose, Capt. Oren J. (RFC)	16	Springs, Capt. Elliott W. (AEF)	12
Wilkinson, Maj. Alan M. (RFC)	19	Warman, Lt. C. T. (RFC)	15	Iaccaci, Lt. Thayer A. (RFC)	11
Hale, Capt. Frank L. (RFC)	18	Libby, Capt. Frederick (RFC)	14	Landis, Capt. Reed G. (AEF)	11
Iaccaci, Capt. Paul T. (RFC)	18	Vaughn, 1st Lt. George A. (AEF)	13	Swaab, Capt. Jacques M. (AEF)	10
		Baylies, Lt. Frank L. (FFC/LE)	12		

AEF—American Expeditionary Force
FFC—French Flying Corps
LE—Lafayette Escadrille
RFC—Royal Flying Corps (British)
RN—Royal Navy (British)

LEADING ARMY AIR FORCES ACES OF WORLD WAR II

(Fourteen and a half or more victories)

Bong, Maj. Richard I.	40	Westbrook, Lt. Col. Robert B.	20	Anderson, Capt. Clarence E., Jr.	16.25
McGuire, Maj. Thomas B., Jr.	38	Gentile, Capt. Donald S.	19.83	Dunham, Lt. Col. William D.	16
Gabreski, Lt. Col. Francis S.	28*	Duncan, Col. Glenn E.	19.50	Harris, Lt. Col. Bill	16
Johnson, Capt. Robert S.	27	Carson, Capt. Leonard K.	18.50	Welch, Capt. George S.	16
MacDonald, Col. Charles H.	27	Eagleston, Maj. Glenn T.	18.50*	Beerbower, Capt. Donald M.	15.50
Preddy, Maj. George E.	26.83	Beckham, Maj. Walter C.	18	Brown, Maj. Samuel J.	15.50
Meyer, Lt. Col. John C.	24*	Green, Maj. Herschel H.	18	Peterson, Capt. Richard A.	15.50
Schilling, Col. David C.	22.50	Herbst, Lt. Col. John C.	18	Whisner, Capt. William T., Jr.	15.50*
Johnson, Lt. Col. Gerald R.	22	Zemke, Lt. Col. Hubert	17.75	Bradley, Lt. Col. Jack T.	15
Kearby, Col. Neel E.	22	England, Maj. John B.	17.50	Cragg, Maj. Edward	15
Robbins, Maj. Jay T.	22	Beeson, Capt. Duane W.	17.33	Foy, Maj. Robert W.	15
Christensen, Capt. Fred J.	21.50	Thornell, 1st Lt. John F., Jr.	17.25	Hofer, 2d Lt. Ralph K.	15
Wetmore, Capt. Ray S.	21.25	Varnell, Capt. James S., Jr.	17	Homer, Capt. Cyril F.	15
Voll, Capt. John J.	21	Johnson, Maj. Gerald W.	16.50	Bochkay, Capt. Donald H.	14.84
Mahurin, Maj. Walker M.	20.75*	Godfrey, Capt. John T.	16.33	Landers, Lt. Col. John D.	14.50
Lynch, Lt. Col. Thomas J.	20			Powers, Capt. Joe H., Jr.	14.50

* Aces who added to these scores by victories in the Korean War.
Ranks are as of last victory in World War II.

USAF ACES OF THE KOREAN WAR

McConnell, Capt. Joseph, Jr.	16	Hagerstrom, Maj. James P.	8.50*	Whisner, Maj. William T., Jr.	5.50*
Jabara, Maj. James	15*	Risner, Capt. Robinson	8	Baldwin, Col. Robert P.	5
Fernandez, Capt. Manuel J.	14.50	Ruddell, Lt. Col. George I.	8*	Becker, Capt. Richard S.	5
Davis, Maj. George A., Jr.	14*	Buttlemann, 1st Lt. Henry	7	Bettinger, Maj. Stephen L.	5
Baker, Col. Royal N.	13*	Jolley, Capt. Clifford D.	7	Creighton, Maj. Richard D.	5*
Blesse, Maj. Frederick C.	10	Lilley, Capt. Leonard W.	7	Curtin, Capt. Clyde A.	5
Fischer, 1st Lt. Harold E.	10	Adams, Maj. Donald E.	6.50	Gibson, Capt. Ralph D.	5
Garrison, Lt. Col. Vermont	10*	Gabreski, Col. Francis S.	6.50*	Kincheloe, Capt. Iven C., Jr.	5
Johnson, Col. James K.	10*	Jones, Lt. Col. George L.	6.50	Latshaw, Capt. Robert T., Jr.	5
Moore, Capt. Lonnie R.	10	Marshall, Maj. Winton W.	6.50	Moore, Capt. Robert H.	5
Parr, Capt. Ralph S., Jr.	10	Kasler, 1st Lt. James H.	6	Overton, Capt. Dolphin D., III	5
Foster, Capt. Cecil G.	9	Love, Capt. Robert J.	6	Thyng, Col. Harrison R.	5*
Low, 1st Lt. James F.	9			Westcott, Maj. William H.	5

*These are in addition to World War II victories.

AAF/USAF ACES OF WORLD WAR II AND LATER WARS

	WW II	KOREA	TOTAL		WW II	KOREA	TOTAL
Gabreski, Col. Francis S.	28	6.50	34.50	Johnson, Col. James K.	1	10	11
Meyer, Col. John C.	24	2	26	Ruddell, Lt. Col. George I.	2.50	8	10.50
Mahurin, Col. Walker M.	20.75	3.50	24.25	Thyng, Col. Harrison R.	5	5	10
Davis, Maj. George A., Jr.	7	14	21	Colman, Capt. Philip E.	5	4	9
Whisner, Maj. William T., Jr.	15.50	5.50	21	Heller, Lt. Col. Edwin L.	5.50	3.50	9
Eagleston, Col. Glenn T.	18.50	2	20.50	Chandler, Maj. Van E.	5	3	8
Garrison, Lt. Col. Vermont	7.33	10	17.33	Hockery, Maj. John J.	7	1	8
Baker, Col. Royal N.	3.50	13	16.50	Creighton, Maj. Richard D.	2	5	7
Jabara, Maj. James	1.50	15	16.50	Emmert, Lt. Col. Benjamin H., Jr.	6	1	7
Olds, Col. Robin	12	4*	16	Bettinger, Maj. Stephen L.	1	5	6
Mitchell, Col. John W.	11	4	15	Visscher, Maj. Herman W.	5	1	6
Brueland, Maj. Lowell K.	12.50	2	14.50	Liles, Capt. Brooks J.	1	4	5
Hagerstrom, Maj. James P.	6	8.50	14.50	Mattson, Capt. Conrad E.	1	4	5
Hovde, Lt. Col. William J.	10.50	1	11.50	Shaeffer, Maj. William F.	2	3	5

* Colonel Olds's 4 additional victories came during the Vietnam War.

AMERICAN ACES OF THE VIETNAM WAR

DeBellevue, Capt. Charles B. (USAF)	6
Cunningham, Lt. Randy (USN)	5
Driscoll, Lt. William (USN)	5
Feinstein, Capt. Jeffrey S. (USAF)	5
Ritchie, Capt. Richard S. (USAF)	5

LEADING AIR SERVICE/ AAF/USAF ACES OF ALL WARS

Bong, Maj. Richard I.	40	WW II	Kearby, Col. Neel E.	22	WW II
McGuire, Maj. Thomas B., Jr.	38	WW II	Robbins, Maj. Jay T.	22	WW II
Gabreski, Col. Francis S.	34.50	WW II, Korea	Christensen, Capt. Fred J.	21.50	WW II
Johnson, Lt. Col. Robert S.	27	WW II	Wetmore, Capt. Ray S.	21.25	WW II
MacDonald, Col. Charles H.	27	WW II	Davis, Maj. George A., Jr.	21	WW II, Korea
Preddy, Maj. George E.	26.83	WW II	Voll, Capt. John J.	21	WW II
Meyer, Col. John C.	26	WW II, Korea	Whisner, Maj. William T., Jr.	21	WW II, Korea
Rickenbacker, Capt. Edward V.	26	WW I	Eagleston, Col. Glenn T.	20.50	WW II, Korea
Mahurin, Col. Walker M.	24.25	WW II, Korea	Lynch, Lt. Col. Thomas J.	20	WW II
Schilling, Col. David C.	22.50	WW II	Westbrook, Lt. Col. Robert B.	20	WW II
Johnson, Lt. Col. Gerald R.	22	WW II	Gentile, Capt. Donald S.	19.83	WW II

SOME FAMOUS FIGHTER FIRSTS

First American to down 5 enemy aircraft in WW I	Pvt. Frederick Libby (serving with the RFC)
First American ace of WW I	Capt. Alan M. Wilkinson (RFC)
First American ace to serve with the AEF	Capt. Raoul G. Lufbery (FFC/LE)
First American AEF ace of WW I	Capt. Douglas Campbell
First American ace of WW II	Pilot Officer William R. Dunn (RAF)
First American USAAF ace of WW II	Lt. Boyd D. "Buzz" Wagner
First American to score an aerial victory in Korea	1st Lt. William G. Hudson (June 27, 1950)
First jet-to-jet kill of the Korean War	1st Lt. Russell J. Brown (Nov. 8, 1950)
First American ace of the Korean War	Capt. James Jabara (May 20, 1951)
First American ace of two wars	Maj. A. J. "Ajax" Baumler (8 in Spain; 5 in WW II)
First USAF ace of two wars	Maj. William T. Whisner, Jr. (15.5 in WW II; 5.5 in Korea)
First USAF ace with victories in WW II and Vietnam	Col. Robin Olds (12 in WW II; 4 in Vietnam)

Source: *Fighter Aces*, by Col. Raymond F. Toliver and Trevor J. Constable, Macmillan Co., N. Y., 1965.

UNITED STATES AIR FORCE MEDAL OF HONOR RECIPIENTS—1918–1988

NAMES, ALPHABETICALLY BY WARS, AND RANK AT TIME OF ACTION	HOME TOWN	DATE AND PLACE OF ACTION	PRESENT ADDRESS OR DATE OF DEATH
WORLD WAR I			
Bleckley, 2d Lt. Erwin R.	Wichita, Kan.	Oct. 6, 1918, Binarville, France	KIA, Oct. 6, 1918
Goettler, 2d Lt. Harold E.	Chicago, Ill.	Oct. 6, 1918, Binarville, France	KIA, Oct. 6, 1918
Luke, 2d Lt. Frank, Jr.	Phoenix, Ariz.	Sept. 29, 1918, Murvaux, France	KIA, Sept. 29, 1918
Rickenbacker, Capt. Edward V.	Columbus, Ohio	Sept. 25, 1918, Billy, France	Died, July 23, 1973
WORLD WAR II			
Baker, Lt. Col. Addison E.	Chicago, Ill.	Aug. 1, 1943, Ploesti, Romania	KIA, Aug. 1, 1943
Bong, Maj. Richard I.	Poplar, Wis.	Oct. 10–Nov. 15, 1944, Southwest Pacific	Killed, Aug. 6, 1945, Burbank, Calif.
Carswell, Maj. Horace S., Jr.	Fort Worth, Tex.	Oct. 26, 1944, South China Sea	KIA, Oct. 26, 1944
Castle, Brig. Gen. Frederick W.	Manila, P.I.	Dec. 24, 1944, Liège, Belgium	KIA, Dec. 24, 1944
Cheli, Maj. Ralph	San Francisco, Calif.	Aug. 18, 1943, Wewak, New Guinea	Died as POW, Mar. 6, 1944
Craw, Col. Demas T.	Traverse City, Mich.	Nov. 8, 1942, Port Lyautey, French Morocco	KIA, Nov. 8, 1942
Doolittle, Lt. Col. James H.	Alameda, Calif.	Apr. 18, 1942, Tokyo, Japan	Carmel, Calif. (Ret. Gen.)
Erwin, SSgt. Henry E.	Adamsville, Ala.	Apr. 12, 1945, Koriyama, Japan	Leeds, Ala.
Femoyer, 2d Lt. Robert E.	Huntington, W. Va.	Nov. 2, 1944, Merseburg, Germany	KIA, Nov. 2, 1944
Gott, 1st Lt. Donald J.	Arnett, Okla.	Nov. 9, 1944, Saarbrücken, Germany	KIA, Nov. 9, 1944
Hamilton, Maj. Pierpont M.	Tuxedo Park, N. Y.	Nov. 8, 1942, Port Lyautey, French Morocco	Died, Mar. 4, 1982
Howard, Lt. Col. James H.	Canton, China	Jan. 11, 1944, Oschersleben, Germany	Belleair Bluffs, Fla. (Ret. Brig. Gen.)
Hughes, 2d Lt. Lloyd H.	Alexandria, La.	Aug. 1, 1943, Ploesti, Romania	KIA, Aug. 1, 1943
Jerstad, Maj. John L.	Racine, Wis.	Aug. 1, 1943, Ploesti, Romania	KIA, Aug. 1, 1943
Johnson, Col. Leon W.	Columbia, Mo.	Aug. 1, 1943, Ploesti, Romania	McLean, Va. (Ret. Gen.)
Kane, Col. John R.	McGregor, Tex.	Aug. 1, 1943, Ploesti, Romania	Barber, Ark. (Ret. Col.)
Kearby, Col. Neel E.	Wichita Falls, Tex.	Oct. 11, 1943, Wewak, New Guinea	KIA, Mar. 5, 1944, Wewak, New Guinea
Kingsley, 2d Lt. David R.	Portland, Ore.	June 23, 1944, Ploesti, Romania	KIA, June 23, 1944
Knight, 1st Lt. Raymond L.	Houston, Tex.	Apr. 25, 1945, Po Valley, Italy	KIA, Apr. 25, 1945
Lawley, 1st Lt. William R., Jr.	Leeds, Ala.	Feb. 20, 1944, Leipzig, Germany	Montgomery, Ala. (Ret. Col.)
Lindsey, Capt. Darrell R.	Jefferson, Iowa	Aug. 9, 1944, Pontoise, France	KIA, Aug. 9, 1944
Mathies, SSgt. Archibald	Scotland	Feb. 20, 1944, Leipzig, Germany	KIA, Feb. 20, 1944
Mathis, 1st Lt. Jack W.	San Angelo, Tex.	Mar. 18, 1943, Vegesack, Germany	KIA, Mar. 18, 1943
McGuire, Maj. Thomas B., Jr.	Ridgewood, N.J.	Dec. 25–26, 1944, Luzon, P.I.	KIA, Jan. 7, 1945, Negros, P.I.
Metzger, 2d Lt. William E., Jr.	Lima, Ohio	Nov. 9, 1944, Saarbrücken, Germany	KIA, Nov. 9, 1944
Michael, 1st Lt. Edward S.	Chicago, Ill.	Apr. 11, 1944, Brunswick, Germany	Fairfield, Calif. (Ret. Lt. Col.)
Morgan, 2d Lt. John C.	Vernon, Tex.	July 28, 1943, Kiel, Germany	Marina del Rey, Calif. (Ret. Col.)
Pease, Capt. Harl, Jr.	Plymouth, N.H.	Aug. 7, 1942, Rabaul, New Britain	KIA, Aug. 7, 1942
Pucket, 1st Lt. Donald D.	Longmont, Colo.	July 9, 1944, Ploesti, Romania	KIA, July 9, 1944
Sarnoski, 2d Lt. Joseph R.	Simpson, Pa.	June 16, 1943, Buka, Solomon Is.	KIA, June 16, 1943
Shomo, Maj. William A.	Jeannette, Pa.	Jan. 11, 1945, Luzon, P.I.	Pittsburgh, Pa. (Ret. Lt. Col.)
Smith, Sgt. Maynard H.	Caro, Mich.	May 1, 1943, St. Nazaire, France	Died, May 11, 1984
Truemper, 2d Lt. Walter E.	Aurora, Ill.	Feb. 20, 1944, Leipzig, Germany	KIA, Feb. 20, 1944
Vance, Lt. Col. Leon R., Jr.	Enid, Okla.	June 5, 1944, Wimereaux, France	Killed, July 26, 1944, near Iceland
Vosler, TSgt. Forrest L.	Lyndonville, N.Y.	Dec. 20, 1943, Bremen, Germany	Baldwinsville, N.Y.
Walker, Brig. Gen. Kenneth N.	Cerrillos, N.M.	Jan. 5, 1943, Rabaul, New Britain	KIA, Jan. 5, 1943
Wilkins, Maj. Raymond H.	Portsmouth, Va.	Nov. 2, 1943, Rabaul, New Britain	KIA, Nov. 2, 1943
Zeamer, Maj. Jay, Jr.	Carlisle, Pa.	June 16, 1943, Buka, Solomon Is.	Boothbay Harbor, Me. (Ret. Lt. Col.)
KOREA			
Davis, Maj. George A., Jr.	Dublin, Tex.	Feb. 10, 1952, Sinuiju-Yalu River, No. Korea	KIA, Feb. 10, 1952
Loring, Maj. Charles J., Jr.	Portland, Me.	Nov. 22, 1952, Sniper Ridge, No. Korea	KIA, Nov. 22, 1952
Sebille, Maj. Louis J.	Harbor Beach, Mich.	Aug. 5, 1950, Hamch'ang, So. Korea	KIA, Aug. 5, 1950
Walmsley, Capt. John S., Jr.	Baltimore, Md.	Sept. 14, 1951, Yangdok, No. Korea	KIA, Sept. 14, 1951
VIETNAM			
Bennett, Capt. Steven L.	Palestine, Tex.	June 29, 1972, Quang Tri, So. Vietnam	KIA, June 29, 1972
Day, Col. George E.	Sioux City, Iowa	Conspicuous gallantry while POW	Shalimar, Fla. (Ret. Col.)
Dethlefsen, Maj. Merlyn H.	Greenville, Iowa	Mar. 10, 1967, Thai Nguyen, No. Vietnam	Died, Dec. 14, 1987
Fisher, Maj. Bernard F.	San Bernardino, Calif.	Mar. 10, 1966, A Shau Valley, So. Vietnam	Kuna, Idaho (Ret. Col.)
Fleming, 1st Lt. James P.	Sedalia, Mo.	Nov. 26, 1968, Duc Co, So. Vietnam	Active duty, Col., Lackland AFB, Tex.
Jackson, Lt. Col. Joe M.	Newnan, Ga.	May 12, 1968, Kham Duc, So. Vietnam	Kent, Wash. (Ret. Col.)
Jones, Lt. Col. William A. III	Norfolk, Va.	Sept. 1, 1968, Dong Hoi, No. Vietnam	Killed, Nov. 15, 1969, Woodbridge, Va.
Levitow, A1C John L.	South Windsor, Conn.	Feb. 24, 1969, Long Binh, So. Vietnam	Vienna, Va.
Sijan, Capt. Lance P.	Milwaukee, Wis.	Conspicuous gallantry while POW	Died while POW, Jan. 1968
Thorsness, Lt. Col. Leo K.	Seattle, Wash.	Apr. 19, 1967, No. Vietnam	Santa Monica, Calif. (Ret. Col.)
Wilbanks, Capt. Hilliard A.	Cornelia, Ga.	Feb. 24, 1967, Dalat, So. Vietnam	KIA, Feb. 24, 1967
Young, Capt. Gerald O.	Anacortes, Wash.	Nov. 9, 1967, Da Nang area, So. Vietnam	Anacortes, Wash. (Ret. Lt. Col.)

SOME FAMOUS FIRSTS AMONG US BOMBARDMENT UNITS

June 12, 1918	First bombs dropped by an AEF bomb unit: 8 Breguet 14s of the 96th Aero Sqdn., led by Maj. Harry M. Brown, on Dommary-Baroncourt railyards in France.
Dec. 10, 1941	First heavy bomb mission of WW II: 5 B-17s of the 93d Bomb Sqdn., 19th Bomb Gp., led by Maj. Cecil Combs, attacked Japanese convoy near Vigan, P.I., also sank the first enemy vessel by US aerial combat bombing.
Apr. 18, 1942	First mission against Japan: 16 B-25s of the 17th Bomb Gp. and 89th Recce Sqdn., led by Lt. Col. James H. Doolittle, launched from the carrier *Hornet*.
June 12, 1942	First mission against a European target: 13 B-24s of HALPRO Detachment, led by Col. H. A. Halverson, flying from Egypt against Ploesti oil fields.
Jan. 27, 1943	First mission against the German homeland: 53 B-17s and B-24s of the 1st and 2d Bomb Wgs., flying from the UK, attacked the Wilhelmshaven naval base.
Aug. 6, 1945	First atomic bomb mission: The *Enola Gay*, a 509th Composite Gp. B-29, piloted by Col. Paul W. Tibbets, Jr., flying from Tinian, attacked Hiroshima, Japan.

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AND HERE FOR THE LONG RUN.

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Air Force Communications Command

AIR Force Communications Command (AFCC) provides critical communications-computer support to Air Force and other Department of Defense agencies. In fact, in today's information-hungry age, AFCC's high-technology services touch the lives of all Air Force personnel.

Headquartered at Scott AFB, Ill., AFCC is the AT&T, the Western Union, the IBM, and the FAA of the Air Force. Its services include telephone systems, base communications centers, computer facilities, radio and satellite stations, and air traffic control. AFCC acquires, engineers, installs, operates, and maintains these systems for permanent and combat locations. AFCC is the Air Force's most widely dispersed command, with some 55,000 people in more than 700 tenant units and 400 locations. AFCC people serve in every state, in US island possessions, and in twenty-six foreign countries.

Additionally, nearly 17,000 Air National Guard members and Air Force Reservists augment the command. Last year, Guard and Reserve personnel contributed more than 80,000 workdays to AFCC programs.

AFCC units work under a unique "dual-hat" arrangement. Communications people belong administratively to AFCC, but their units are operationally controlled by the commands they serve. This allows centralized management of Air Force communications needs while ensuring operational commanders immediate control of their communications resources.

AFCC also plays a key role in integrating Air Force communications-computer systems. Through management of the Air Force Communications-Computer Systems Integration Office (CSIO), the command minimizes communications costs by eliminating duplication of effort. Created in October 1987, the office ensures that proposed base-level systems will work within the existing communications infrastructure. To make sure major systems that the Air Force CSIO reviews work before Air Force-wide acceptance, AFCC field-tests them at Mather AFB, Calif., the Air Force's communications and computer systems model base.

Established in June 1986, the model base's goal is to create a fully integrated base-level communications and computer environment for the Air Force—one in which all systems can share information, regardless of who manufactured them. For instance, in September 1988, Mather became the first DoD installation to use Integrated Services Digital Network (ISDN) technology. ISDN will enable many formerly independent communications and computer systems to interface for the first time. These pioneer integration efforts will influence future communications architecture at Air Force bases worldwide.

As one of three Air Force acquisition commands, AFCC meets customer needs from off-the-shelf sources, instead of developing new, military-unique systems. This role continues to grow, with command acquisitions expected to exceed $17 billion by 1993.

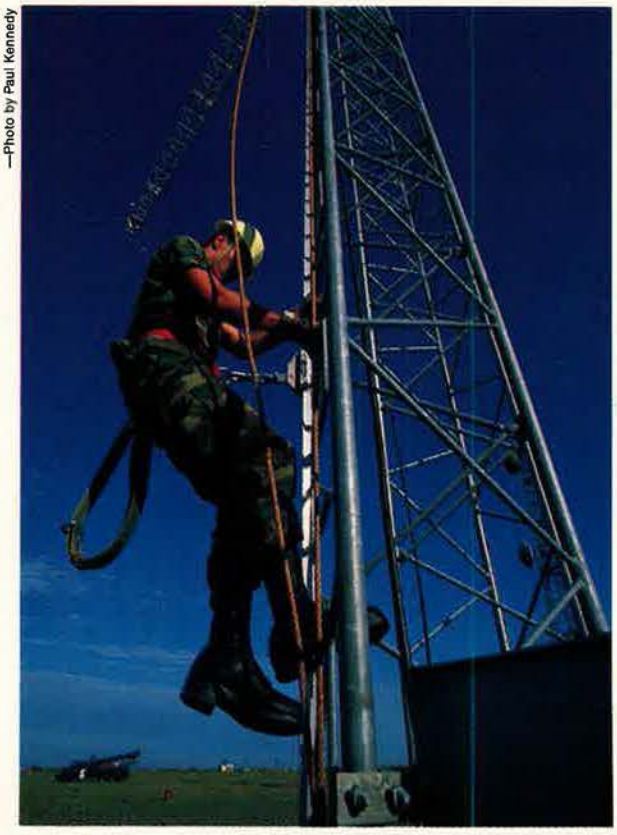
Many AFCC acquisitions affect other DoD agencies in addition to the Air Force. For example, in October 1988, the command awarded a $929 million contract to AT&T to procure an estimated 20,000 small computers for the Air Force and some other DoD agencies.

Additionally, AFCC's Standard Systems Center at Gunter AFB, Ala., is meeting America's military computer needs through a program called Desktop III. The resulting $1 billion contract will provide approximately 250,000 state-of-the-art microcomputers to replace Zenith Z-248 computers DoD-wide.

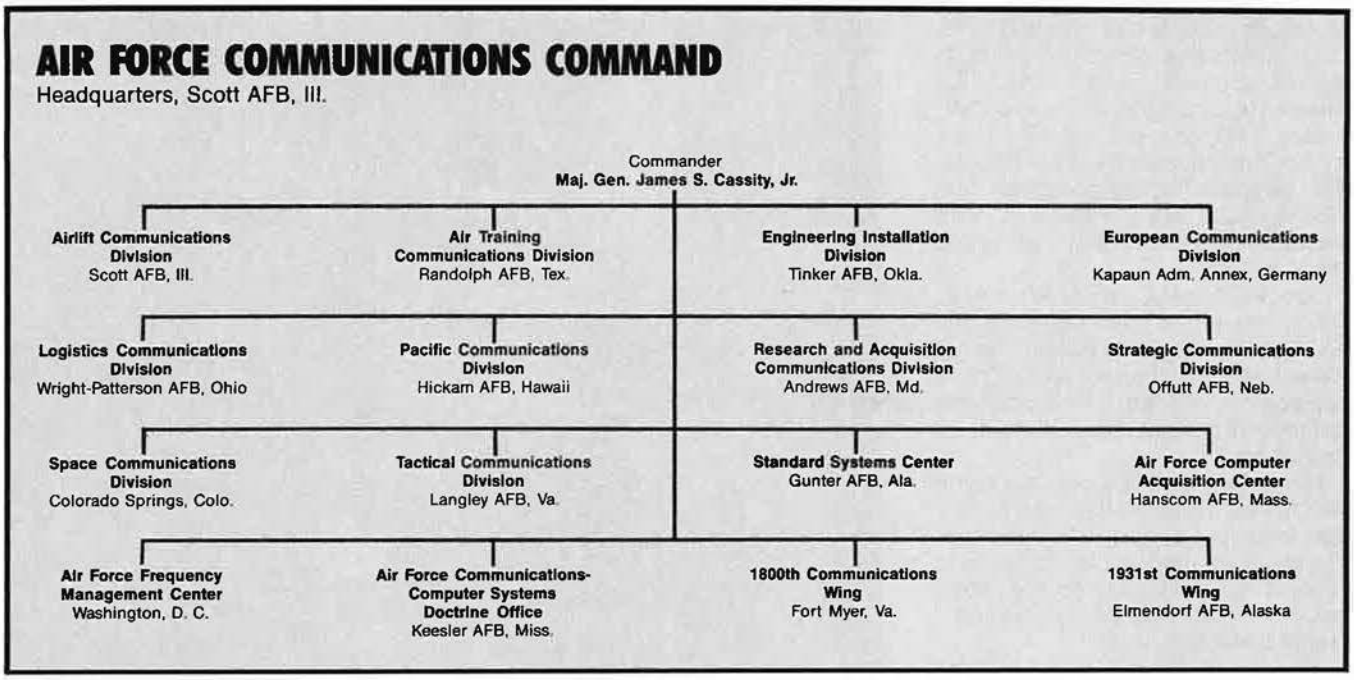
However, AFCC faces its biggest challenge in improving software development and acquisition. Since virtually every weapon system relies on software, AFCC is working hard to make sure software is the greatest strength of those systems—not the Achilles' heel.

AFCC's Standard Systems Center will be a model standard systems soft-

—Photo by Paul Kennedy



Air Force Communications Command's engineering and installation units play an important role in ensuring USAF's combat capability. The ten active-duty and nineteen Air National Guard units of AFCC's Engineering Installations Division, headquartered at Tinker AFB, Okla., install new communications systems around the globe—a perfect example of the Total Force policy at work.



ware acquisition agent and life-cycle manager.

AFCC also operates the largest, safest military air traffic control system in the free world. Second only to the Federal Aviation Administration's in size, the AFCC system handles more than 38,000 operations daily. During Fiscal Year 1988 alone, AFCC controllers helped save more than $116 million worth of imperiled aircraft.

AFCC's specialized communications functions, including engineering, installation, and combat communications, also help maximize the Air Force's combat capability. For instance, the ten active-duty and nineteen Air National Guard units of AFCC's Engineering Installation Division, headquartered at Tinker AFB, Okla., install new communications systems around the world, providing millions of dollars' worth of services to their customers.

Similarly, AFCC's combat communications units also routinely support operational commanders in the field. Five active-duty and eight Air National Guard combat communications units support DoD exercises worldwide, such as Team Spirit in South Korea.

AFCC people work on the leading edge of technology to provide Air Force commanders the global communications, computer, and air traffic control services that they need to fight and win. These services enable our country's forces to work and win together as a team. ■

Air Force Logistics Command

AIR Force Logistics Command's quality program is the ace in the hole for meeting the command's mission: providing combat strength through logistics.

With a massive maintenance and acquisition mission, AFLC is the Air Force's industrial arm and a classic candidate for total quality management. Through its network of air logistics centers, the command's 85,000 civilians and 12,000 military members buy, supply, transport, maintain, and repair everything needed to keep weapon systems combat-ready.

"We simply can't hope to meet the logistics challenge in a time of fiscal austerity and funding instability by throwing money and people at a problem," said Gen. Alfred G. Hansen, AFLC Commander. "We must be concerned with doing the job right the first time, instead of trying to spot defects once they occur. We can't inspect quality into a product. We must build quality into our processes."

AFLC is a pacesetter in DoD's "Quality Revolution," with more than 700 process action teams tackling problems across the spectrum of logistics and building excellence into day-to-day business. These processes range from building a logistics infrastructure for new weapon systems to modernizing existing systems and streamlining acquisition.

The command, which celebrates its forty-fifth anniversary on July 14, is poised for the future.

A management restructuring has strengthened the role of the command's system program managers, those responsible for logistics needs of weapon systems from cradle to grave. AFLC also has its first full-time chief scientist/engineer, responsible for managing strategic planning for technology insertion and overseeing the command's 4,300 scientists and engineers.

A computer-modernization program, to be completed in 1994, is already giving AFLC faster and better information about weapon systems, parts, and equipment worldwide.

Many AFLC facilities are being upgraded, and some new ones are being built. Oklahoma City Air Logistics Center (ALC), Tinker AFB, Okla., opened a modern engine-blade repair facility, and San Antonio ALC, Kelly AFB, Tex., has a new depot machine facility in its maintenance center.

AFLC's Aerospace Guidance and

Metrology Center at Newark AFB, Ohio, completed construction on its Radiac Laboratory, where devices for measuring radioactivity are calibrated. At Ogden ALC, Hill AFB, Utah, a new Consolidated Avionics Integration Support Facility combines previously scattered F-16, F-4, and Peacekeeper missile engineering and test facilities.

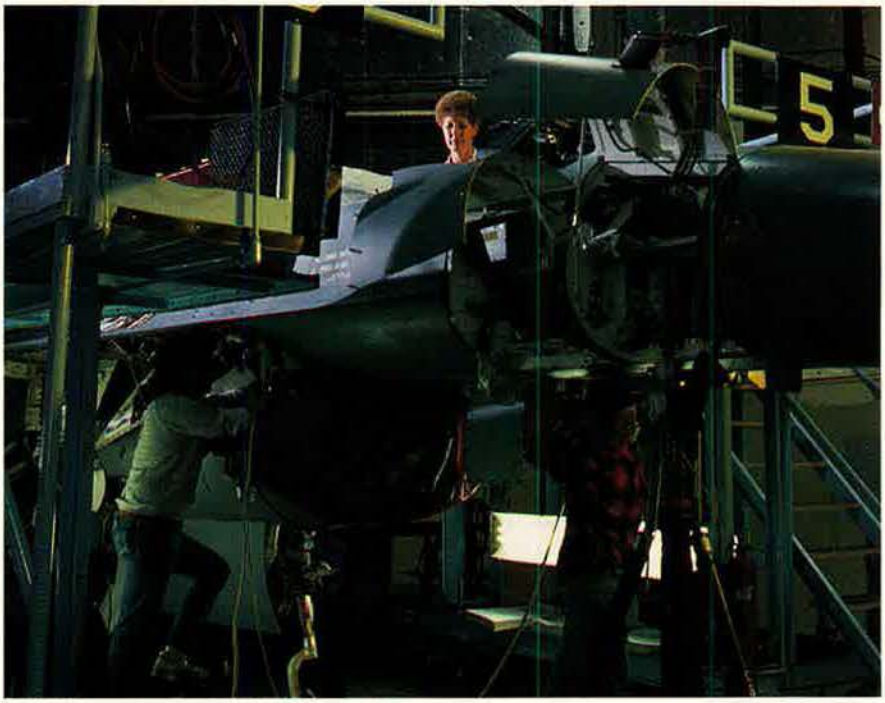
Sacramento ALC at McClellan AFB, Calif., has a new Electronic Warfare and Communications Repair Center. It also has the Air Force's only neutron radiography system, which performs detailed structural inspections of intact aircraft.

Many ALC facilities are still World War II vintage, and plant-modernization remains a priority. "We need continuing plant modernization funds to meet quality objectives and keep pace with technology demands," General Hansen said.

Several weapon systems benefited from AFLC modifications in the past year.

- Warner Robins ALC, Robins AFB, Ga., is progressing with a multistage, comprehensive modification for the F-15 fleet.
- San Antonio ALC extended the life of F-15s and F-16s by overhauling F100/200 engine cores.
- Ogden ALC is refurbishing 1,000 aging silos and 100 launch-control facilities for Minuteman missiles.
- Oklahoma City ALC finished bird-strike modifications to the B-1B bomber.

AFLC isn't just a maintenance-oriented command—it's an "acquisition" command awarding $10 billion a year in contracts, across some 300,000 contracting actions.



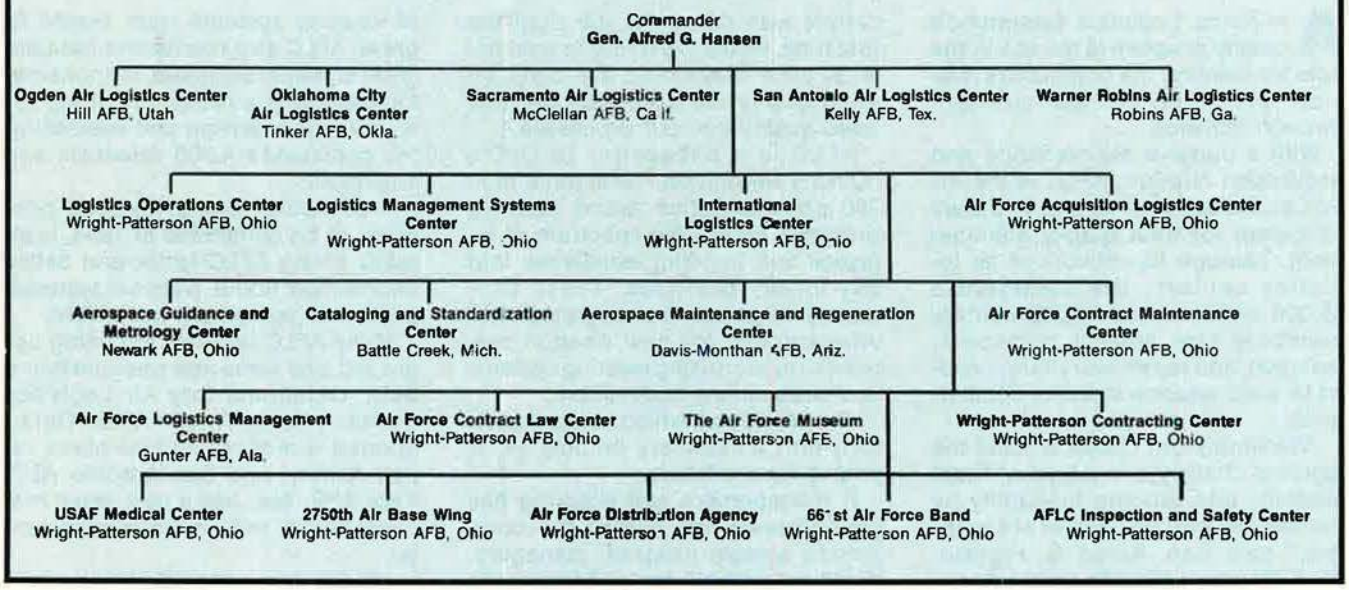
Here, aircraft mechanics at Ogden Air Logistics Center, Hill AFB, Utah, perform maintenance on an F-16. Ogden ALC is one of AFLC's five specialized centers. In addition to providing logistics support for the F-16, Ogden is refurbishing aging silos and launch-control facilities for Minuteman missiles.

Fiscal 1988 marked AFLC's best year ever for budgetary execution, a success General Hansen attributed to innovative contracting procedures. "We've slain the myth about poor budget execution," he said. For example, ninety-three percent of the $2.2 billion aircraft-replenishment spares account was obligated, well over the DoD goal of eighty percent.

While AFLC's main job is keeping aircraft and missiles flying, it's also systematically destroying one system at the command's Aerospace Maintenance and Regeneration Center at Davis-Monthan AFB, Ariz. AFLC

AIR FORCE LOGISTICS COMMAND

Headquarters, Wright-Patterson AFB, Ohio



workers have already begun literally cutting up 443 ground-launched cruise missiles and their launchers and are to finish by 1991 under the INF Treaty.

A Sacramento ALC detachment at Peterson AFB, Colo., is taking on logistical support responsibilities for Air Force space and early warning systems. This "normalization" of space logistics means that, for the first time, AFLC will support many Air Force space systems in much the way it supports aircraft and missiles.

Providing combat strength through logistics remains AFLC's goal into the 1990s. Beyond the need for plant modernization, two critical issues will affect how well that goal is met, according to General Hansen.

"We need a management environment free of excessive oversight and congressional restriction—an environment that allows commanders and managers the flexibility to maximize the effectiveness of their resources. And funding stability is a must in providing quality support to our weapon systems during reduced funding periods." ■

Air Force Space Command

THE Air Force Space Command (AFSPACECOM), with headquarters at Peterson AFB, Colo., is responsible for organizing, training, equipping, and operating forces in support of strategic aerospace defense, space control, and space operations.

Lt. Gen. Donald J. Kutyna, as Commander of Air Force Space Command, has sole responsibility for 8,400 Air Force military and civilian men and women and some 5,400 contractor personnel at thirty-five installations worldwide.

To operate, manage, and maintain its numerous assets, the command employs the 1st and 2d Space Wings, the 3d Space Support Wing, the Space and Warning Systems Center, the 1013th Combat Crew Training Squadron, the Command Inspection Center, and the Systems Integration Office.

The 1st Space Wing, located at Peterson AFB, Colo., operates twenty missile-warning, space-surveillance, and communications sites worldwide. The wing's ballistic missile warning mission was enhanced with the addition of two new phased-array radar systems and the upgrade of a third in 1986 and 1987.

Data from the 1st Space Wing warning sensors would be the first indication of an aerospace attack aimed at North America. Monitored by AFSPACECOM crews, these data are transmitted to command centers located at Cheyenne Mountain AFB, Colo., where the NORAD Commander in Chief evaluates and assesses the validity of detection information. Once a positive assessment of an aerospace attack is made, the President of the United States and the Prime Minister of Canada are contacted simultaneously. Information is also relayed to Strategic Air Command, the National Military Command Center, and the Alternate National Military Command Center.

The 1st Space Wing space surveillance and optical sensors provide more than 48,000 observations daily to keep track of more than 7,000 man-made objects in space. Wing communications units manage and operate satellite communications stations around the world.

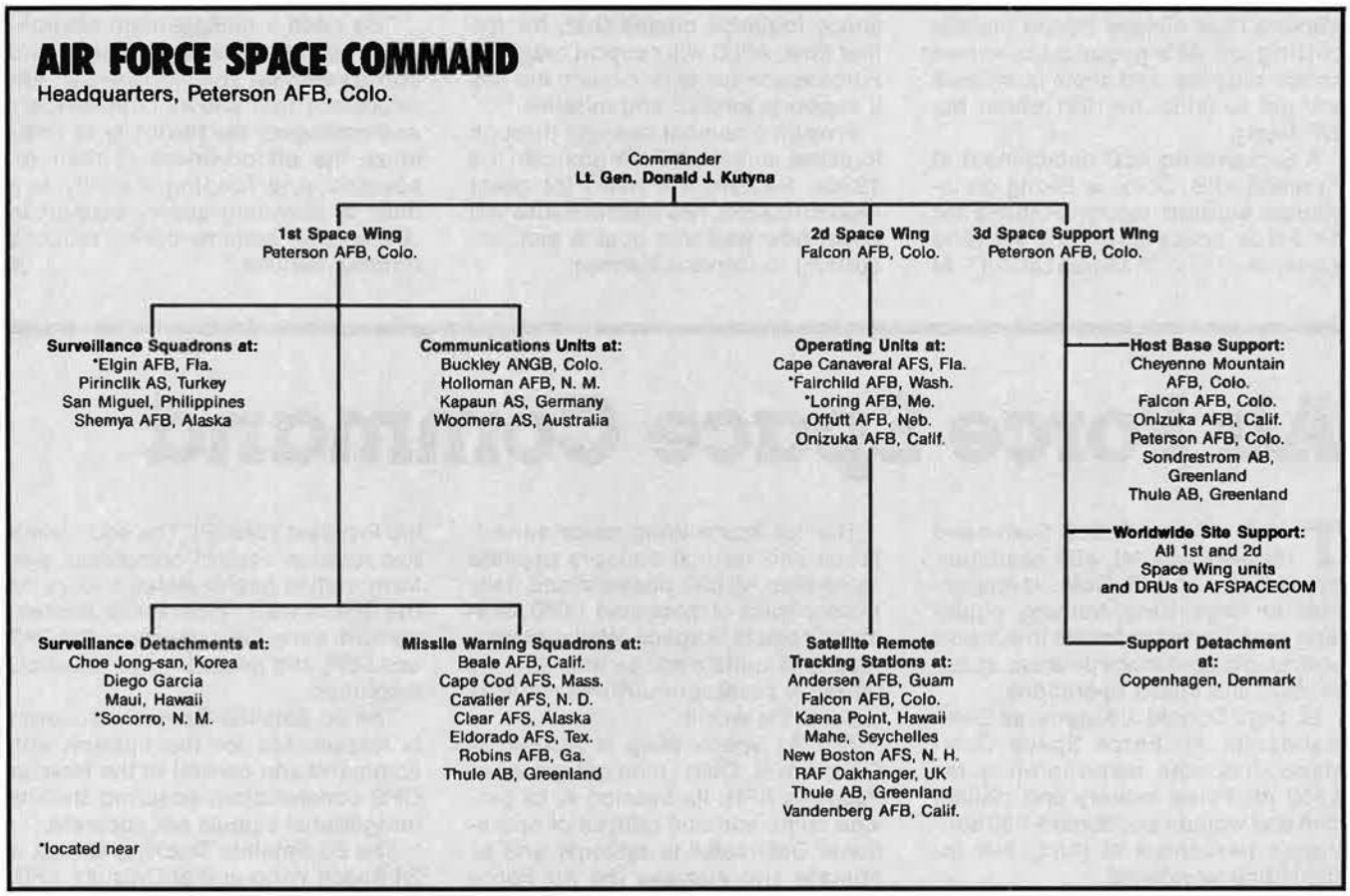
The 2d Space Wing is located at Falcon AFB, Colo., nine miles east of Peterson AFB. Its mission is to provide command and control of operational DoD satellite systems and to operate and manage the Air Force Satellite Control Network (AFSCN).

The 1st Satellite Control Squadron supports satellites of the Defense Support Program (DSP) and the Navstar Global Positioning System (GPS) and provides backup support for the Defense Meteorological Satellite Program (DMSP). The squadron's two mission-control complexes perform routine health-status checks on the spacecraft, monitor launches, perform early-orbit checkout for GPS and DSP, and provide major anomaly resolution.

The 2d Satellite Control Squadron is responsible for the mission and command and control of the Navstar GPS constellation, ensuring that its navigational signals are accurate.

The 2d Satellite Tracking Group, a 2d Space Wing unit at Onizuka AFB, Calif., is responsible for the daily operation of the common-user element of the AFSCN, a worldwide network of eight tracking stations. The AFSCN mission is to command, track, record, and process on-orbit satellite data in support of DoD and NATO programs.

Air Force Space Command's 2d Space Wing is located at Falcon AFB, Colo., a few miles east of AFSPACECOM's Peterson AFB headquarters. One of 2d Space Wing's primary missions is to provide command and control of DoD satellite systems. Shown here is one of two such Mission Control Complexes at Falcon.



The wing's other major subordinate unit, the 1000th Satellite Operations Group, is located at Offutt AFB, Neb. Its mission is to command and control DMSP satellites, which meet unique military requirements for worldwide weather information. Data from these satellites are collected at three command stations and relayed to the Air Weather Service's Global Weather Central at Offutt and to the Navy's Fleet Numerical Oceanography Center in Monterey, Calif., where weather information is compiled for use by DoD units worldwide.

In the future, the 2d Space Wing will also support the Defense Satellite Communications System (DSCS), the Fleet Satellite Communications System (FLTSATCOM), and the next-generation military communications constellation, Milstar.

The 3d Space Support Wing, located at Peterson AFB, is the single organization responsible for supporting the command's installations around the world.

The Space and Warning Systems Center is the command's newest unit. Formed on December 1, 1988, and located at Peterson AFB, the Center is responsible for the maintenance, modification, and selected development of the software-intensive command and control systems that are utilized by both NORAD and USSPACECOM.

Air Force Space Command today faces great but achievable challenges and opportunities. With the increasing importance of space-based assets, the command plays an ever-expanding role in support of US forces and the maintenance of peace through deterrence. ■

Air Force Systems Command

AIR Force Systems Command (AFSC) represents the Air Force's future. It is the only Air Force organization charged with identifying and acquiring emerging technologies for the Air Force.

From its headquarters at Andrews AFB, Md., AFSC researches, develops, tests, evaluates, and acquires the weapon systems needed by the operational forces to deter and, if necessary, overcome the threat.

The ability to deliver weapon systems that will keep the fighting forces strong depends on a combination of factors that includes a streamlined acquisition system, effective procurement strategies, and a stable corps of talented people. The command employs some 10,700 officers, 13,000 enlisted personnel, and 27,700 civilians.

AFSC operates under three common-sense goals set by Gen. Bernard P. Randolph, AFSC commander:

- *Support the operational user.* AFSC is a support organization providing the best equipment possible, using the resources available, to the Air Force fighting commands. Systems Command works closely with the users to ensure that they get the right equipment at the right time.
- *Increase acquisition excellence.* How well the warfighters are supported depends on how well the command marshals its resources. While

AFSC has only six percent of the service's manpower, it manages about one-third of the entire Air Force budget, some $30 billion annually, and more than 15,000 active contracts valued at about $215 billion. As steward of the Air Force's R&D dollars, AFSC is responsible for effectively and efficiently managing the acquisition process. During the past year, the command has actively streamlined the acquisition process and charted clearly defined development paths for its program managers.

• *Enhance technological superiority.* Maintaining the technological edge is the key to a strong and ready fighting force. AFSC employs more than half of all the scientists and engineers in the Air Force.

To challenge a large, complex acquisition process to meet these goals demands change—in fact, a commitment to excellence. This commitment means that no philosophy receives more attention in AFSC these days than Total Quality Management. Every process is examined and every action challenged to find better ways to do the job, creating a more responsive, streamlined system. TQM is the common tool to leverage efforts to achieve all command goals.

Systems Command no longer advocates programs; that's now the operational commanders' job. AFSC helps convert the user's stated needs into mutually understood requirements that will lead to executable programs.

Further, AFSC also provides operational commanders with options that recognize technological and budgetary realities. The acquisition cycle starts when the fighting forces develop and validate their statements of need. AFSC then helps to define technical opportunities and identify systems options, and, finally, the users choose the best solution to satisfy their needs.

Air Force Systems Command is the only Air Force organization charged with identifying and acquiring emerging technologies for the Air Force. Some AFSC activities, like this examination of the arrangement of stores on an aircraft model at Arnold Engineering Development Center in Tennessee, put emerging technologies to practical application.

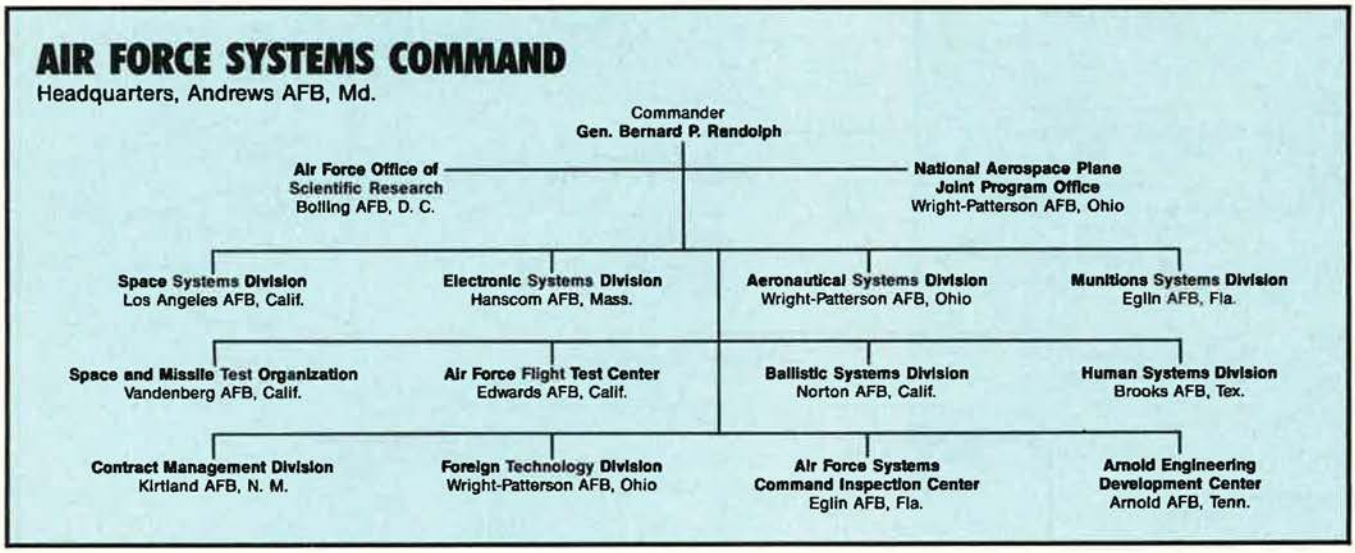
System support is also the key to the acquisition mindset. Once a weapon system is developed and delivered, it isn't going to be worth much if spares and support are not in place from the beginning. Strong acquisition logistics means that support elements and mission equipment will be delivered at the same time.

Streamlining source selection is another key step in improving the overall acquisition process. Previously, the command averaged 180 days from release of Request for Proposal to contract award. Several areas were targeted for improvement to reduce that average to 120 days or fewer, and it's working.

The command increased its emphasis on past performance in source selections and established a new performance-reporting system for evaluating contractor performance.

By reducing excessive requirements and controls, the command aims to achieve a no-discussions evaluation for every competition. When contract objectives are clear and everyone understands the issues up front, the selection process becomes manageable and realistic. AFSC is getting closer to that 120-day goal every day.

Acquisition strategy panels are another tool Systems Command created to verify that all functional processes and resources are paying off in executable programs. The panel's objective is to answer the tough questions: Have we given our users value? Do we have an executable program?



The command philosophy is simple: If quality isn't designed into a program in the planning cycle, it can't be inspected in later.

Current investments in science and technology (S&T) define the limits of systems the Air Force will field and, in effect, determine future Air Force capabilities. Decisions made today determine the technology base of tomorrow.

Staying abreast of today's changing technology is a challenging task. Significant opportunities must be continually examined in light of changing future requirements. The Air Force's S&T investment strategy depends on AFSC to regain, improve, and sustain a technologically superior force by accurately diagnosing the threat and planning technology to suppress it. ■

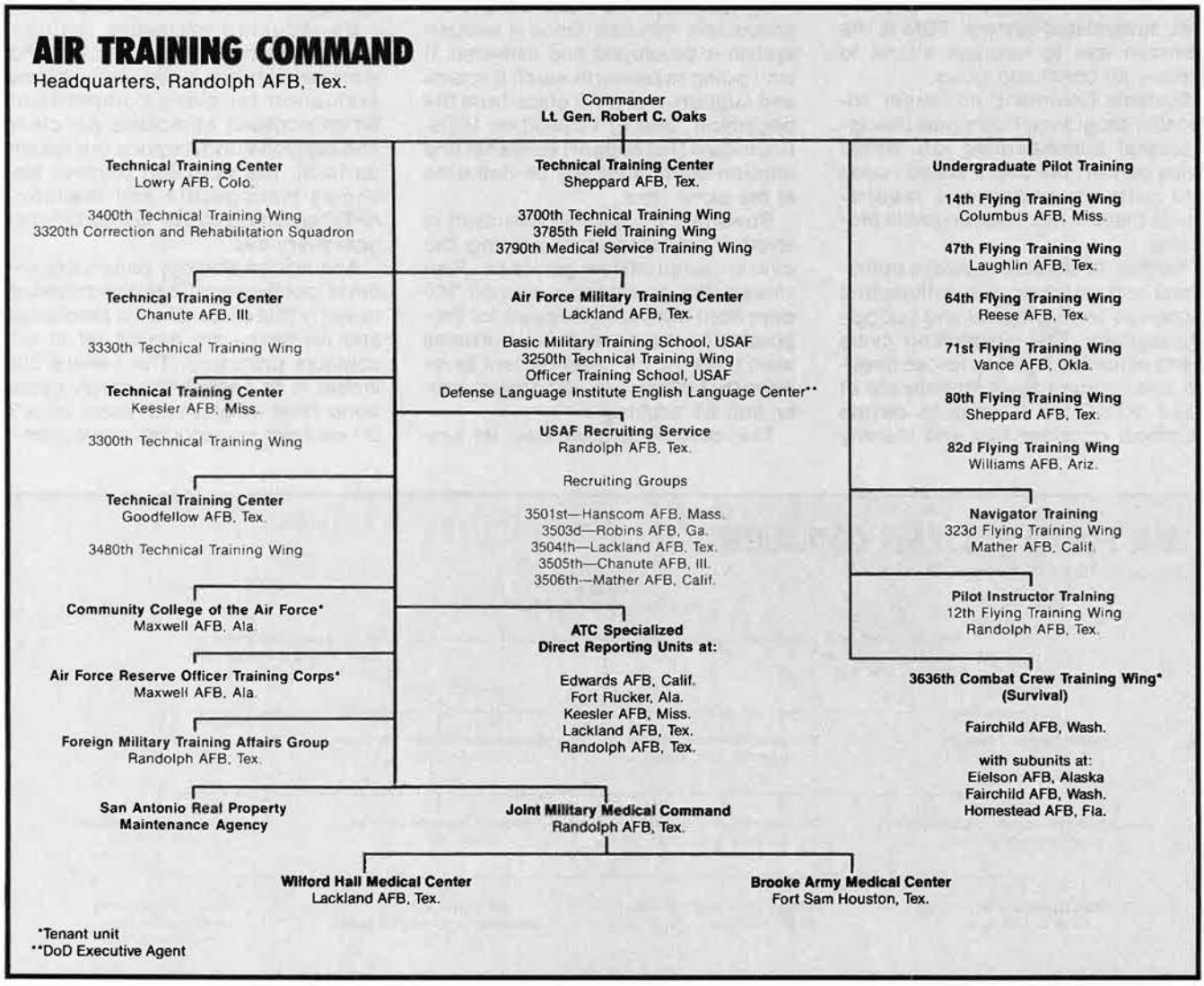
Air Training Command

AIR Training Command's focus is clearly on the future.

ATC has developed a comprehensive roadmap to cost-effective, mission-oriented flying training in the future—the USAF Trainer Master Plan. Similarly, the frontiers of technology are being pressed in technical training, as ATC maximizes the advantages of computer-assisted instruction and develops advanced training systems.

The young people whom the command recruits and trains today will lead the Air Force far into the next century, and ATC continues to provide the highly trained people to keep the United States Air Force second to none. By every measure, today's recruits are the best ever, and no diminishing of that quality is expected as ATC's Air Force Recruiting Service works on an FY '89 goal of 47,000 accessions.

Most new airmen enter the Air Force through the "Gateway to the Air Force"—Lackland AFB, Tex. In FY '88, 46,740 men and women completed the Basic Military Training School there, and another 943 were commissioned through Lackland's USAF Officer Training School. ATC also commissioned 2,823 new lieutenants through its 151 Air Force Reserve Officer Training Corps units nationwide. More than 1,500 physicians, nurses, and dentists received officer training last year through the Military Indoctrination for Medical Service Officers course at Sheppard AFB, Tex.



Training more than 400,000 people each year in 6,300 courses and 350 technical specialties, ATC is a training organization of vast proportions. The command's six technical training centers, eight flying training wings (including six undergraduate pilot training wings, one instructor pilot training wing, and one navigator training wing), the survival schools of the 3636th Combat Crew Training Wing, and the 3785th Field Training Wing's ninety-seven worldwide detachments constitute the free world's largest technical training system.

As always, producing skilled aviators is a top priority for Air Training Command. During FY '88, 1,634 pilots and 639 navigators received their wings through ATC flying training programs.

In the early 1990s, pilot training will become more mission-specific with the introduction of Specialized Undergraduate Pilot Training (SUPT). SUPT will provide pilot training tailored to the operational aircraft students will fly after graduation. It will include a common core of fundamental flying training in the T-37, followed by specialized training in either of two tracks: Tanker-Transport (TT) or Bomber-Fighter (BF).

As the Air Force plans for its future in space, ATC is an active participant. At Lowry Technical Training Center's Undergraduate Space Training program, Lowry AFB, Colo., ATC trains men and women from all services for assignment to space control, sensor, and satellite operations around the world.

ATC also plays a key role in military medical care and education. ATC's San Antonio Joint Military Medical Command (JMMC) provides health care for more than 180,000 active-duty and retired military and dependents. The JMMC also leads in graduate medical education, with about 550 physicians in training at any one time. Combined with the 8,774 graduates of medical and dental courses at Sheppard AFB, this makes ATC the Air Force leader in both medical care and medical training.

The command is international in scope. As the executive agent for all Air Force security assistance training, ATC manages the language, technical, and flying training of more than 4,000 international students from more than ninety countries.

The future is now in Air Training Command as quality people acquire the skills, techniques, and technologies essential to their success as new generations of airmen. ■

Recruiting: FY '88 Marks Top Quality

More than 43,000 young Americans entered the Air Force in FY '88. Across America and at dozens of overseas locations, Air Force recruiters brought in the highest quality officers and enlisted people in the history of the Air Force.

Those accessions included 41,200 nonprior service and 300 prior service enlistees. In addition, 943 men and women graduated from the USAF Officer Training School at Lackland AFB, Tex., and more than 1,500 health-care professionals entered the Air Force Medical Service. Almost 300 students received Air Force health-profession scholarships in FY '88.

Last year's new officers and enlistees brought with them the high marks of scholastic accomplishment. Officer Training School candidates ranked in the top one-third of all college graduates, with a grade point average of 3.1. Fully 99.1 percent of nonprior service enlistees entered the Air Force with their high school diplomas. While the average US high school graduate reads at the ninth-grade level, Air Force recruits averaged at the eleventh-grade level. Fifty-two percent of FY '88 Air Force enlistees scored in the top two mental categories on qualifying tests.

To broaden its recruiting efforts, the Recruiting Service and USAF Reserve Officer Training Corps (AFROTC) implemented a new, team approach to officer recruitment. For the first time, Air Force recruiters assumed responsibility for attracting scholarship and nonscholarship ROTC applications. By year's end, USAF recruiters had exceeded the AFROTC scholarship application goal of 5,000 by more than 4,500 and recorded more than 18,000 nonscholarship applications.

Air Force recruiters are seeking approximately 50,000 new members this year. That goal includes more than 47,000 nonprior service and 300 prior service enlistees, 1,267 officer trainees, and more than 1,500 health-care professionals. In addition, AFROTC is seeking 8,000 four-year scholarship, 500 four-year nursing scholarship, 200 two- and three-year nursing scholarship, and 10,000 nonscholarship applications.

From its headquarters at Randolph AFB, Tex., the USAF Recruiting Service, with its five regional recruiting groups and thirty-four squadrons, directs the efforts of more than 1,300 recruiting offices in every state, Puerto Rico, Guam, and other overseas locations in Europe and the Pacific.

To continue recruiting new members for America's high-technology Air Force, the Recruiting Service needs about 500 new recruiters each year. Any career noncommissioned officer who wishes to learn more about this challenging duty—and the possibilities for an assignment to a location of choice—should call the Recruit-the-Recruiter Team Chief at AUTOVON 487-2812 or commercial (512) 652-2812.

—USAF photo by A1C Scott Lindvall

The young people Air Training Command recruits and trains today will lead the Air Force far into the next century. Producing skilled pilots and navigators is a top priority. Here, at Columbus AFB, Miss., pilots review the upcoming mission on the wing of their T-37 during ATC's annual flying and maintenance competition.

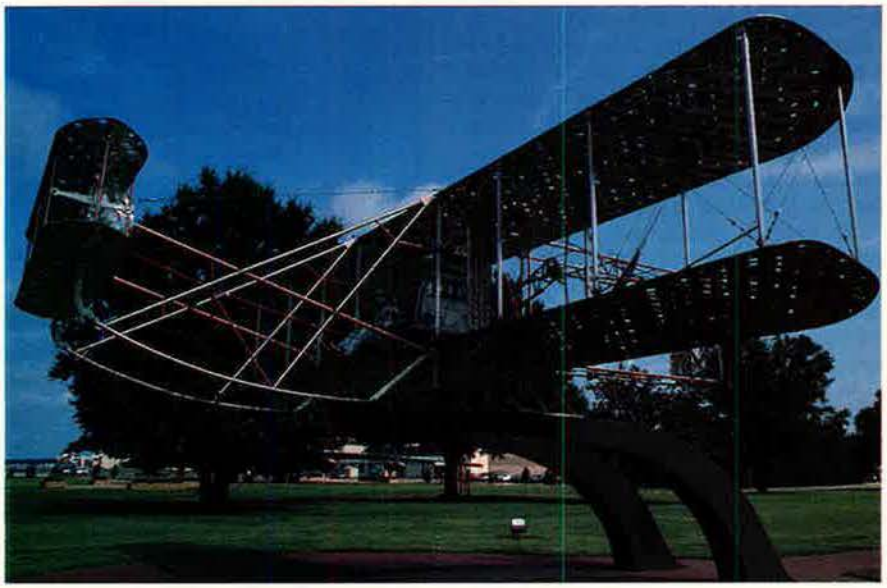
Air University

AIR University (AU), with headquarters at Maxwell AFB, Ala., is responsible for providing professional military education (PME) and degree-granting professional continuing education (PCE) for officers, NCOs, and Department of Defense civilians.

Most of AU's schools are located at Maxwell AFB. They include Air War College (AWC) for senior officers, Air Command and Staff College (ACSC) for midcareer officers, and Squadron Officer School (SOS) for company-grade officers. The Air Force Senior Noncommissioned Officer Academy (SNCOA), the highest level of NCO PME, is located at nearby Gunter AFB.

Other major AU organizations include the Ira C. Eaker Center for Professional Development (CPD); the Center for Aerospace Doctrine, Research and Education (CADRE); the Air University Library (AUL); and Hq. Civil Air Patrol-USAF (CAP-USAF), all located at Maxwell AFB. Gunter AFB is the home of the Extension Course Institute (ECI), and the Air Force Institute of Technology (AFIT) is located at Wright-Patterson AFB, Ohio.

Nearly 2,700 military and 1,600 civilian personnel are permanently assigned to AU. Close to 25,000 military members and civilians completed resident AU classes last year, and thousands more completed courses through nonresident programs. Currently, many AU schools are undergoing major changes to support the Air Force philosophy of "The right PME at the right time with the right focus."



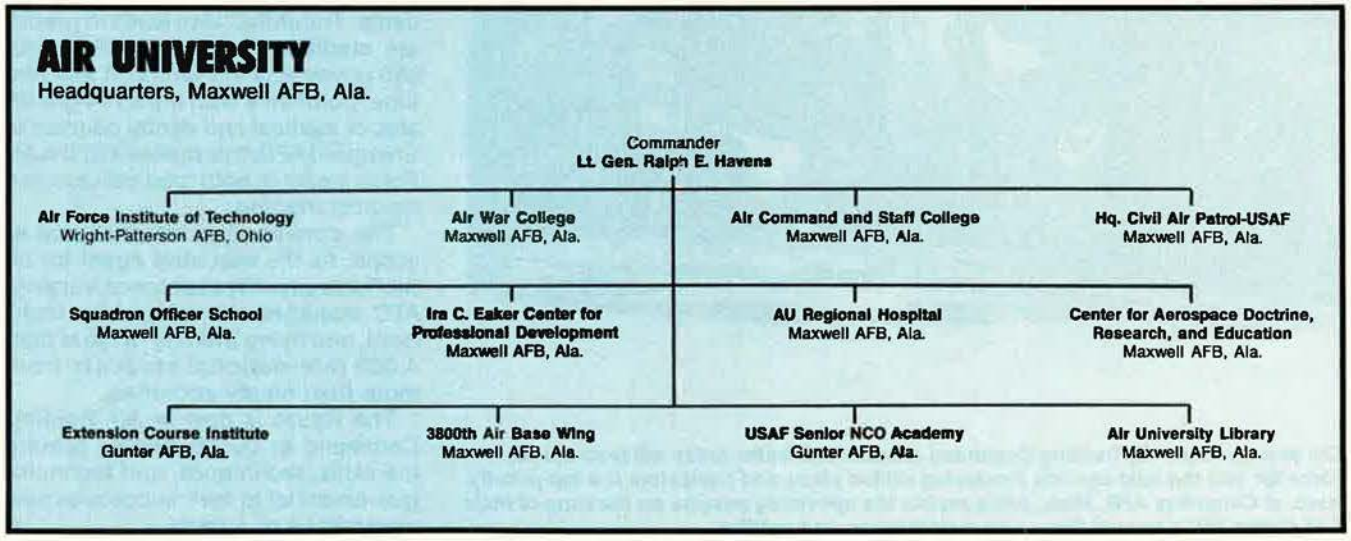
—USAF photo by TSgt. Kit Thompson

At the entrance to Maxwell AFB, Ala., home of the Air University, this stainless steel replica of the Wright-B Flyer is a lasting tribute to the perseverance and achievement of the Wright brothers and the leadership and foresight of the citizens of nearby Montgomery who together established the nation's first civil aviation school.

AWC is USAF's premier professional military education school. Its mission is to enhance the Air Force's warfighting capability by emphasizing the unique skills, perspectives, knowledge, and analytical thinking required of senior officers through a curriculum emphasizing joint and combined operations. The school's Air University National Security Briefing Team, in its sixth year of operation, gave more than 300 presentations in forty-four states. Since 1983, the team has made more than 1,400 presentations.

ACSC will undergo major changes next year. Most notable is the change from one ten-month course to two six-month courses per year. The change gives more officers an opportunity to attend the school in residence. The school has incorporated joint-service specialties into its curricula for those students going on to joint-service assignments.

In order to provide increased opportunity for company-grade officers to attend SOS in residence, the course was shortened from eight and a half weeks to seven. This allows the



school to provide all captains an opportunity to attend in residence.

The SNCOA also expanded its attendance opportunities for in-residence attendance by senior NCOs this year. Changes to the program now allow master sergeants to attend the in-residence school. The number of classes was increased from five per year to six. The change will allow the school to increase its current attendance rate of 1,250 students a year to 2,000 per year by 1991.

CPD provided professional development through eight schools with fifty-five courses. Last year, more than 4,000 students graduated from comptroller, historian, judge advocate, international officer, chaplain, personnel, resource management, systems information, base commander, and other courses.

CADRE's PCE courses provide military and civilians with unique, operational, combat-oriented experiences to enhance their understanding of wartime operations in a joint context. In addition, the Air Force Wargaming Center serves as the clearinghouse for USAF wargaming applications and as the service's focal point for information on computer-assisted war games. The Airpower Research Institute publishes the *Air Power Journal*, the Air Force's professional journal, and performs research on the employment of airpower.

AFIT provides graduate-level education in support of Air Force and DoD requirements by offering accredited resident degree and PCE programs in its schools of Engineering, Civil Engineering and Services, and Systems and Logistics. AFIT saves the government approximately $23 million a year through student and faculty research projects. Each year, AFIT tracks more than 3,000 Air Force members attending approximately 300 civilian colleges, universities, and medical schools, and sixty-six industrial firms worldwide. Construction on AFIT's new $12.8 million, 110,000-square-foot Science and Research Center began in 1987 and is scheduled for completion this year.

ECI, the center for the Air Force's nonresident education programs, served approximately 375,000 students enrolled in career development, specialized, and professional military education courses.

AUL—the most comprehensive military library in the free world—continued to serve the command's academic and research needs.

Also active under the AU umbrella is Hq. CAP-USAF, the Air Force organization that advises and assists CAP with its primary missions of emergency services, aerospace education, and a youth cadet program. In 1986, the US Customs Service began using CAP aircraft and aircrews to support the antidrug effort. Last year, CAP flew about half the Customs Service's passive surveillance flying hours in support of this effort. ■

Alaskan Air Command

A demanding Arctic environment, vast distances, and a changing threat challenge the men and women of Alaskan Air Command (AAC) as they fulfill their command's motto of providing "Top Cover for North America." AAC provides, trains, and equips tactical air forces to preserve the sovereignty of United States lands, waters, and airspace.

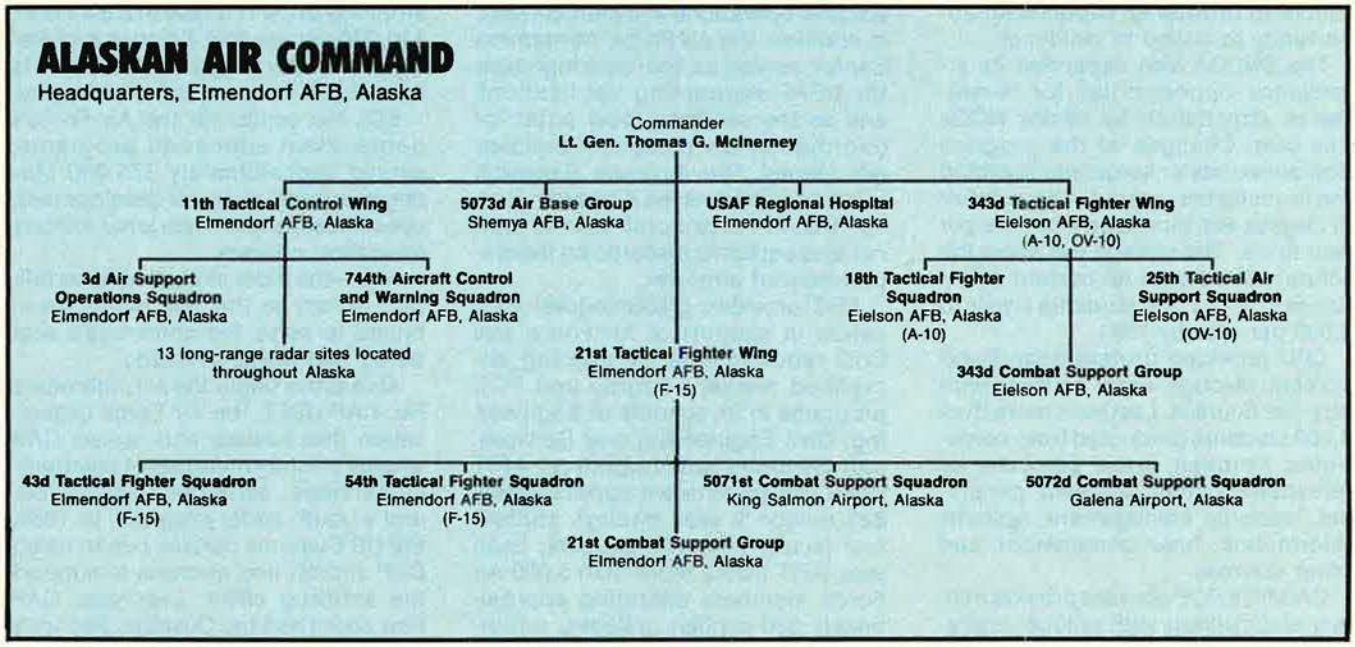
Alaska's strategic location has been recognized for many years. The state lies across the most frequently flown routes connecting the Orient with Europe and North America, making Alaska an ideal location for deployment or refueling of aircraft flying polar routes. The Alaska and Soviet land masses are separated by only about fifty miles at the Bering Strait.

Alaska-based forces have gained increased significance as the first line of defense against the Soviet air-launched cruise missile. AAC F-15 Eagles on North American Aerospace Defense Command alert intercepted forty-six Soviet military aircraft in 1988, of which thirty-six were Bear-G or cruise-missile-capable Bear-H bombers. Early in the year, AAC F-15s intercepted two Bear-H bombers just 660 miles from the North Pole—the northernmost interception ever. Another "first" was recorded when AAC F-15s intercepted two more Bear-Hs and handed them off to three CF-18s for the first Canadian Forces interception in the western Arctic. In mid-June, a flurry of interceptions included three in one day for the first time. Between June 14 and June 21, the F-15s launched eight times, intercepting a total of thirteen Soviet aircraft for yet another record.

The AAC Commander also serves as Commander, Alaskan NORAD Region. In this capacity, he is responsible to the Commander in Chief, NORAD, for the defense of North America against atmospheric attack and for accomplishing assigned operational missions.

AAC people are assigned to three main bases and two forward operat-

"Bear hunting" in Alaska often involves the F-15 Eagles of Alaskan Air Command, who regularly connect with cruise-missile-capable Soviet Bear-H bombers, such as this one intercepted over the Arctic Ocean in June 1988. This is one of the ways Alaskan Air Command continues to provide top cover for North America.



ing bases. The main bases are Elmendorf AFB, adjacent to Anchorage; Eielson AFB, twenty-six miles southeast of Fairbanks; and Shemya AFB, near the tip of the Aleutian Islands chain. Galena and King Salmon Airports are forward operating bases on state-owned airports where F-15s from Elmendorf sit alert.

AAC maintains headquarters at Elmendorf, home also of the 11th Tactical Control Wing, 21st Tactical Fighter Wing (host unit), and 21st Combat Support Group. The 21st, flying F-15Cs, is charged with an air-superiority and strategic air defense mission for America's first line of defense. In 1988, the wing made history when two AAC fighter pilots flew two F-15s from Bitburg AB, West Germany, to Elmendorf, flying over the North Pole rather than flying the normal route through the lower forty-eight states. Additionally, the 21st was host to large-scale NORAD-sponsored air defense exercises, such as Amalgam Warrior '88.

The 11th TCW is responsible for the Alaskan NORAD Region Operations Control Center (ROCC) and the command's thirteen long-range radar sites. The wing also operates the Alaskan Tactical Air Control System and is the operating agency for the command's Alternate Command Post.

The ROCC maintains surveillance around the clock to protect the air sovereignty of the Alaskan NORAD Region. In addition, the wing provides airborne battle staff members aboard Airborne Warning and Control System E-3 Sentry aircraft in support of the Alaskan NORAD Region.

The Distant Early Warning Line on Alaska's north coast began a modernization program in 1987, when three sites were converted to modern Minimally Attended Radars under the US-Canada North Warning System. Other sites are being converted, and new sites are being added. Work is also under way to integrate an over-the-horizon backscatter radar into the Alaska air defense system to provide tactical warning and attack assessment. When completed, it will interconnect with the west coast OTH-B and the Navy's relocatable OTH-B radar on Amchitka Island in the Aleutians.

Eielson AFB is headquarters for the 343d Tactical Fighter Wing and the 343d Combat Support Group. The wing flies the A-10 Thunderbolt II in the demanding close air support role, with particular emphasis on anti-armor capability in supporting friendly ground forces in an Arctic environment.

The oldest air combat unit in Alaska, the 343d has conducted deployments to locations worldwide, including Korea, Norway, and Canada. Additionally, the wing is host to Yukon Lightning, an A-10 tactical employment competition.

Alaska is a key player in the defense of North America. Its strategic location, in relation to potential enemies as well as to allies, provides a valuable staging base for allied operations. Alaska's strategic importance can only increase in the future. The tactical forces of AAC are meeting the challenges of today and are prepared for the future. ■

Electronic Security Command

ELECTRONIC Security Command (ESC) is a major Air Force command with headquarters at Kelly AFB, Tex. Headquarters ESC has an all-source intelligence function and provides electronic combat support and operations security (OPSEC) support to Air Force units.

ESC units provide rapid radio relay, command control and communications countermeasures (C^3CM), computer security (COMPUSEC), and communications security (COMSEC) support to US and allied forces worldwide.

The command plays an important role in developing Air Force electronic warfare (EW) and C^3CM capabilities, techniques, and systems. By providing C^3CM training to operational support elements during exercises, the command helps prepare the Air Force for combat operations in a hostile electromagnetic environ-

ELECTRONIC SECURITY COMMAND

Headquarters, San Antonio, Tex.

Commander
Maj. Gen. Paul H. Martin

Hq. Air Force Electronic Warfare Center
San Antonio, Tex.

Hq. Air Force Cryptologic Support Center
San Antonio, Tex.

Hq. Continental Electronic Security Division
San Antonio, Tex.

694th Electronic Security Wing
San Antonio, Tex.

695th Electronic Security Wing
Langley AFB, Va.

6940th Electronic Security Wing
Fort Meade, Md.

6960th Electronic Security Support Group
San Antonio, Tex.

Hq. European Electronic Security Division
Ramstein AB, Germany

690th Electronic Security Wing
Tempelhof, Berlin, Germany

691st Electronic Security Wing
Lindsey AB, Germany

693d Electronic Security Wing
RAF Chicksands, UK

6917th Electronic Security Group
San Vito Dei Normanni AB, Italy

Hq. Pacific Electronic Division
Hickam AFB, Hawaii

6981st Electronic Security Group
Elmendorf AFB, Alaska

6903d Electronic Security Group
Osan AB, Korea

6920th Electronic Security Group
Misawa AB, Japan

6924th Electronic Security Group
Wheeler AFB, Hawaii

6990th Electronic Security Group
Kadena AB, Japan

ment. To help combat commanders satisfy their C³CM requirements, ESC develops, maintains, updates, and disseminates the Air Force C³CM support database, Constant Web.

ESC is also the executive agent for the Air Force operations security program, with the responsibility of strengthening and supporting the OPSEC program for the entire Air Force.

To fulfill mission requirements, Headquarters ESC formulates all-source intelligence requirements and plans and procures all-source intelligence systems to ensure connectivity with national databases, while providing database support and services to the command and the Joint Electronic Warfare Center. As part of the all-source intelligence function, the command prepares threat assessments to support Air Force and command mission systems and develops and disseminates unique information on the tactics and capabilities of potential adversaries.

Combat elements depend heavily on ESC support during exercises and real-world operations. During an average year, ESC provides support for more than 100 exercises around the world. The command is dedicated to helping the US and allied military forces accomplish their mission. ESC experts support exercises such as Red Flag, Green Flag, Team Spirit, Reforger, Global Shield, Bright Star, Cope Thunder, and many others.

To provide training to aircrews in hostile electronic environments, ESC people deploy around the world to perform the role of adversary in military exercises. In this role, ESC people jam transmissions to degrade communication. For aircrews who have never experienced these disruptions and false transmissions, the impact can be significant.

ESC personnel also monitor US radio and telephone communications to determine whether information of value is being exposed.

In 1988, the command's readiness was improved by a major reorganization that involved the creation of six operational, Air Force-controlled wings. The new field structure is intended to align ESC more closely with the combat commands ESC supports.

The changes are based on ESC's three primary theaters of operation. Divisions in Europe and the continental United States now have subordinate wings. However, the Pacific division will retain the group/squadron support structure because of geographic considerations.

Communication between ESC units and other Air Force organizations will exist at a number of levels. For example, the European Electronic Security Division interfaces with United States Air Forces in Europe, while the 693d Electronic Security Wing at RAF Chicksands is linked to Third Air Force headquarters.

The new structure will ensure that ESC will continue to perform its wartime mission by maintaining the peace, according to ESC Commander Maj. Gen. Paul H. Martin. ■

—USAF photo by TSgt. Sheila Donovan

A1C James Coffey of Detachment 3, 695th Electronic Security Wing, Nellis AFB, Nev., manually operates a multiband jammer of the sort used in USAF's "Red Force" program, a training effort to emulate a hostile electronic combat environment for the realistic training of aircrews, weapons controllers, and other communicators.

Military Airlift Command

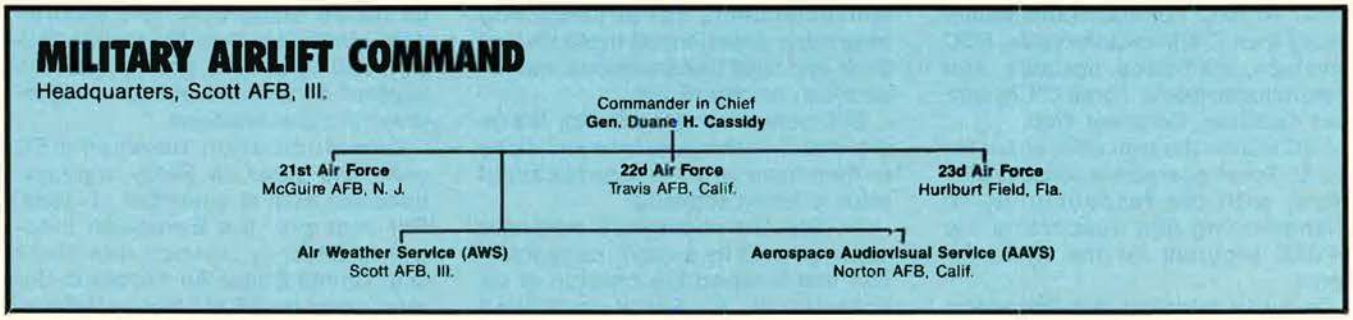
THE Military Airlift Command's 90,000 active-duty military and civilians operate more than 1,000 aircraft at some 292 locations in twenty-five countries. MAC-gained ANG and AFRES assets add 71,000 people and approximately 400 aircraft.

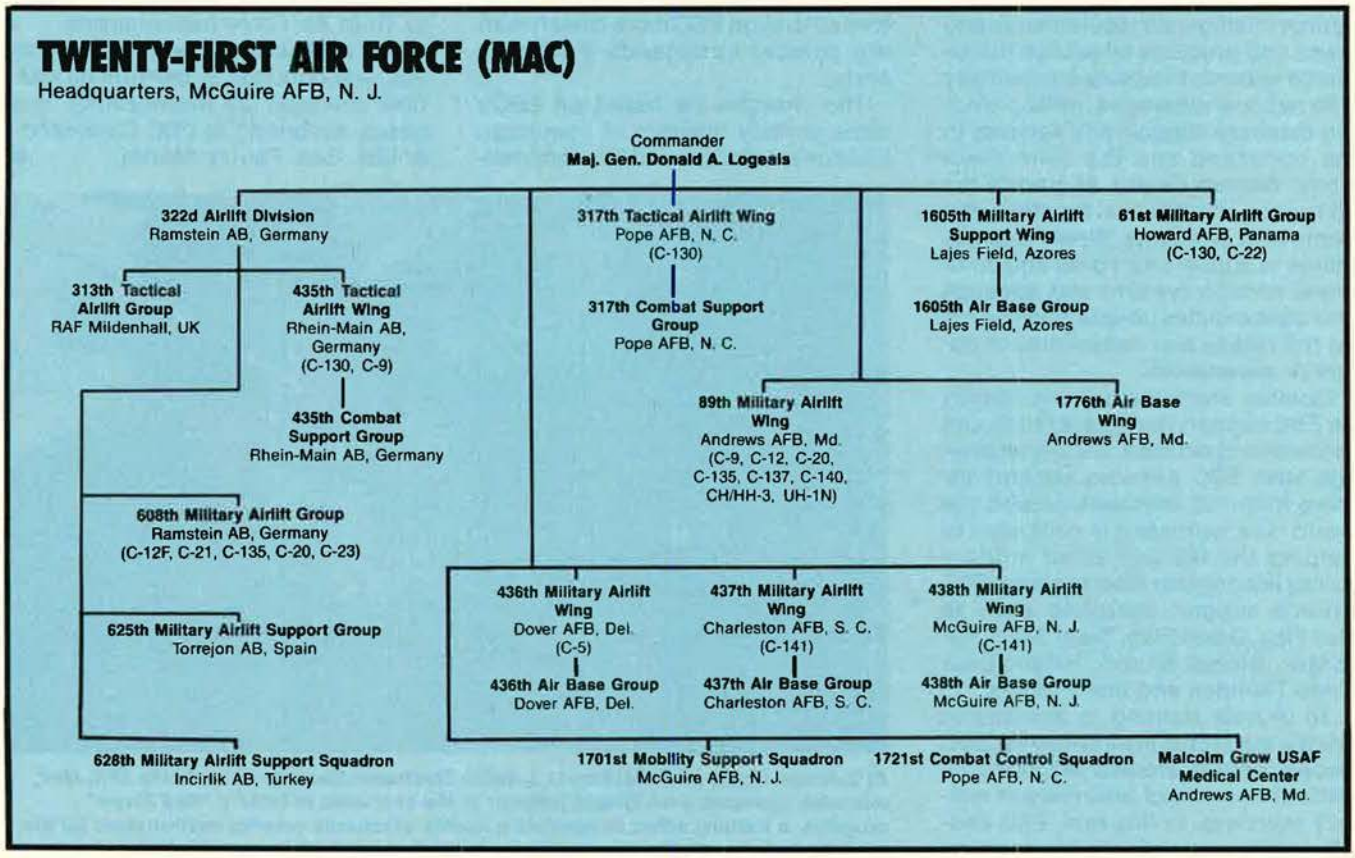
MAC operates thirteen bases in the United States and controls US facilities at Lajes Field in Portugal's Azores and at Rhein-Main AB, West Germany. To accomplish its airlift mission of deployment, employment, resupply, and redeployment of combat forces and support equipment, MAC also operates aerial ports of embarkation and debarkation. MAC is the Air Force component of the US Transportation Command, and MAC's Twenty-third Air Force is the Air Force component for US Special Operations Command. MAC's Commander in Chief, Gen. Duane H. Cassidy, is also USCINCTRANSCOM.

In Fiscal Year 1989, MAC units will participate in eighty-one of the ninety JCS exercises—more than any other command. This worldwide exercise involvement requires some 74,000 flying hours and constitutes twelve percent of MAC's yearly flying-hour program.

Most of MAC's flying hours are devoted to "channel missions," which provide regular service between important locations. There are about 880 active channels operating in eighty-seven nations. MAC channel missions moved more than 351,000 tons of cargo and about 2,225,000 passengers in FY '88.

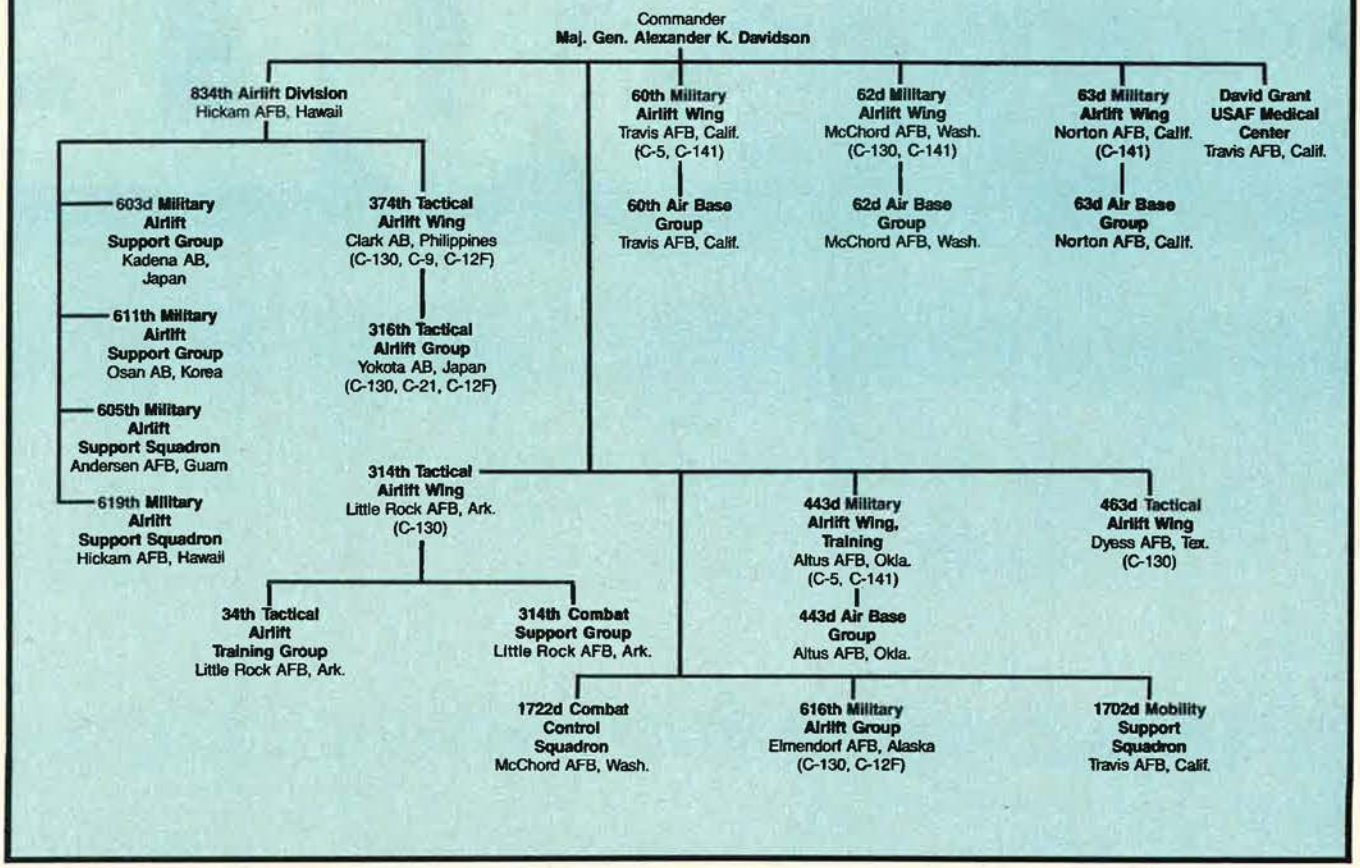
MAC operated at peak peacetime levels in FY '88. In addition to routine and exercise airlift, the command provided earthquake relief to Soviet Armenia; moved US and Soviet Intermediate-range Nuclear Forces (INF) Treaty verification teams in the United States and Soviet Union; airlifted United Nations peacekeeping forces; flew relief operations in Bangladesh,





TWENTY-SECOND AIR FORCE (MAC)

Headquarters, Travis AFB, Calif.



—Staff photo by Guy Aceto

MAC's Twenty-third Air Force controls Air Force special operations and provides combat search and rescue Air Force-wide. The arrival into the inventory of the new MH-60G Pave Hawk aircraft will greatly enhance the forces now using the HH-53 and HC-130 aircraft shown here at Hurlburt Field, Fla.

the Marshall Islands, Sudan, and Jamaica; supported Panama security enhancement; and provided airlift support for the President and Vice President.

To bolster MAC's C-5, C-141, and C-130 airlift capabilities, the Air Force received approval in December 1988 to produce the first twelve C-17 aircraft. The C-17's capability to deliver outsize cargo directly to forward areas in both an airland and airdrop role will increase strategic airlift flexibility. The first C-17 flight is scheduled for August 1990, with delivery of the first operational aircraft to Charleston AFB, S. C., set for October 1991.

During contingencies or wartime, MAC's capabilities would be expanded through activation of the Civil Reserve Air Fleet. The CRAF is a partnership between MAC and US commercial air carriers, providing approximately 480 civilian passenger and cargo aircraft for military missions. On a daily basis, CRAF aircraft augment MAC capabilities by flying contract missions to move DoD personnel.

MAC's Twenty-third Air Force controls Air Force special operations,

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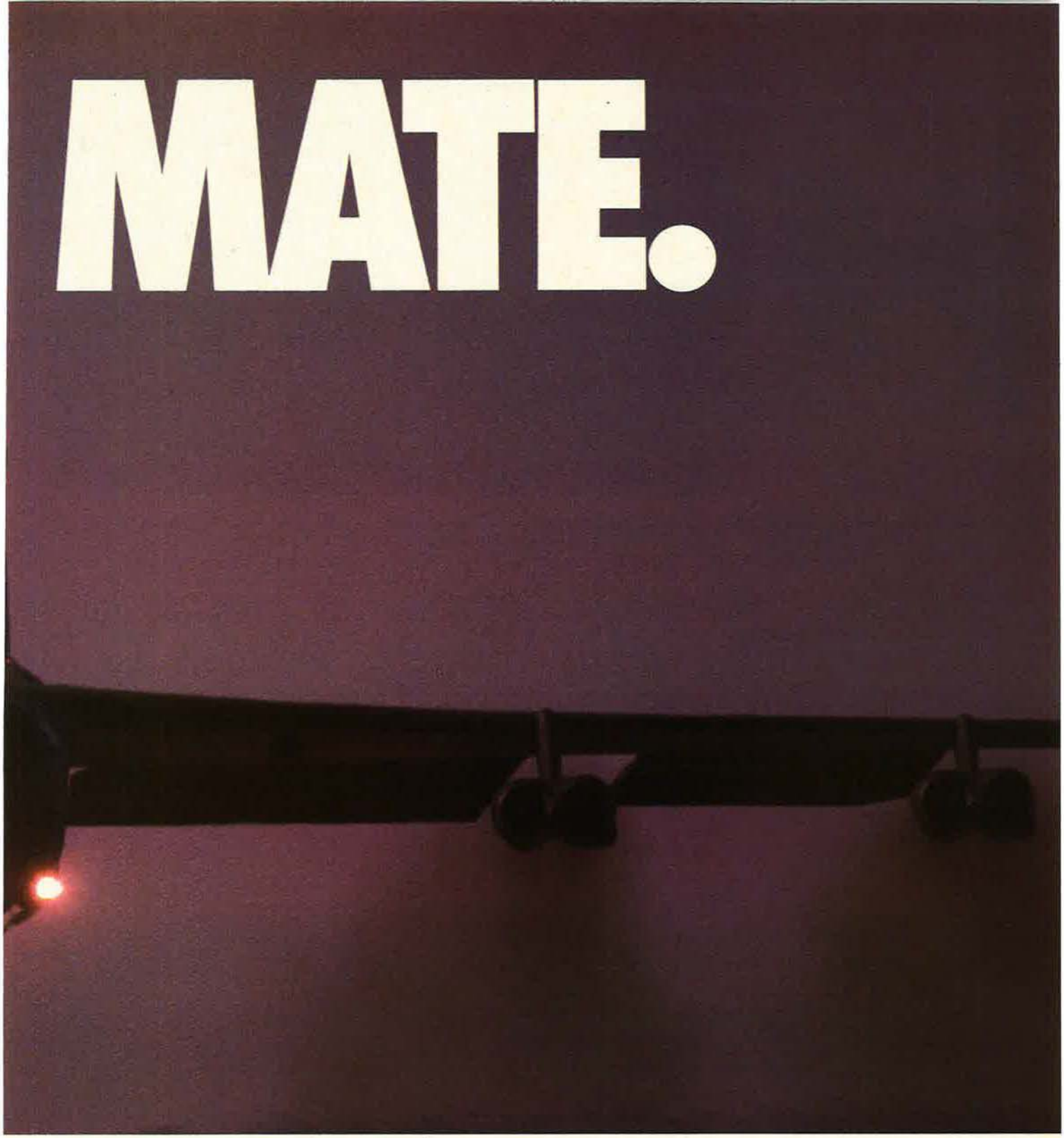

systems. In fact, AAI is the first contractor with three MATE applications.

So, the MIDATS, as well as other MATE systems, is yet another achievement that represents AAI's commitment to developing state-of-the-art electronic and mechanical tools for the Department of Defense and industrial use.

To meet today's challenges, AAI is really your only choice. Our sensible approach to solving problems has made us a major force with industry and the Department of Defense.

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THE SENSIBLE SOLUTION

—USAF photo by SSgt. F. Lee Cockran

After last year's disastrous earthquake in Armenia, Military Airlift Command flew some of the first rescue experts and relief supplies to the stricken Soviet state. Here's the view from the flight deck of one of MAC's C-141s of the 172d Military Airlift Group as it flies into Soviet airspace en route to Armenia.

combat search and rescue, and weather reconnaissance aircraft. It also commands CONUS aeromedical evacuation forces, supports air sampling missions, and provides operational-support airlift, including helicopter support for SAC missile sites.

MAC's special operations capabilities will improve in 1989 when the first of twenty-four new MC-130H aircraft arrives to augment the current MC-130E force. The first of the new MH-60Gs has joined the combat rescue force.

Aerospace Rescue and Recovery Service, an element of Twenty-third Air Force, is the executive management agency for all federal search and rescue within the contiguous United States. Rescue forces have saved more than 23,000 lives during the past forty years.

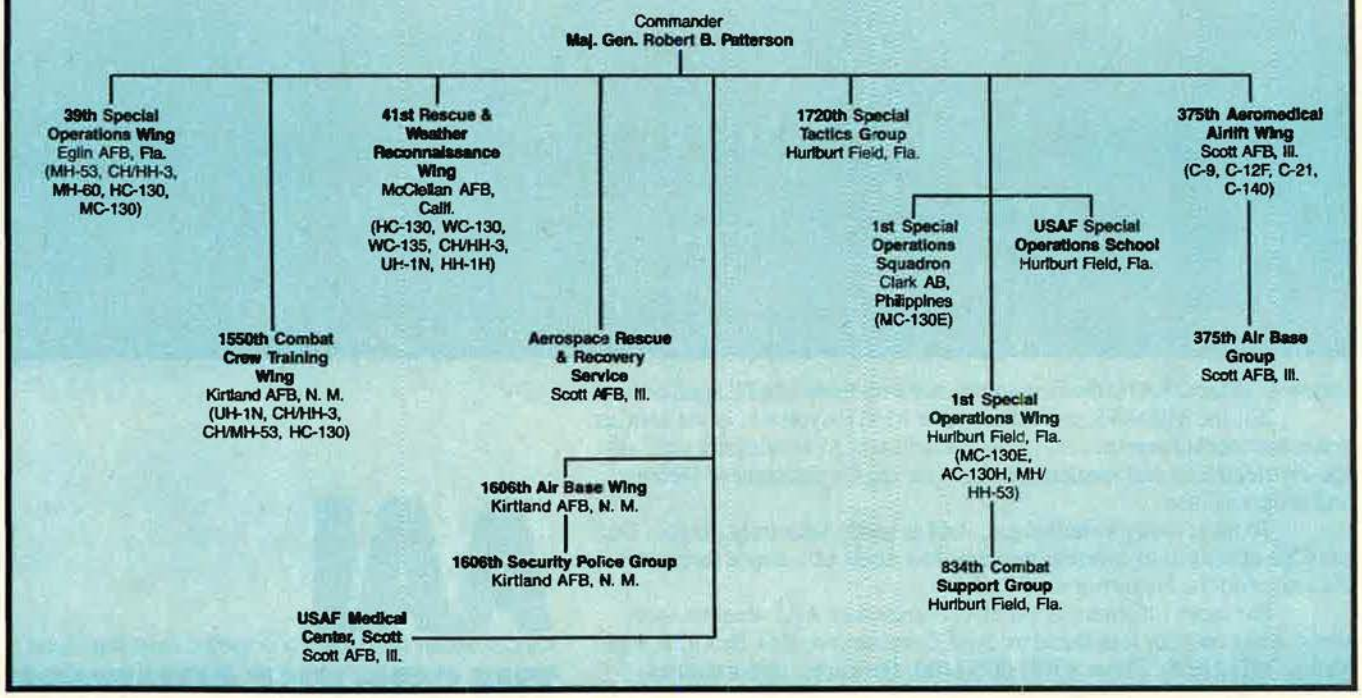
Aeromedical airlift is another vital MAC mission. In FY '88, MAC and AFRES aircrews and medical crews airlifted patients on approximately 5,000 C-9, C-141, C-130, C-21, and C-12 missions.

MAC forces also include two technical services—the Air Weather Service, with about 5,000 military and civilian people serving in more than 260 locations worldwide; and the Aerospace Audiovisual Service, the Air Force's single manager for visual information documentation of operational activities and audiovisual production and services.

People all over the world depend on MAC. For many disaster victims, MAC provides the only means of support and survival. At the same time, MAC's readiness to airlift troops and equipment around the world provides the backbone of deterrence. ■

TWENTY-THIRD AIR FORCE (MAC)

Headquarters, Hurlburt Field, Fla.



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VERSATILE

NEW SHORTS C-23B SHERPA. As a reliable, short haul military transport, the Shorts 330/C-23 Sherpa has earned its wings from Kwajalein Atoll to Zweibrucken AB, West Germany.

New Shorts C-23B Sherpas will soon be serving the Army National Guard. The B model incorporates major enhancements to the C-23 that make this extremely capable and cost-efficient performer even more versatile.

This new generation aircraft features inward opening side doors, double hinged rear ramp/door, new P&W PT6A-65AR engines, upgraded wing and rugged landing gear.

The C-23B Sherpa carries more cargo farther while operating from unimproved runways. And its multi-role capabilities include air drop, paratrooping, medevac. equipment/cargo or personnel transport.

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Short Brothers (USA), Inc., 2011 Crystal Drive,
Suite 713, Arlington, VA 22202-3719.
Or call us at (703) 769-8700.

SHORTS

Pacific Air Forces

With headquarters at Hickam AFB, Hawaii, the Pacific Air Forces (PACAF) provides the principal air arm of the US Pacific Command. PACAF's primary mission is to plan, conduct, and coordinate offensive and defensive air operations in an area extending from the west coast of the Americas to the east coast of Africa and from the Arctic to the Antarctic.

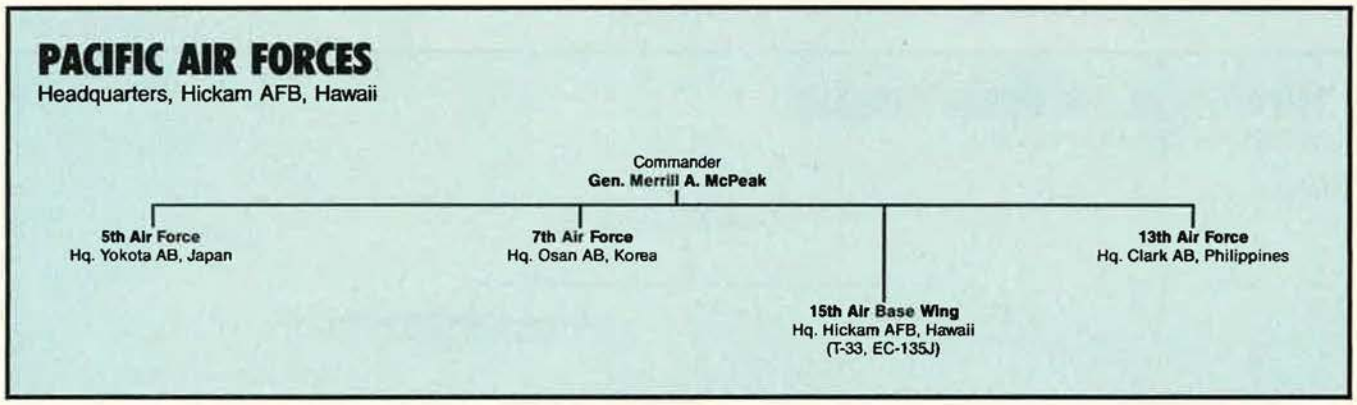
To maintain security in the vast Pacific region, PACAF has fewer than 300 fighter and attack aircraft, including air-superiority F-15s, multirole F-4E/Gs, ground-attack F-16s and A-10s, and RF-4s. Aircraft from MAC, SAC, and TAC provide crucial support as well.

Gen. Merrill A. McPeak, Commander in Chief, Pacific Air Forces, is responsible for the more than 60,000 Air Force military and civilian people on duty in the Pacific. Along with their more than 35,000 family members, this force is distributed among ten major and many smaller installations, primarily in Hawaii, Japan, the Republic of Korea, and the Republic of the Philippines.

PACAF's military professionals stand ready to defend US interests and fulfill mutual defense agreements in an area covering half the world's surface, containing thirty-nine countries and more than two billion people. Seventeen time zones spanning more than 12,000 miles—almost four times the breadth of the US—separate the command's eastern and western boundaries, posing a major challenge for PACAF warplanners.

Organizational improvements and the introduction of newer weapon systems go a long way toward getting the most out of PACAF's widely dispersed forces. The new "C" model F-16, with improved engines and avionics, operates out of Kunsan AB, Korea, and Misawa AB, Japan. The 51st Tactical Fighter Wing, Osan AB, Korea, has completed a trade of its twenty-four Phantoms for twenty-four F-16Cs.

Intermediate-level aircraft maintenance has moved back to PACAF's tactical fighter wings, and the Com-



—USAF photo by SSgt. Theodore J. Koniares

Pacific Air Forces' SSgt. Morris E. Thomas, Jr., right, a crew chief with the 432d Aircraft Generation Squadron, Misawa AB, Japan, shares his knowledge of the F-16 with a Royal Thai Air Force maintenance man during exercise Cobra Gold '88 in Thailand.

FIFTH AIR FORCE (PACAF)

Headquarters, Yokota AB, Japan

Commander
Lt. Gen. James B. Davis

- **475th Air Base Wing**
  Yokota AB, Japan
  (UH-1N)
- **313th Air Division**
  Hq. Kadena AB, Japan
  - **400th Munitions Maintenance Squadron**
    Kadena AB, Japan
    (Theater Munitions Maintenance)
  - **18th Tactical Fighter Wing**
    Kadena AB, Japan
    (F-15, RF-4C)
  - **18th Combat Support Wing**
    Kadena AB, Japan
- **432d Tactical Fighter Wing**
  Misawa AB, Japan
  (F-16)

SEVENTH AIR FORCE (PACAF)

Headquarters, Osan AB, Korea

Commander
Lt. Gen. Thomas A. Baker

- **8th Tactical Fighter Wing**
  Kunsan AB, Korea
  (F-16)
- **51st Tactical Fighter Wing**
  Osan AB, Korea
- **5th Tactical Air Control Group**
  Osan AB, Korea
- **6th Tactical Intelligence Group**
  Osan AB, Korea

THIRTEENTH AIR FORCE (PACAF)

Headquarters, Clark AB, Philippines

Commander
Maj. Gen. Donald Snyder

- **3d Tactical Fighter Wing**
  Clark AB, Philippines
  (F-4E/G, F-5E)
- **6200th Tactical Fighter Training Group**
  Clark AB, Philippines

bat Oriented Supply Organization has expanded operations to support jet engine and aerospace ground equipment maintenance, improving PACAF's ability to generate combat sorties.

Even with the most sophisticated weapons, highly trained and motivated people, and improved logistics systems, PACAF's planners realize that their success ultimately depends on joint and combined operations. Ninety-eight percent of all PACAF exercises are conducted jointly with Navy, Marine, or Army units.

More than fifty times last year, PACAF forces participated in dynamic and realistic field training and command post exercises. During last year's Team Spirit exercise in Korea, more than 16,000 USAF personnel and 882 aircraft joined with other American and Republic of Korea forces to provide a visible demonstration of the US commitment to defend the region.

Eighty-two percent of PACAF exercises are also combined operations with allied or friendly countries, up from sixty percent in past years. Cope North exercises in Japan continue to develop a close working relationship with the Japan Air Self-Defense Force. PACAF F-16s flew to Thailand to participate in Cobra Gold '88, while Exercise Pitch Black '88 gave PACAF F-15 pilots the opportunity to work with the Royal Australian Air Force. Cope Thunder, held in the Philippines seven times annually, gives PACAF's pilots and those of other nations intense, realistic tactical air warfare training. During FY '88, PACAF's pilots flew an impressive 73,316 sorties for 99,248 hours.

While the emphasis must remain on readiness, PACAF hasn't forgotten its people and their welfare. PACAF's Family Support Centers, fully operational throughout the command, strengthen the bond between the Air Force's mission and its families. PACAF also boasts an aggressive program to renovate and upgrade existing family housing and MWR facilities and to construct new housing and other quality-of-life facilities.

The newly renovated PACAF NCO Academy and PME (professional military education) center at Kadena AB, Okinawa, Japan, meet the absolute highest standards in construction quality.

PACAF's concern for the welfare of its people has paid big dividends in terms of higher enlisted retention rates. About seventy percent of eligible PACAF first-termers reenlisted in FY '88, well above the Air Force average.

A combination of state-of-the-art equipment, highly trained and motivated men and women, and the parts and supplies to keep aircraft flying makes PACAF a formidable force to help stabilize the region, to deter conflict, and—should deterrence fail—to fight and win. ■

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Mercade A. Cramer, Jr.
Chief Executive Officer

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Raymond F. Carlin, Jr.
Chief Operating Officer

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TI's Multi-Function Radar: key to survival

The battlefield of today and tomorrow is riddled with hazards. Survival over this battlefield will depend, in a large part, on how well a pilot navigates these hazards.

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TI's MFR allows an aircraft to fly as low as 100 feet above the deck. This prevents detection by enemy missile sites and radar-directed guns, which saves aircraft and aircrews and acts as a force multiplier.

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TEXAS INSTRUMENTS

01-0830-891

Strategic Air Command

THE Strategic Air Command (SAC) is USAF's largest command. SAC shoulders much of the responsibility for providing a nuclear capability strong enough to deter an attack on the US or its allies.

In addition to controlling two legs of the US nuclear triad, SAC is tasked to support worldwide conventional power projection with its bombers. Reconnaissance, refueling, and command and control systems round out SAC's total warfighting capability.

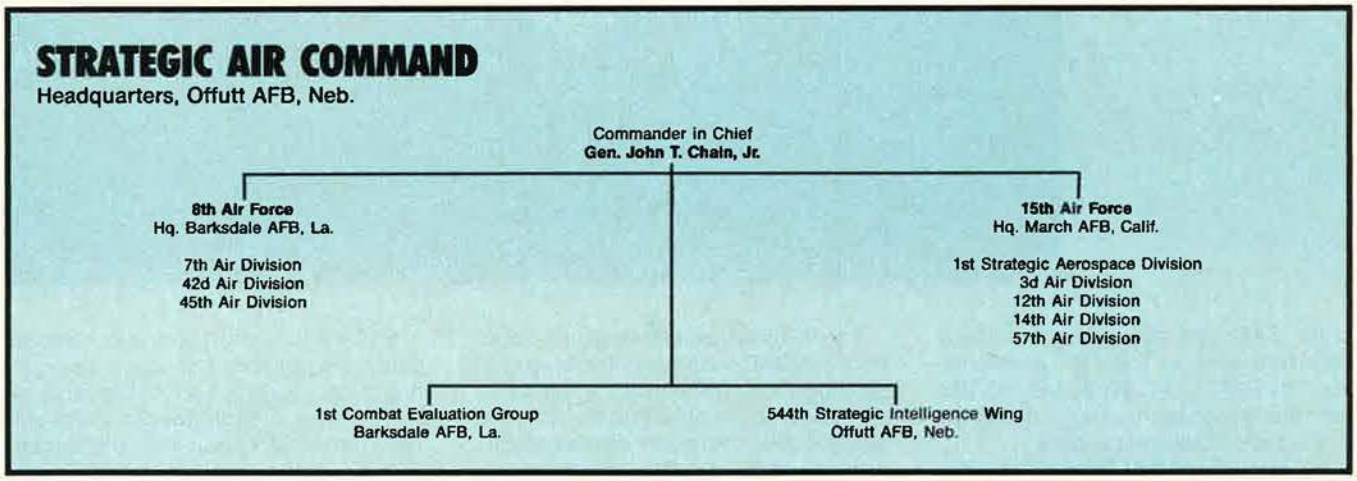
Two strong pillars support SAC's combat capability. These are weapons/support systems and people. More than 116,000 officers, enlisted, and civilians, as well as the 15,000 SAC-gained Reservists and Guardsmen, solidly sustain the command.

These highly motivated people are SAC's most valuable resource. Their professionalism is the most significant advantage over any potential adversary. To recognize them, SAC celebrates 1989 as the "Year of the SAC Warrior."

SAC's striking power comes from a powerful force of bombers and missiles. More than 400 bombers—B-1Bs, B-52s, and FB-111s—are ready to fly, fight, and win. Peacekeeper and Minuteman ICBMs, numbering 1,000, provide SAC with a hardened, responsive force and a deterrent posture that promises swift retaliation to our nation's enemies.

To extend the bombers' range, more than 600 tankers can take to the sky. The KC-10 and KC-135, including aircraft of the Air Force Reserve and the Air National Guard, serve the entire Air Force, the Navy, and many allied air forces.

Through its reconnaissance air-



—Staff photo by Guy Aceto

Systems modifications and superb maintenance combine to enable thirty-year-old B-52s to continue to pull twenty-four-hour-a-day alert duty. This B-52H is starting its engines in an alert pad test at K. I. Sawyer AFB, Mich. SAC's 410th Bomb Wing at Sawyer will be the first SAC unit to receive the new AGM-129A Advanced Cruise Missile.

—Photo by Paul Kennedy

Intense training and attention to detail have helped missileers like these bring their LGM-118A Peacekeeper missiles to full operational capability. Here SAC missileers continue their training in a simulator at F. E. Warren AFB, Wyo. Performance of the first fifty Peacekeepers deployed is surpassing even SAC's high expectations.

craft, SAC can provide specialized eyes and ears to theater commanders. The SR-71, U-2, TR-1, and RC-135 use the latest technology to deliver immediate intelligence data.

No force can fight effectively without efficient and reliable command and control of its units. The EC-135 and E-4B Post Attack Command and Control System aircraft offer a survivable means of keeping the leaders in touch with the warriors.

Technology has moved fast in the 1980s. To keep up, SAC has upgraded some of its older aircraft and missiles and is bringing on line new weapons and command and control systems.

Offensive and defensive system modifications keep the thirty-year-old B-52 viable. It is the air-launched cruise missile platform—integrating a new weapon with a proven workhorse. This combination makes the B-52 a vital contributor to deterrence.

The B-52G is a key element of the theater CINCs' conventional warfare assets, with its worldwide range, heavy payload, and rapid response capabilities. All B-52 crews train to drop nonnuclear weapons. In addition, B-52 aircraft are adapted to support the Navy in minelaying, sea reconnaissance, and antiship operations with the Harpoon missile.

The B-1B is now an integral component of SAC's bomber force and is proving to be the world's most capable bomber. Its ability to fly low and fast, its reduced radar cross section, and its electronic countermeasures make the B-1B an effective penetrator that will be difficult to detect and intercept.

With the B-2 rollout last year, the world saw the bomber of the future. Additional systems such as the AGM-129A Advanced Cruise Missile and the AGM-131A Short-Range Attack Missile will sustain bombers as a component of the triad. Conventional standoff weapons are also being developed to increase the strength of all the bombers.

The tankers are also being upgraded. The KC-135 will serve well into the next century, thanks to the installation of new engines, reskinning of the wings, and improvements to the cockpit.

The initial allotment of fifty Peacekeeper missiles is now deployed, with performance surpassing even SAC's high expectations. The Peacekeeper complements the reliable Minuteman ICBM, which is undergoing the most extensive modification, upgrade, and improvement program since its deployment in the 1960s.

SAC's new underground command center represents the latest in command and control technology, ensuring that the Commander in Chief will have communication with his forces. Fully computerized, the new command center utilizes the Defense Satellite Communications System, Milstar, the Air Force Satellite Communications system, and the new EMP-resistant Ground Wave Emergency Network to provide the best possible communications.

The people who maintain and operate these systems sustain SAC's power as the premier force ensuring world peace through deterrence of war.

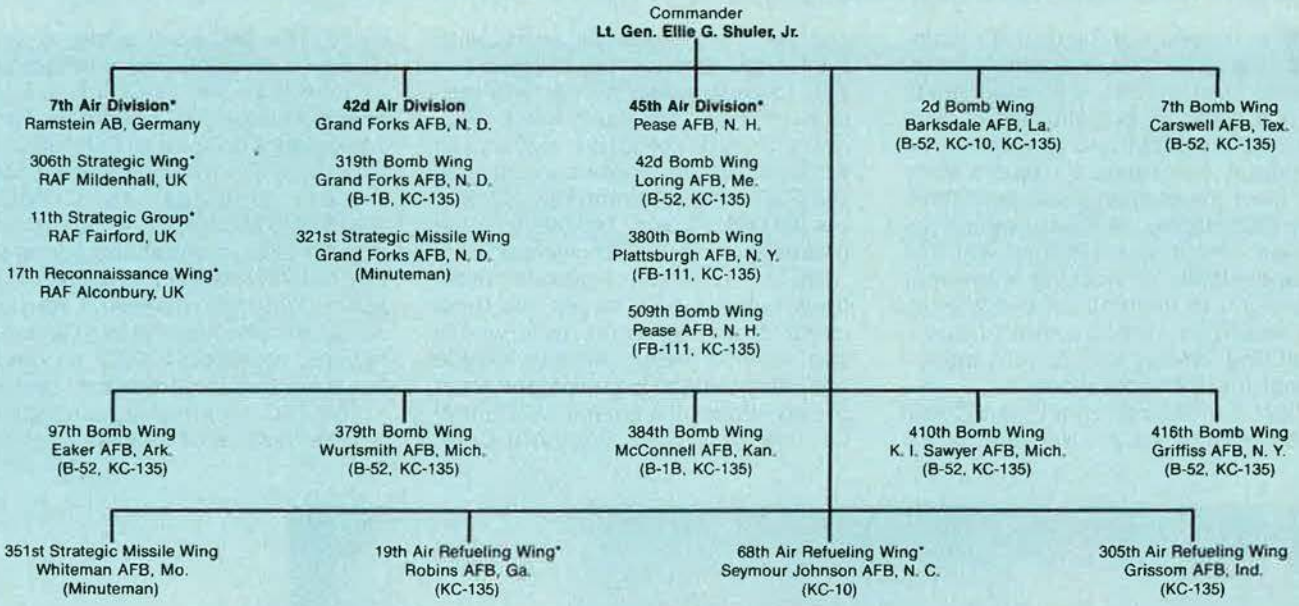
If called to war, they will be ready because SAC is dedicated to "training the way we'll fight."

The new Strategic Warfare Center at Ellsworth AFB, S. D., will stress aircrew training through improved tactics and evaluation. SAC has identified additional training routes nationwide to provide even greater challenges to the crews.

Increased deployments prepare people for the conditions they could face in wartime. These deployments educate leaders and warriors about the complexities of performing their mission anywhere in the world. ■

EIGHTH AIR FORCE (SAC)

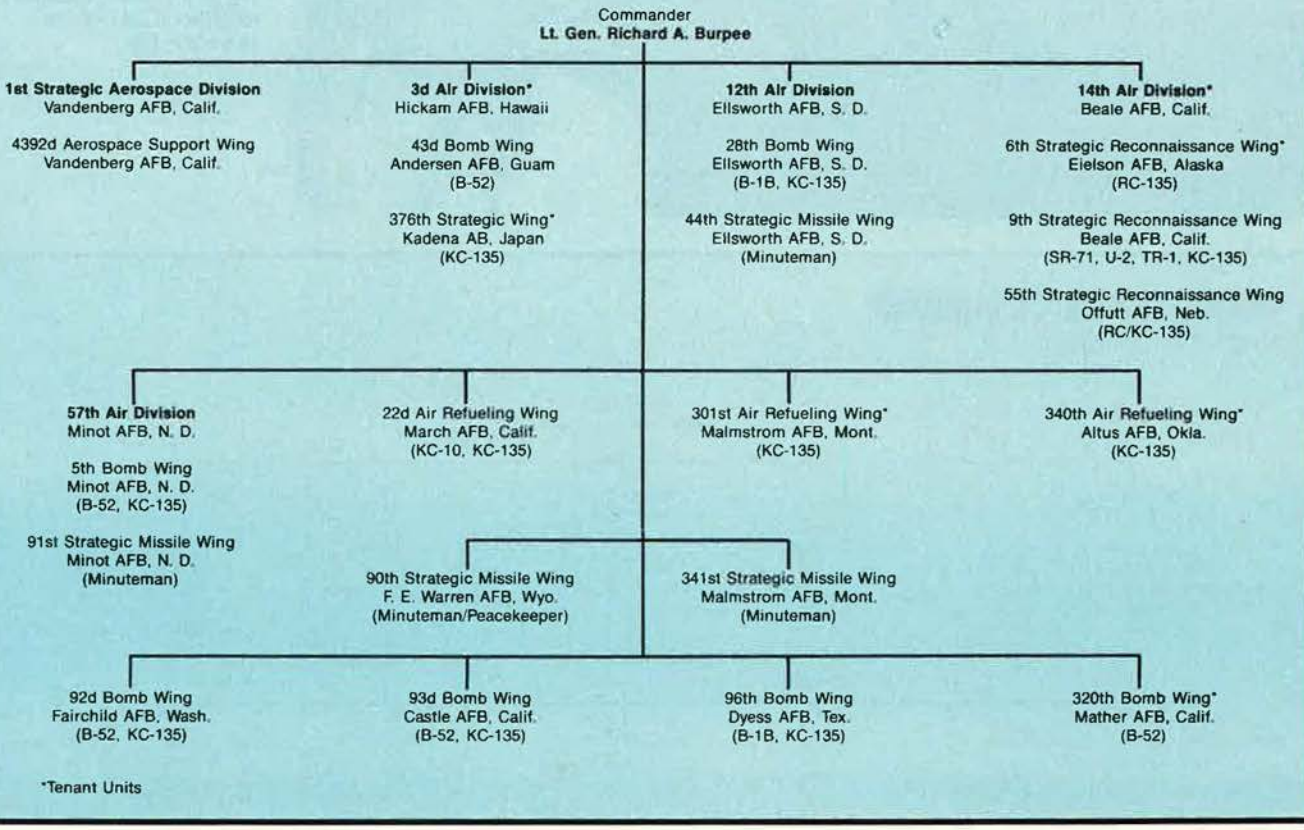
Headquarters, Barksdale AFB, La.



*Tenant Units

FIFTEENTH AIR FORCE (SAC)

Headquarters, March AFB, Calif.



*Tenant Units

Tactical Air Command

THE mission of Tactical Air Command (TAC) is to organize, train, equip, and maintain combat-ready forces capable of rapid deployment and employment and to ensure that strategic air defense forces are ready to meet the challenges of peacetime air sovereignty and wartime air defense. TAC is also charged with the responsibility of working with other services to develop joint doctrine, procedures, tactics, techniques, training, publications, and equipment for joint operations.

When mobilized, more than 70,000 members of the Air National Guard and Air Force Reserve, along with their 1,400 aircraft, are assigned to TAC to accomplish its wartime mission. In total, TAC and these TAC-gained units comprise more than 4,000 aircraft (forty-four percent of all USAF aircraft) and some 188,000 people (22,000 officers, 148,000 enlisted personnel, and 18,000 civilians).

TAC's forces are organized under three numbered air forces and three major direct reporting units whose joint service responsibilities include providing the Air Force component of the US Atlantic Command, US Central Command, and US Southern Command. The TAC commander is dual-hatted as MAJCOM commander and as Commander in Chief, US Air Forces Atlantic. TAC's Ninth Air Force commander doubles as COMUSCENTAF, and TAC's Twelfth Air Force commander doubles as COMUSSOUTHAF. TAC's First Air Force commander also serves as the commander of the CONUS North American Aerospace Defense (NORAD) Region, which, with the Alaskan and Canadian regions, provides NORAD an operational command and control system.

The TAC commander provides a general reserve of tactical air strate-

—USAF photo by TSgt. Kit Thompson

At last year's William Tell gunnery meet at Tyndall AFB, Fla., TSgt. Dennis Krebs of the 33d Tactical Fighter Wing, Eglin AFB, Fla., directs the positioning of an AIM-7 Sparrow missile on one of his team's F-15s.

TACTICAL AIR COMMAND

Headquarters, Langley AFB, Va.

Commander
Gen. Robert D. Russ

1st Air Force
Hq. Langley AFB, Va.

24th Air Division
25th Air Division
USAF Air Defense Weapons Center
Air Forces Iceland

9th Air Force
Hq. Shaw AFB, S. C.

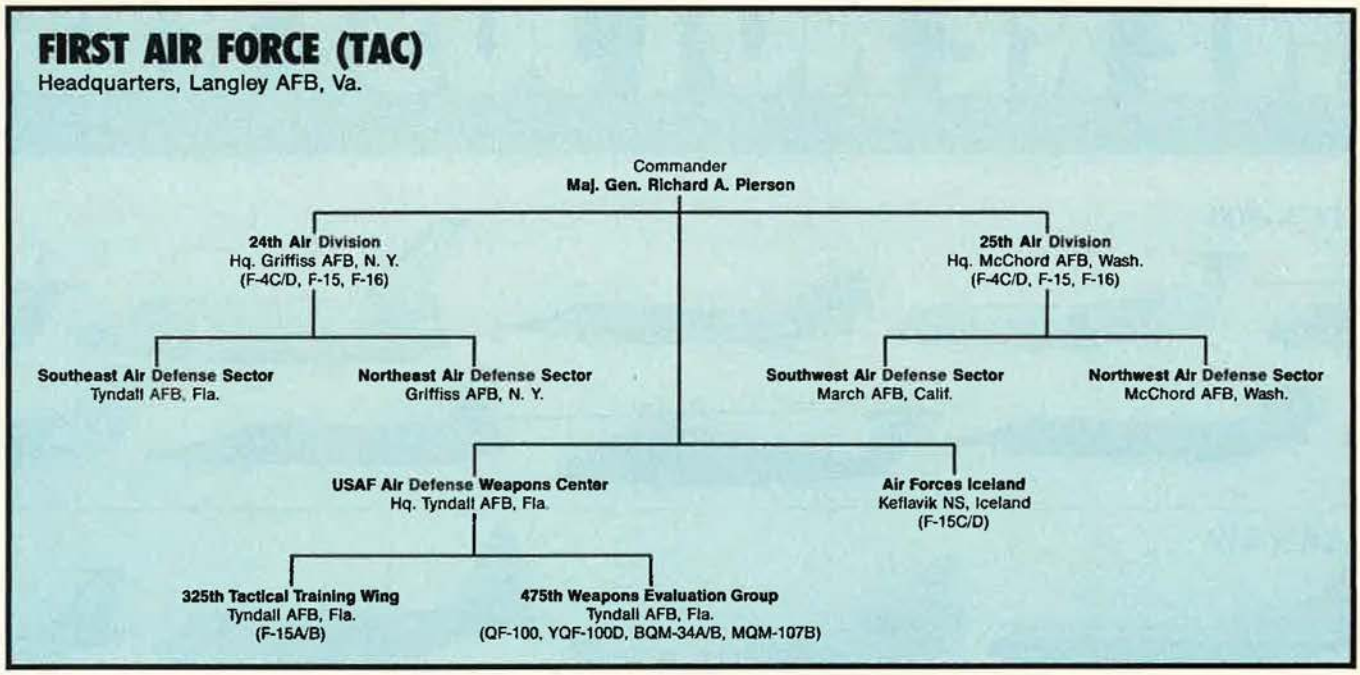
12th Air Force
Hq. Bergstrom AFB, Tex.

830th Air Division
831st Air Division
832d Air Division
833d Air Division
836th Air Division

USAF Tactical Fighter Weapons Center
Hq. Nellis AFB, Nev.

28th Air Division
Hq. Tinker AFB, Okla.

USAF Tactical Air Warfare Center
Hq. Eglin AFB, Fla.



gic reserve forces to reinforce unified commands and the binational command, NORAD. In concert with the gaining CINCs, he exercises peacetime operational control of CONUS-based tactical forces, until directed otherwise by the National Command Authorities. Furthermore, the TAC commander is responsible for readiness and related deployment planning for assigned or programmed forces to reinforce unified commands and NATO. He is also responsible for the joint training of assigned forces.

First Air Force, headquartered at Langley AFB, Va., includes two air divisions, each having two air defense sectors responsible for the air defense of particular CONUS geographic areas. First Air Force also manages the USAF Air Defense Weapons Center at Tyndall AFB, Fla., which provides specialized air defense weapons training and tactics development and performs operational test and evaluation of strategic air defense systems. The First Air Force commander, as commander, CONUS NORAD Region, reports directly to CINCNORAD for the air sovereignty and air defense of the CONUS.

Ninth Air Force at Shaw AFB, S. C., has ten wings performing tactical fighter operations and training, reconnaissance, and tactical air control.

Twelfth Air Force at Bergstrom AFB, Tex., has five air divisions. Four of the air divisions and thirteen wings perform tactical fighter operations and training, reconnaissance, tactical air control, and a wide range of electronic combat tasks. A fifth air division at Howard AFB, Panama, is responsible for the joint defense of the Panama Canal.

Direct reporting units include the USAF Tactical Air Warfare Center (USAFTAWC) at Eglin AFB, Fla., which is responsible for all aspects of electronic combat activities; the

—Staff photo by Guy Aceto

F-4G "Wild Weasel" aircraft like this one from the 561st Tactical Fighter Squadron, George AFB, Calif., are especially designed for radar suppression. The 37th TFW takes part in as many exercises as it can in an effort to maintain TAC's electronic combat capability at a constant peak.

WE'RE NOT JUST REST

TCN-500

ARN-139

ARN-118

Some people are a little surprised that we developed a new TACAN. Because our TACANs are flying aboard a majority of all U.S. military aircraft, and because they've been chosen by the armed forces of 40 other countries. The fact is, we've delivered more than 27,000 TACANs.

Nonetheless, we sat down and created the TCN-500, a TACAN that's half the weight and half the size of our ARN-118. Without sacrificing range. And while we were at it, we increased the MTBF to more than 3,500 hours.

With its MIL-STD-1553B bus compatibility, the TCN-500 has been chosen for the YF-22A, Mirage 2000, Gulfstream IV, Space Shuttle and numerous applications we can't talk about. So along with our ARN-118 and our beaconing TACAN, the ARN-139, the TCN-500 is helping

ING ON OUR TACANS.

to meet aircraft navigation needs around the globe.

Why build the TCN-500? Simple. Because leadership is more than a position. It's an attitude.

For more information contact: Collins Government Avionics Division, Rockwell International, Cedar Rapids, Iowa 52498. 319-395-2208. Telex 464-421 COLLENGR CDR.

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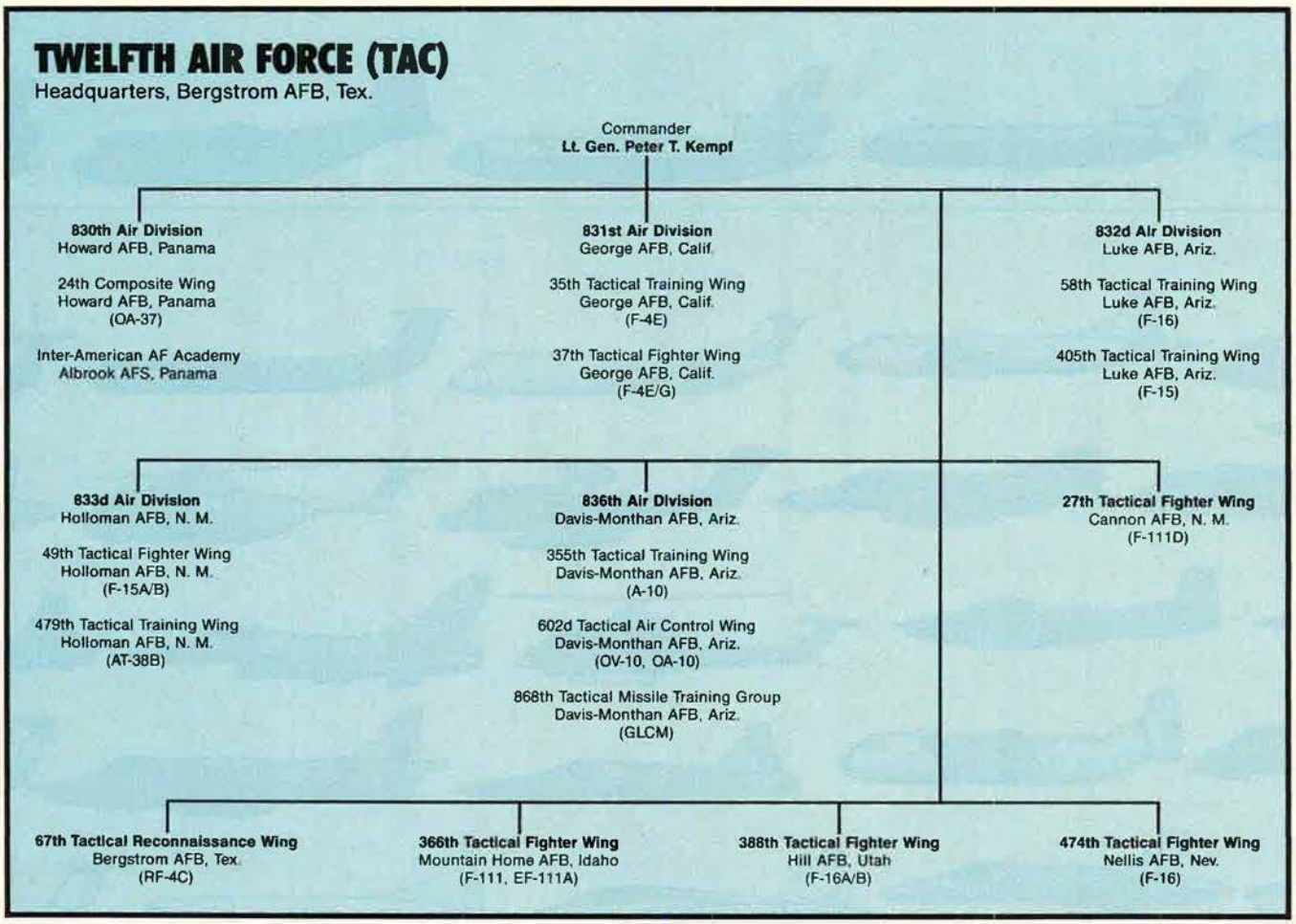

USAF Tactical Fighter Weapons Center (USAFTFWC) at Nellis AFB, Nev., which conducts advanced training and testing in tactical air concepts, doctrine, weapons, and tactics; and the 28th Air Division at Tinker AFB, Okla., whose mission includes worldwide airborne command and control responsibilities.

In 1988, TAC accelerated its involvement in joint forces development through increased participation in both joint exercises and initiatives with other services. These joint initiatives include developing the Joint Surveillance and Target Attack Radar System, developing Army/Air Force doctrine and procedures for external defense of air bases, improving joint suppression of enemy air defenses, and developing joint reconnaissance roadmaps to identify requirements and refine the force mix for future surveillance and reconnaissance systems.

Also in 1988, Davis-Monthan AFB, Ariz., hosted inspection teams from the Soviet Union who observed the initial destruction of ground-launched cruise missiles under the terms of the Intermediate-range Nuclear Forces (INF) Treaty.

The Thunderbirds, USAF's Air Demonstration Team, flew eighty demonstrations throughout the US, Canada, and Mexico before millions of spectators.

Of the three biennial tactical competitions that TAC sponsors, two were held in 1988—the worldwide Reconnaissance Air Meet and William Tell, an air-to-air combat competition. The third, the Gunsmoke bombing competition, is scheduled for October 1989. ■

DO YOU BELIEVE IN GHOSTS?

It's enough to scare any radar operator; a scope swarming with bogies. The unnerving thing is that only some of them are real.

Radar deception is just a small part of Sanders' specialties. Our countermeasures systems mislead weapons directed by radio frequency, infrared and opto-electronics, protecting jet fighters, bombers, special mission planes, helicopters, ships, tanks and space vehicles.

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And we've advanced our own mission to continue to improve the hydraulic, pneumatic and fuel systems – and their components – that are vital to today's aerospace industry.

At Parker Bertea Aerospace, we're proud to be part of the team that builds and flies the world's finest aircraft and engines.

And we look forward to leading the way to tomorrow's technology.

Take advantage of our experience to help you gain the edge.

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United States Air Forces in Europe

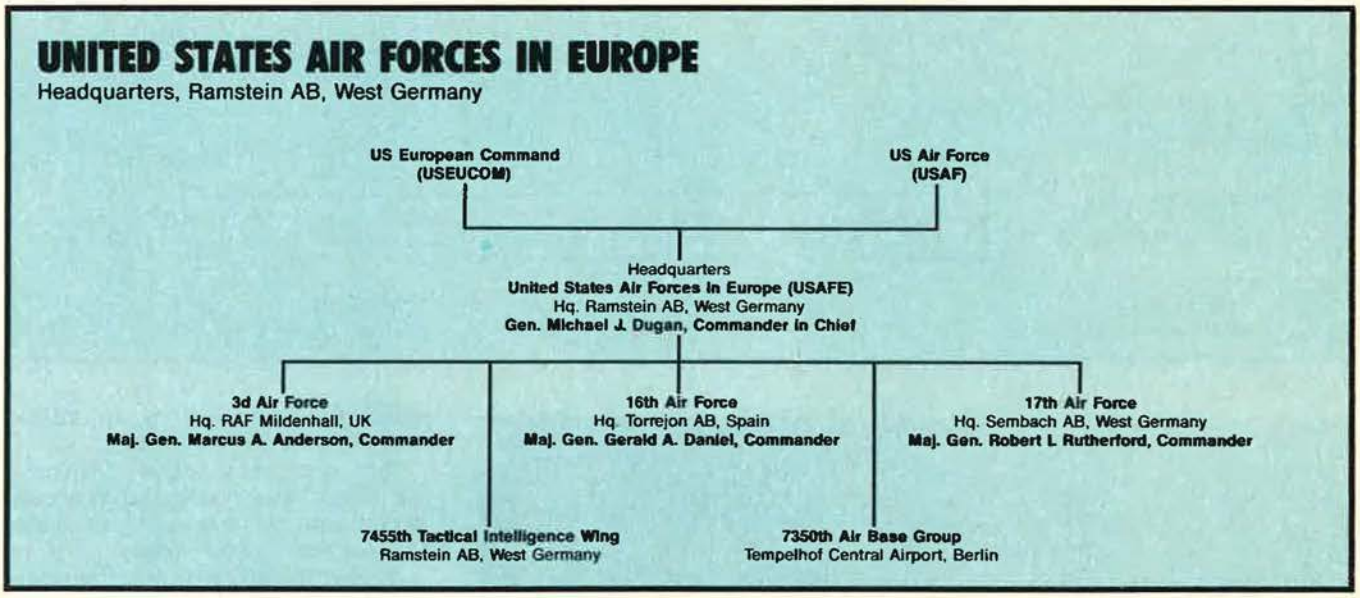
FORCE modernization, relocation, and drawdown are words that have real meaning to the US Air Forces in Europe (USAFE) as it closes out the 1980s.

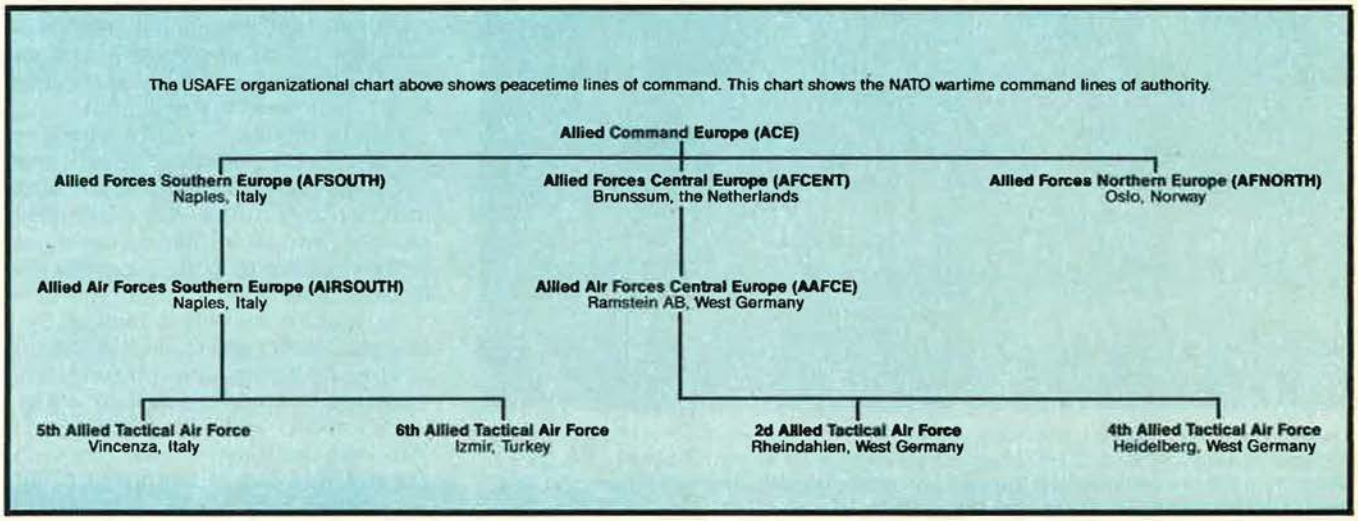
USAFE is the air component of the US European Command and a key element of NATO. USAFE consists of Third Air Force in England, Sixteenth Air Force in the Southern Region, and Seventeenth Air Force in Central Europe.

The USAFE Commander in Chief is also Commander of Allied Air Forces Central Europe. Air resources are provided by Belgium, Canada, West Germany, the Netherlands, the United Kingdom, and the United States. COMAAFCE controls some 2,000 tactical aircraft through the Second and Fourth Allied Tactical Air Forces. AAFCE is augmented in wartime by tactical forces deploying from Stateside bases to approximately seventy collocated operating bases in Europe.

USAFE aircraft flew 216,111 hours in FY '88, significantly less than the FY '87 total of nearly 225,000. Reductions were caused by congressional budget cuts, squadron inactivations, and aircraft conversions. USAFE plans to fly more than 225,000 hours in FY '89.

The command completed its program to replace F-16A/B models, as well as the F-5s assigned to the 527th Aggressor Squadron, with the F-16C/D. Other command capabilities were enhanced: F-15s received improved avionics packages, EF-111As were retrofitted with TF30-P-109 engines to increase thrust and fuel efficiency, and the Avionics Modernization Program began upgrading the F-111F





THIRD AIR FORCE (USAFE)

Headquarters, RAF Mildenhall, United Kingdom

Commander
Maj. Gen. Marcus A. Anderson

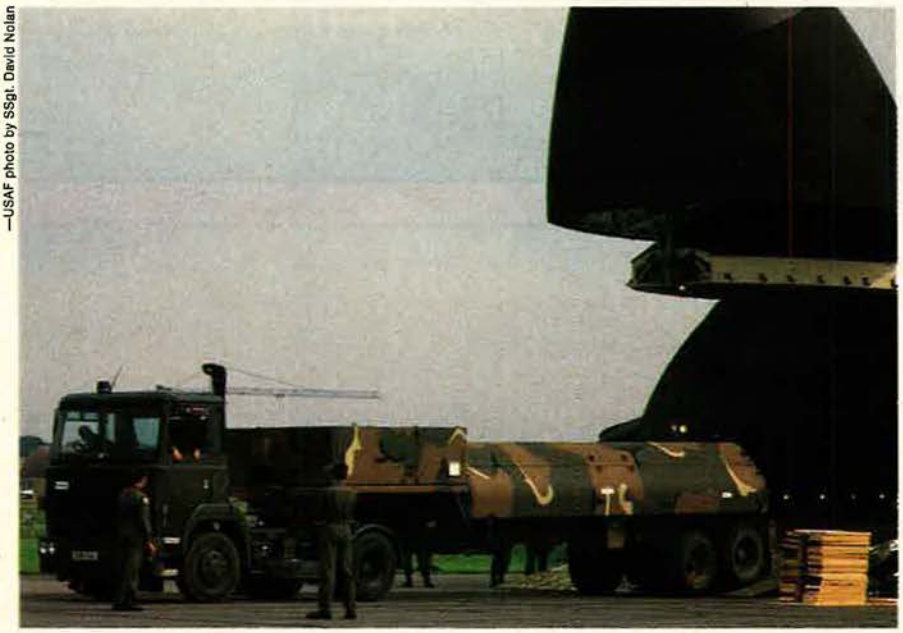
- **10th Tactical Fighter Wing**
  RAF Alconbury, UK
  (A-10, SAC TR-1)
- **20th Tactical Fighter Wing**
  RAF Upper Heyford, UK
  (F-111, EF-111)
- **48th Tactical Fighter Wing**
  RAF Lakenheath, UK
  (F-111F)
- **81st Tactical Fighter Wing**
  RAF Bentwaters/Woodbridge, UK
  (A-10; F-16C/D; MAC Special Operations MC-130, MH-53, HC-130, HH-53)
- **501st Tactical Missile Wing**
  RAF Greenham Common, UK
  (BGM-109G GLCM)
- **513th Airborne Command and Control Wing**
  RAF Mildenhall, UK
  (USAFE EC-135; MAC rotational C-130; SAC rotational KC-135, SAC SR-71)
- **7020th Air Base Group**
  RAF Fairford, UK
  (SAC rotational KC-135)
- **7274th Air Base Group**
  RAF Chicksands, UK
  (Support; communications)

SIXTEENTH AIR FORCE (USAFE)

Headquarters, Torrejon AB, Spain

Commander
Maj. Gen. Gerald A. Daniel

- **Hq. TUSLOG**
  Ankara AS, Turkey
  (Logistics management)
- **401st Tactical Fighter Wing**
  Torrejon AB, Spain
  (F-16C/D)
- **406th Tactical Fighter Training Wing**
  Zaragoza AB, Spain
  (Tactical range support, weapons)
- **487th Tactical Missile Wing**
  Comiso AB, Italy
  (BGM-109G GLCM)
- **39th Tactical Group**
  Incirlik AB, Turkey
  (Rotational USAFE aircraft)
- **7217th Air Base Group**
  Ankara AS, Turkey
  (Command and logistical management)
- **40th Tactical Group**
  Aviano AB, Italy
  (Rotational USAFE aircraft)
- **7206th Air Base Group**
  Hellenikon AB, Greece
  (Support; communications)
- **7275th Air Base Group**
  San Vito dei Normanni AB, Italy
  (Support; communications)
- **7276th Air Base Group**
  Iraklion AB, Greece
  (Support; communications)
- **7241st Air Base Group**
  Izmir AS, Turkey
  (NATO unit support)



—USAF photo by SSgt. David Nolan

A ground-launched cruise missile transporter/erector/launcher from RAF Molesworth, England, is loaded onto a C-5B Galaxy cargo aircraft for transport back to the States under terms of the Intermediate-range Nuclear Forces (INF) Treaty. This was the first removal of treaty-limited items from the theater.

bomb navigation system and attack and terrain-following radars.

Three ground-launched cruise missile wings were inactivated in accordance with the Intermediate-range Nuclear Forces (INF) Treaty.

Another action affecting the command is the relocation of the 401st Tactical Fighter Wing from Torrejon AB, Spain, to Crotone, Italy. NATO invited the Italian government to host the wing, which will move as soon as NATO completes the new base.

Closely related to tactical flying is the Tactical Air Control System. The TACS supplements fixed radar with mobile, ground-based, command control, and surveillance radar, as well as providing ground-control intercept capabilities.

As host for the Allied Tactical Operations Center Sembach, USAFE installed a digital communications switch to upgrade the system, merging classified and unclassified lines into one instrument. The Interface Control Board is modernizing ATOC automation with the development of

an advanced decision support system, enhancing war planning and execution.

The Central Region Wing Command and Control System should be operational this year, providing tactical wing battle staffs with an automated, secure, near-real-time method of obtaining accurate resource information for command and control. System enhancements being developed include greater survivability, enlarged user base, and system interface capability.

Air base operability programs continue to increase unit abilities to survive attack and to recover rapidly. Current emphasis is on fielding the Survivable Collective Protective System (SCPS), setting priorities for funding and warplanning, and improving mission execution capability at collocated operating bases.

A Sixteenth Air Force War Support System was established to help make a quick transition from peacetime to a wartime posture. A Sixteenth Air Force War Support Center and mission-support centers at Aviano AB, Italy, and Ankara AS, Turkey, were established to help coordinate and plan wartime missions with NATO.

Medical war-readiness materiel was delivered last year to USAFE's newest 500-bed contingency hospital in Denmark. If approved and funded, military construction programs totaling $56 million over the next five years will provide an additional 3,000 wartime beds. SCPS-Medical will be located at airfields, providing basic emergency patient care in a chemical warfare environment.

—USAF photo by SSgt. David Nolan

A munitions-loading team member from the 52d Tactical Fighter Wing, Spangdahlem AB, West Germany, prepares to move a load of practice bombs. Behind him is one of the unit's F-16C aircraft.

Military construction projects totaling $74 million will begin at four bases to build new medical facilities or alter existing ones. In addition to improving access to health care, these projects will incorporate the latest health-care technology.

USAFE is committed to its military and civilian employees and their families. Quality of life remains a top command priority, as reflected in "Creek Positive" programs.

As USAFE heads into the 1990s, it will continue to rely on its number-one resource—people—to provide the deterrent forces required to meet the challenges of the twenty-first century. ■

SEVENTEENTH AIR FORCE (USAFE)

Headquarters, Sembach AB, Germany

Commander
Maj. Gen. Robert L. Rutherford

65th Air Division
Lindsey AB, Germany

52d Tactical Fighter Wing
Spangdahlem AB, Germany
(F-4G, F-16C/D)

66th Electronic Combat Wing
Sembach AB, Germany
(EF-111A stationed at RAF Upper Heyford, UK; EC-130H)

601st Tactical Control Wing
Sembach AB, Germany
(Command control communications)

26th Tactical Reconnaissance Wing
Zweibrücken AB, Germany
(RF-4, C-23)

36th Tactical Fighter Wing
Bitburg AB, Germany
(F-15C/D)

38th Tactical Missile Wing
Wueschheim AB, Germany
(BGM-109G GLCM)

50th Tactical Fighter Wing
Hahn AB, Germany
(F-16C/D)

7100th Combat Support Wing
Lindsey AB, Germany
(7100th CSW Regional Medical Center; collocated operating bases; munitions support squadrons; command control communications)

32d Tactical Fighter Squadron
Soesterberg AB, The Netherlands
(F-15C/D)

316th Air Division
Ramstein AB, Germany

86th Tactical Fighter Wing
Ramstein AB, Germany
(F-16C/D)

377th Combat Support Wing
Ramstein AB, Germany
(Support)

Air Force Accounting and Finance Center

THE Air Force Accounting and Finance Center (AFAFC), located on Lowry AFB, Colo., is the focal point for Air Force financial operations worldwide.

AFAFC provides centralized pay service to all Air Force military members—active duty, retired, Air National Guard, and Air Force Reserve—and accounts for all money appropriated to the Air Force. The Center reports to Congress and financial managers throughout the government on the use of these funds.

In 1988, the Center's sixty-nine officers, 165 enlisted, and 2,156 civilians paid more than 769,000 active, Guard, and Reserve personnel from combined appropriations totaling more than $21 billion. AFAFC accounted for more than $122 billion, controlled more than 60,000 reports, and processed more than 1,400,000 disbursement and collection vouchers.

Last year, Retired Pay Operations paid more than $6.8 billion to 556,760 retirees and 41,360 annuitants under the Survivor Benefit Plan. Air Force retirees enjoy customer service at 124 bases worldwide and toll-free telephone assistance from anywhere in the United States.

Work continues on designing a centralized pay system for Air Force civilians. The current system, which operates at 100 locations throughout the Air Force, is complex and labor-intensive. Under the more efficient, centralized method, civilians will be paid from AFAFC.

By the end of 1988, the System 2200 program had installed 112 Sperry System 2200 computer systems in base-level comptroller organizations. These new computers are used to run accounting and finance and budget systems. Six of the seven software packages have been completed and distributed. The remaining one will be fielded in 1989.

The Base-Level Accounting and Reporting System is the Center's newest and largest system design undertaking. The system will begin at base level and combines all accounting systems. It will ultimately integrate base- and command-level accounting systems and be the foundation for the single-source, general-ledger Air Force accounting systems required by the Comptroller General.

The Directorate of Network Operations serves as the communications link between AFAFC and the field. New emphasis has been put on identifying problems with policy, procedures, and systems. Those problems within AFAFC's responsibility that affect the field's ability to perform at peak efficiency are worked with AFAFC directorates from the field perspective. This field input is used to improve service to the MAJCOMs and their bases.

AFAFC is also the executive agent for the Security Assistance Accounting Center, responsible for the overall financial management of the total DoD Foreign Military Sales program, consisting of about 17,000 active cases valued at nearly $148.5 billion. The Center is developing an automated accounting and billing system to be linked to improved automated systems in each of the services.

AFAFC has a commitment to excellence, built on personal initiative and hard work. The Center's focus is to make sure that all users get the support they deserve. With the goal of "doing things right—the first time," AFAFC is dedicated to on-time delivery of fully tested, reliable systems that will carry the Air Force accounting and finance mission into the twenty-first century. ■

Air Force Audit Agency

THE Air Force Audit Agency (AFAA), a separate operating agency headquartered at Norton AFB, Calif., provides all levels of Air Force management with independent, objective, and constructive evaluations of managerial responsibilities (financial, operational, and support). Reports of audit indicate effectiveness, efficiency, and economy of Air Force program management.

The Auditor General of the Air Force, John W. Boddie, reports directly to the Secretary of the Air Force. This enables AFAA independently to assess the activities and functions it audits.

The Auditor General and the staff directorates, Operations (AFAA/DO) and Resource Management (AFAA/RM), are located at Norton AFB, Calif. The Auditor General maintains liaison with Hq. USAF and other governmental agencies in the Washington, D. C., area through the Deputy Auditor General of the Air Force, Brig. Gen. Basil H. Pflumm, in the Pentagon (SAF/AGA).

AFAA's line operations were realigned as of July 1, 1988. Installation-level audit offices are now defined along major command rather than along geographic lines.

- *The Acquisition and Logistics Audit Directorate* (AFAA/QL), located at Wright-Patterson AFB, Ohio, directs the development and management of multisite audits relating to supply, maintenance, acquisitions/logistics, computer systems, transportation, and weapon systems. AFAA/QL is also responsible for the Systems Audit Region (AFAA/QLQ) at Andrews AFB, Md., and the Logistics Audit Region (AFAA/QLL) at Wright-Patterson AFB. The regions are responsible for area audit offices located at nine Air Force Systems Command bases and at six Air Force Logistics Command bases, respectively.
- *The Financial and Support Audit Directorate* (AFAA/FS) at Norton AFB, Calif., directs the development and management of audits relating to financial management; personnel; support services; command control communications and computer systems; and morale, welfare, and recreation. Its Training Audit Region (AFAA/FST) is headquartered at Randolph AFB, Tex., and is responsible for area audit offices located at six Air Training Command bases.
- *The Field Activities Directorate* (AFAA/FD), located at Norton AFB, manages installation-level audit work at forty-eight area audit offices (AAOs). Supervision of forty-six of the AAOs is exercised through the follow-

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ing five regions established along major command organizational lines: Tactical Audit Region, Langley AFB, Va. (twelve AAOs); Strategic Audit Region, Offutt AFB, Neb. (thirteen AAOs); Airlift Audit Region, Scott AFB, Ill. (seven AAOs); European Audit Region, Ramstein AB, Germany (nine AAOs); and Pacific Audit Region, Hickam AFB, Hawaii (five AAOs). The AAOs at Air Force Space Command, Peterson AFB, Colo., and Alaskan Air Command, Elmendorf AFB, Alaska, report directly to the Deputy Director, Field Activities.

The Air Force Audit Agency has two basic procedures for reporting audit results to Air Force management. These are:

- Reports of audit containing the overall results of Air Force-wide multisite audit efforts are addressed to the Secretary of the Air Force and the Chief of Staff.
- Reports of audit containing results of installation-level audits are addressed to major commanders through local commanders.

The Air Force Audit Agency employs approximately 950 people and has a ratio of seventy-five civilians to twenty-five military. Of the 817 auditors, ninety-seven percent have at least one college degree, and forty percent have graduate degrees. Twenty-four percent are certified public accountants, certified internal auditors, and/or certified information system auditors. ■

Air Force Commissary Service

THE Air Force Commissary Service (AFCOMS) is a separate operating agency with headquarters at Kelly AFB, Tex.

AFCOMS is a centralized commissary system. Its primary mission is to provide food and supplies to troops in wartime and peacetime operations. Its most visible mission is the operation of more than 140 resale stores.

Military commissaries provide an income benefit to the military people. As the only source of US food and household goods overseas, the commissaries give military members and their families an important sense of "belonging."

Patrons saved $776 million in 1988 because commissary food prices are twenty-five percent cheaper than those in commercial food stores. Patrons saved even more through special sales and deep price cuts of up to sixty percent on some items throughout the year.

AFCOMS is the eleventh largest food-retailing group in the United States. Figure in the twenty-five percent savings factor and AFCOMS becomes the ninth largest. During the year, shoppers added more than $54 million to their savings by redeeming more than 117,000,000 cents-off coupons.

The most visible portion of AFCOMS is operations. One of the agency's major challenges for '89 is to do a better job of serving patrons stationed at Andersen AFB, Guam. AFCOMS is studying the possibility of setting up a system that will airlift perishable items to Guam from a West Coast commissary. A similar service is currently provided for patrons stationed in Turkey.

The master stock list program has proven extremely successful in providing AFCOMS patrons with the country's top-selling items at every commissary. There are about 4,000 items on the list, leaving plenty of room for regional and local items.

AFCOMS opened eight new stores in 1988: three of them overseas—Camp Courtney, Japan; Incirlik AB, Turkey; and RAF Alconbury, England—and five in the United States—at Goodfellow and Brooks AFBs, Tex.; at Malmstrom AFB, Mont.; at Bangor ANGB, Me.; and at Belle Fourche AFS, S. D.

Since 1976, when AFCOMS was formed, the agency has built seventy-five new stores—about one every second month.

In 1989, five new stores are scheduled to open: at Kirtland AFB, N. M., and Wilder AS, Idaho, in the United States and at Lajes, Azores; Bitburg, Germany; and Camp Kinser, Japan, overseas.

AFCOMS is growing to provide Air Force members and their families with ever-better products, service, and prices. ■

Air Force Engineering and Services Center

THE Air Force Engineering and Services Center (AFESC) at Tyndall AFB, Fla., is a separate operating agency and an integral part of the Air Staff.

The Center assists MAJCOMs and bases in fire protection, unaccompanied housing, food service, mortuary services, readiness, and the operation and maintenance of facilities, utility systems, and pavements throughout the Air Force.

The Center manages USAF's lead R&D laboratory for air base operability, civil engineering, and environmental science and engineering.

AFESC is developing systems for rapid runway repair (RRR) to improve wartime capability to launch and recover aircraft.

The Center ensures that weapon system beddown and program costs include sufficient funds to acquire, operate, and maintain needed facilities.

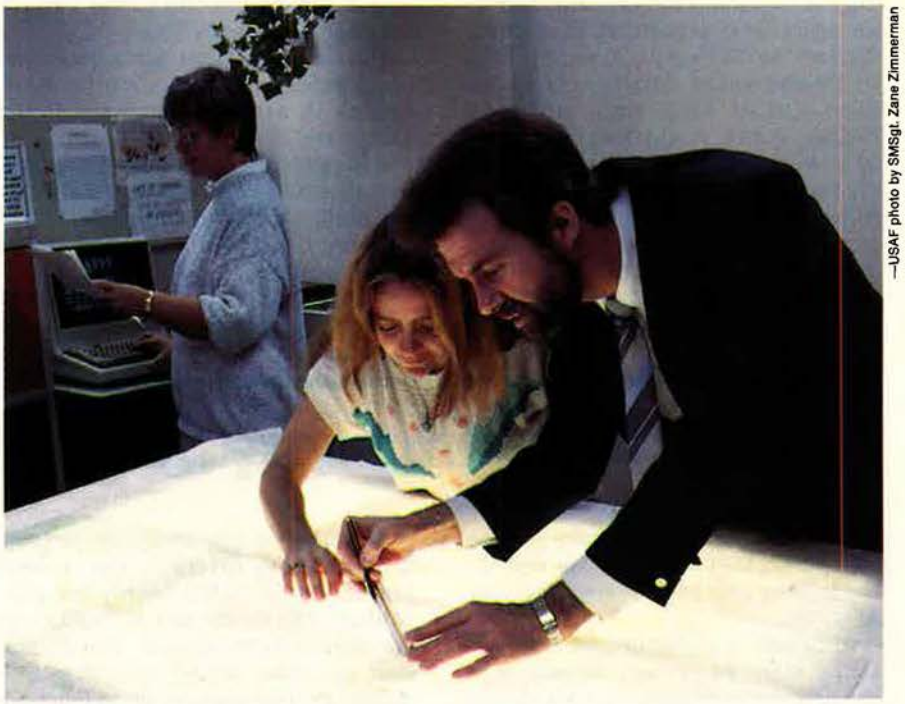
Finally, the Center manages the development of specialized data-processing systems: the Work Information Management System and the Services Information Management System.

During 1988, Center personnel:

- Revised the standard USAF food service contract packages to improve contractor performance and make the contracts easier to manage.
- Assisted in the development of the "Gold Book," which outlines policies and procedures for the privatization of Air Force facilities and services.
- Successfully completed negotiations on privatization projects for visitors' quarters at Wright-Patterson AFB, Ohio, and Nellis AFB, Nev., and housing units at Carswell AFB, Tex.
- Continued development of an integrated graphics system that will

provide engineers with a computer graphics and analysis capability.

- Restructured Engineering and Services mobility teams into force packages tied to their respective home-station flying units.
- Developed the "regional equipment operator training site" concept, providing for proficiency upgrade of the RRR equipment operator force at three training locations.
- Refurbished power generators and high-voltage electrical circuitry for Air Force units and the Defense Nuclear Agency for projected cost savings of more than $2 million.
- Completed a full-scale Herbicide Orange incineration project at a dioxin-contaminated site in Gulfport, Miss., returning the site to full use and providing a transferable technology.
- Developed a system that allows technicians to determine immediately whether or not treated groundwater that was thought to be contaminated by volatile organic compounds can be reused.
- Developed prototype fire training facilities at three bases to provide realistic training for firefighters while protecting groundwater from contamination.
- Developed an industrial wastewater treatment system for Tinker AFB, Okla., that should save more than $650,000 annually in hazardous waste disposal costs.
- Engineered a fuel-additive injection system for jet engines to eliminate the visible smoke exhaust plume emitted during testing.
- Implemented the Air Force Asbestos Management Program, which included training for more than 2,000 major-command and base-level craftsmen and supervisors.
- Evaluated airfield pavements at twenty-nine bases.
- Continued successful implementation of the Simplified Acquisition of Base Engineering Requirements (SABER) contract system at eighteen bases. ■



—USAF photo by SMSgt. Zane Zimmerman

Linda Merritt (left) and Stuart Millard of the Air Force Engineering and Services Center study a computer-generated noise contour map that depicts noise levels created by aircraft around an Air Force base. Their work helps USAF resolve problems with local communities concerning land acquisition, building projects, and the use of airspace.

Air Force Inspection and Safety Center

THE Air Force Inspection and Safety Center (AFISC), Norton AFB, Calif., provides the Secretary of the Air Force, the Chief of Staff, and major commands and separate operating agencies an assessment of Air Force fighting capability and resource management effectiveness. Maj. Gen. Stanton R. Musser commands AFISC and is also the Deputy Inspector General for Inspection and Safety, Hq. USAF.

AFISC has 363 military and 139 civilians, representing 111 Air Force specialties. The Center includes a command section and four directorates. The command section provides legal, computer, manpower, personnel, budget, supply, administrative, graphics, and public-affairs support. The command section also publishes the bimonthly magazine *TIG Brief*, which addresses trends in management and leadership. There are two Air Reserve Force advisors on the commander's staff who represent the Air National Guard and the Air Force Reserve. The Center also serves as USAF custodian and repository for flight records (dating from 1911) of rated individuals.

- The Directorate of Medical Inspection plans and conducts Air Force health services management inspections (HSMIs), Air National Guard/Reserve components health services readiness inspections (HSRIs), and special investigations to ensure effective management of health-care resources and the readiness of Air Force medical units. In addition to the 290 functional areas inspected in each medical facility, special emphasis items (SEIs), as selected by the Air Force Surgeon General, are given close attention.
- The Directorate of Nuclear Surety, also known as Detachment 1, AFISC, located at Kirtland AFB, N. M., manages the Air Force Nuclear Weapons Surety Program and ensures that DoD nuclear weapon system safety standards are met during all phases of design, operation, maintenance, modification, and movement. The directorate also publishes the *USAF Nuclear Surety Journal*. The directorate has the nuclear surety responsibility for terrestrial nuclear reactor systems and for review procedures concerning nuclear power systems and space or missile use of radioactive power sources.
- The Directorate of Aerospace Safety is the Air Force manager for flight, ground, missile, explosives, and systems safety programs. The directorate guides and monitors the implementation and effectiveness of

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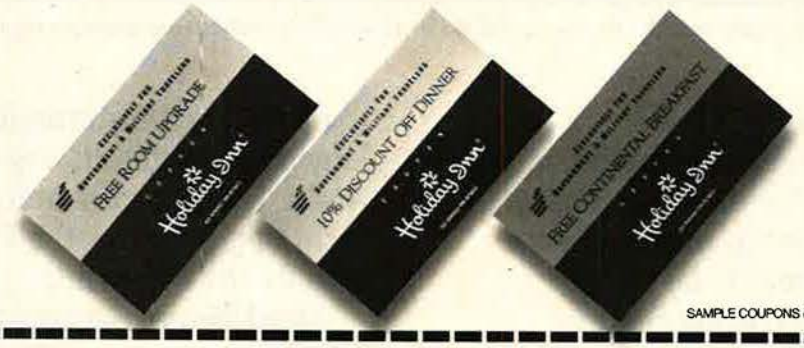

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mishap-prevention programs. This includes analyzing the investigation process to determine the causes and corrections of mishaps. The directorate also designs, plans, and develops resources for professional safety education programs, including university-level safety courses, and publishes *Flying Safety* and *Road and Rec* magazines.

• The Directorate of Inspection determines operational readiness status within the major commands by analyzing their operational readiness inspection (ORI) results and by conducting assistance and command evaluation (ACE) inspections with command inspector general teams during ORIs. The directorate also evaluates the effectiveness and efficiency of USAF management systems through functional management inspections (FMIs), system acquisition management inspections (SAMIs), and follow-up inspections. ■

The Inspection School at the Air Force Inspection and Safety Center at Norton AFB, Calif., instructs more than 800 inspectors worldwide in the proper methods to use during the inspection process. Aerospace safety is the other major concern of AFISC.

Air Force Intelligence Agency

THE Air Force Intelligence Agency (AFIA), a separate operating agency reporting directly to the Assistant Chief of Staff for Intelligence (ACS/I), provides the Air Staff with perspective and synergy in the application of all-source intelligence in support of the Air Staff and combatant commands.

More than 2,300 active-duty, reserve, and civilian intelligence professionals are stationed worldwide to collect, process, disseminate, and apply reliable, accurate, and timely intelligence for Air Force commanders during peace, war, and contingency situations.

Headquartered in Washington, D. C., AFIA is composed of eleven directorates functionally aligned under Deputy Commanders for Assessments and Resources and the Air Force Special Activities Center.

The Deputy Commander for Assessments is responsible for estimative, targeting, and warning intelligence. The directorates within the deputate are Regional Estimates, Research and Soviet Studies, Threat and Technology, Warning and Current Intelligence, and Targets.

AFIA acts as the ACS/I's executive agent in the national intelligence process by developing Air Force positions in National Intelligence Estimates (NIEs), Defense Intelligence Projections for Planning (DIPPs), Air Force Planning Guide (AFPG), and a host of other finished intelligence assessments used by plans and operations staffs.

AFIA directorates work closely with Air Force System Command's Foreign Technology Division in determining the threat to Air Force weapon systems posed by current and projected foreign weapon systems. These estimates, provided to Air Force weapons design and acquisition experts, ensure that USAF systems will be effective on the battlefields of today and tomorrow.

AFIA elements conduct the Soviet Awareness Program. While hosting presentations at Bolling AFB, D. C., and throughout the world, they also publish several unique publications on Soviet military writings. Also at Bolling is the Directorate of Targets, the Hq. USAF executive agent for classical targeting functions and for influencing weapons research, development, and acquisition. The directorate is also the focal point for all USAF mapping, charting, and geodesy matters.

From the Pentagon, AFIA provides daily intelligence highlights to more than eighty organizations, including all four services, the Defense Intelligence Agency, the State Department, and the White House. The Secretary of the Air Force and the Chief of Staff receive AFIA intelligence briefings on a regular basis and special briefings as necessary.

The Deputy Commander for Resources, with elements at Bolling AFB and Fort Belvoir, Va., is responsible for AFIA's intelligence-related support functions, including the Directorates of Security and Communications Management, Intelligence Data Management, Personnel/Force Management, Intelligence Reserve Forces, Attaché Affairs, and Joint Services Support.

AFIA sets policy and manages the worldwide Air Force Special Security Office and Sensitive Compartmented Information programs. AFIA also plans, develops, and manages all Air Force intelligence data-handling systems.

AFIA develops and manages policies and procedures for intelligence personnel accessions and training and professional development for both active-duty and reserve forces. AFIA also centrally manages 1,400 intelligence reservists to support peacetime, wartime, and contingency requirements of twenty-six MAJCOMs and agencies.

Other functions managed by AFIA organizations include Air Force participation in the Defense Attaché program, Department of Defense Code of Conduct training programs, and central control of Air Force human intelligence activities. ■

Air Force Legal Services Center

THE Air Force Legal Services Center (AFLSC), headquartered in Washington, D. C., helps provide complete civil and military legal services to the US Air Force and its members around the world.

The Center provides specialized legal services in military justice, claims for and against the Air Force, tort litigation, legal aid, and labor, environmental, acquisition, and preventive law. The Center also handles all Air Force patent, copyright, and other intellectual-property matters, provides judges and counsel for courts-martial, and reviews trial results.

The Air Force Judge Advocate General serves in a dual role as Commander of AFLSC.

The Judiciary Directorate in AFLSC has six divisions that administer or manage a variety of military justice services.

- *The Air Force Court of Military Review* (AFCMR) reviews all courts-martial resulting in confinement of one year or more or in punitive discharge. Decisions made by the AFCMR may be appealed to the Court of Military Appeals and ultimately to the US Supreme Court.
- *The Military Justice Division* reviews certain other petitions and records of trial that are not reviewed by AFCMR.
- *The Trial Judiciary Division* oversees seven judiciary circuits. The chief judge of each circuit supervises the military judges and administrators of that circuit. Military judges are appointed by the Judge Advocate General.
- *The Defense Services Division* supervises 123 Area Defense Counsels worldwide and represents Air Force members before the AFCMR, the Court of Military Appeals, and the Supreme Court.
- *The Government Trial and Appellate Counsel Division* supervises twenty-one trial prosecutors and represents the Air Force before the appellate courts.
- *The Clemency, Corrections, and Officer Review Division* prepares officer cases for Secretarial action; advises the Judge Advocate General on and monitors matters of confinement, corrections, and rehabilitation policies and programs; and recommends appropriate clemency action.

The Judge Advocate General's Civil Law Directorate consists of eight divisions, six of which are included in the Legal Services Center.

- *The Preventive Law and Legal Assistance Office* provides personal legal assistance to USAF personnel assigned to the Pentagon and metropolitan Washington, D. C., and advises the Air Staff on federal and state income tax issues affecting military interests.
- *The Claims and Tort Litigation Division* adjudicates aviation, environmental, medical malpractice, and general tort claims and defends lawsuits arising from such claims. It also manages worldwide Household Goods, Hospital Recovery, and Government Property Recovery programs.
- *The Environmental Law Division* represents USAF in environmental, occupational safety and health, and land-use litigation and deals with regulatory agencies to achieve compliance with environmental laws and prevent interference with USAF operations. It also advises Air Staff, commanders, and engineers on environmental legislation.
- *The General Litigation Division* represents USAF in administrative proceedings and all civil litigation brought against USAF and its officials involving personnel actions, the Freedom of Information Act, the Privacy Act, taxes, utilities, and constitutional and personal torts.
- *The Contract Law Division* represents USAF in Federal Court litigation involving Air Force contracts. It also advises Air Staff and subordinate commands on contract law issues and is the USAF focal point on contract-fraud matters and on issues in technical data and computer software rights.
- *The Patents Division* investigates and makes administrative decisions on patent and copyright claims against USAF and prepares/submits patent applications for USAF. ■

Air Force Management Engineering Agency

THE primary mission of the Air Force Management Engineering Agency (AFMEA) is to develop and maintain Air Force manpower standards in order to improve manpower utilization and ensure the implementation of technical and procedural guidance for the Air Force Management Engineering Program (MEP). In addition, AFMEA manages Air Force productivity programs, develops manpower programming tools, and provides data systems support for the MAJCOM manpower community.

To do this, AFMEA works with units and headquarters to apply the most progressive industrial engineering techniques available. The resulting manpower standards specify, by grade and skill, the number of individuals necessary to perform each unit's mission. The MEP also enables AFMEA and commanders to assess wartime manpower needs and develop models to help determine what manpower will be required for wartime operations.

AFMEA administers major Air Force productivity programs that capitalize on technological advances and new ideas to increase productivity and free manpower for other priorities in the Air Force. These programs include the Air Force Suggestion program, the Fast-Payback Capital Investment (FASCAP) program, and the Commercial Activities (A-76) program. In FY '88, the Suggestion program saved taxpayers a record $354 million. Also in FY '88, AFMEA directed the distribution of $11.3 million to help bases finance productivity improvements and provided technical guidance to MAJCOMs for the A-76 program, which eliminated 3,800 manpower authorizations, thereby saving taxpayers another $44 million.

AFMEA's other major responsibilities include managing the Air Force's officer/enlisted grade distribution; operating and maintaining the Logis-

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tics Composite Model (LCOM), a computer simulation that determines maintenance manpower requirements for different weapon systems; developing Transient and Holding Accounts factors for special Air Force manpower accounts; and providing automated support for facets of the manpower management community that involve management engineering and productivity programs.

From its headquarters at Randolph AFB, Tex., AFMEA directs eleven subordinate organizations throughout the US and provides assistance and technical guidance to Command Management Engineering Teams (CMETs) at nearly every Air Force base in the world. These eleven organizations include eight Functional Management Engineering Teams (FMETs) and three specialized organizations.

The FMETs are responsible for using industrial engineering work measurement techniques to develop efficient organizations and manpower standards in functional areas common to most locations throughout the Air Force. When possible, the FMETs are collocated with functional centers.

The FMETs include the Comptroller Management Engineering Team (AFCOMPMET) located at Lowry AFB, Colo.; the Engineering and Services Management Engineering Team (AFESMET) at Tyndall AFB, Fla.; the Intelligence Management Engineering Team (AFINTELMET) at Fort Belvoir, Va.; the Medical Management Engineering Team (AFMEDMET) at Maxwell AFB, Ala.; the Manpower and Personnel Management Engineering Team (AFMPMET) at Randolph AFB, Tex.; the Special Staff Management Engineering Team (AFSSMET) at Peterson AFB, Colo.; the Security Police Management Engineering Team (AFSPMET) at Kirtland AFB, N. M.; and the Logistics Management Engineering Team (AFLOGMET) at Dover AFB, Del.

The specialized organizations are OLA at the Pentagon, which provides data support to Hq. USAF/PRM; the Air Force Wartime Manpower and Personnel Readiness Team (AFWMPRT) at Fort Ritchie, Md., which advises Hq. USAF on such matters as wartime manpower requirements, personnel availability, and training; and the Joint Health-Care Management Engineering Team (JHMET) at San Antonio, Tex., which develops and maintains joint service medical standards.

AFMEA has an authorized strength of seventy-four officers, 140 enlisted, and 112 civilians. ■

Air Force Military Personnel Center

THE Air Force Military Personnel Center (AFMPC), located at Randolph AFB, Tex., is the hub of Air Force personnel management programs. Nearly 600,000 active-duty Air Force men and women worldwide are affected by the procedures and policies formulated and implemented at AFMPC. In addition, AFMPC provides services to approximately 600,000 retired Air Force members.

AFMPC's most significant responsibility is to put personnel with the right skills in the right job at the right time to enable commanders to accomplish their missions. To do this, AFMPC's military and civilian personnel balance the need to accommodate individual preferences and professional goals with meeting the skill needs of commanders. Even before initial assignments are made, AFMPC works closely with the Air Force Recruiting Service and Air Training Command to acquire, classify, and train the numbers and types of personnel the Air Force needs.

AFMPC also manages officer programs and conducts promotion boards. Last year, AFMPC hosted fourteen selection and evaluation boards for promotion of individuals from senior master sergeant through the grade of colonel.

The US Air Force Retention Division is responsible for identifying present and future staffing deficiencies, evaluating policies and programs that affect the Air Force's retention environment, and developing and implementing initiatives designed to improve retention when needed.

AFMPC administers the Weighted Airman Promotion System (WAPS) and the Stripes for Exceptional Performers (STEP) program. In 1988, approximately 30,000 enlisted members received promotions under WAPS, and 550 were selected by commanders for STEP promotions.

Air Force awards and decorations, quality force, line of duty determinations, physical-fitness, and dress and

—USAF photo by John Seymore

TSgt. Jose Aleman researches a recommendation package as part of his job in the recognition programs branch of the Air Force Military Personnel Center at Randolph AFB, Tex. AFMPC is responsible for managing personnel matters for Air Force members worldwide, including promotions, assignments, separations, retirements, and various other activities.

personal-appearance programs are AFMPC's responsibilities, as well. AFMPC also handles all separations and retirements, administers survivor annuity programs, and is the focal point for retiree activities.

AFMPC is also responsible for the development, implementation, and management of the officer and enlisted evaluation systems, directly affecting more than 650,000 active-duty and reserve forces officers and enlisted members. On August 1, 1988, the revised Officer Evaluation System was implemented. During 1988, AFMPC also conducted a study to examine the enlisted evaluation system. The decision was made to revise this system as well. Development efforts are well under way, with expected implementation beginning May 1, 1989.

Another primary responsibility of AFMPC is to provide procedural and operational guidance to 125 active-duty consolidated base personnel offices (CBPOs) worldwide. AFMPC was recently designated the Air Force functional manager for more than 3,000 unit orderly rooms Air Force-wide and given the responsibility to coordinate future orderly-room automation initiatives.

AFMPC is also responsible for Air Force Morale, Welfare, and Recreation (MWR) activities. In fact, MWR personnel at AFMPC are responsible for one of the largest recreational support systems anywhere in the world.

One of the most sensitive areas AFMPC is charged with is administering the Air Force Casualty Service Program. In addition to assisting families of active-duty and retired casualties, the Center maintains contact with the families of the 879 unaccounted-for Air Force members from the Southeast Asian conflict. ■

Air Force Office of Medical Support

THE Air Force Office of Medical Support (AFOMS) is a separate operating agency with headquarters at Brooks AFB, Tex. The AFOMS Commander serves on the staff of the Surgeon General, USAF, as the Director of Health-Care Support and is also the Deputy Corps Chief, Medical Service Corps.

The Air Force Office of Medical Support assists the Air Force Surgeon General in developing programs, policies, and practices relating to Air Force health care. The office is organized in the Directorate of Health-Care Support and selected Professional Affairs activities.

The Directorate of Health-Care Support develops plans, programs, and management guidance through five divisions:

- *The Patient Administration and Air Force-Managed Health-Care Division* develops and implements plans to manage medical administrative functions for patient administration, ambulatory services, managed health care, and medical records.
- *The Health Facilities Division* serves as a consultant for medical design, construction, and maintenance.
- *The Medical Service Information Systems Division* monitors the development, acquisition, installation, and application of computer-based medical information handling and retrieval systems.
- *The Medical Logistics Division* develops plans and policies concerning medical materiel, supply and equipment, biomedical equipment maintenance repair, facility management, and service contracts.
- *The Center for Health-Care Innovation Division* develops in-house initiatives, evaluates innovative recommendations, validates potential solutions for implementation, and disseminates this information through an innovative exchange network.

The Professional Affairs activities consist of two programs and one committee, each assisting the Surgeon General in its particular area of expertise.

- The Health Promotion Program provides policy and guidance to major command and medical treatment facility program coordinators by disseminating health information.
- The Family Advocacy Program office manages, monitors, and coordinates policy and guidance for the Air Force Exceptional Family Member Program (EFMP) and the Air Force Child and Spouse Abuse Program.
- The USAF Radioisotope Committee coordinates administrative and regulatory aspects of licensing, possession, use, storage, handling, and disposal of all radioactive material used by the Air Force.

AFOMS is directly involved on a daily basis with the Air Force Surgeon General, other Air Staff directorates, major commands, and other federal agencies in support of health-care operational policies and practices. ■

Air Force Office of Security Police

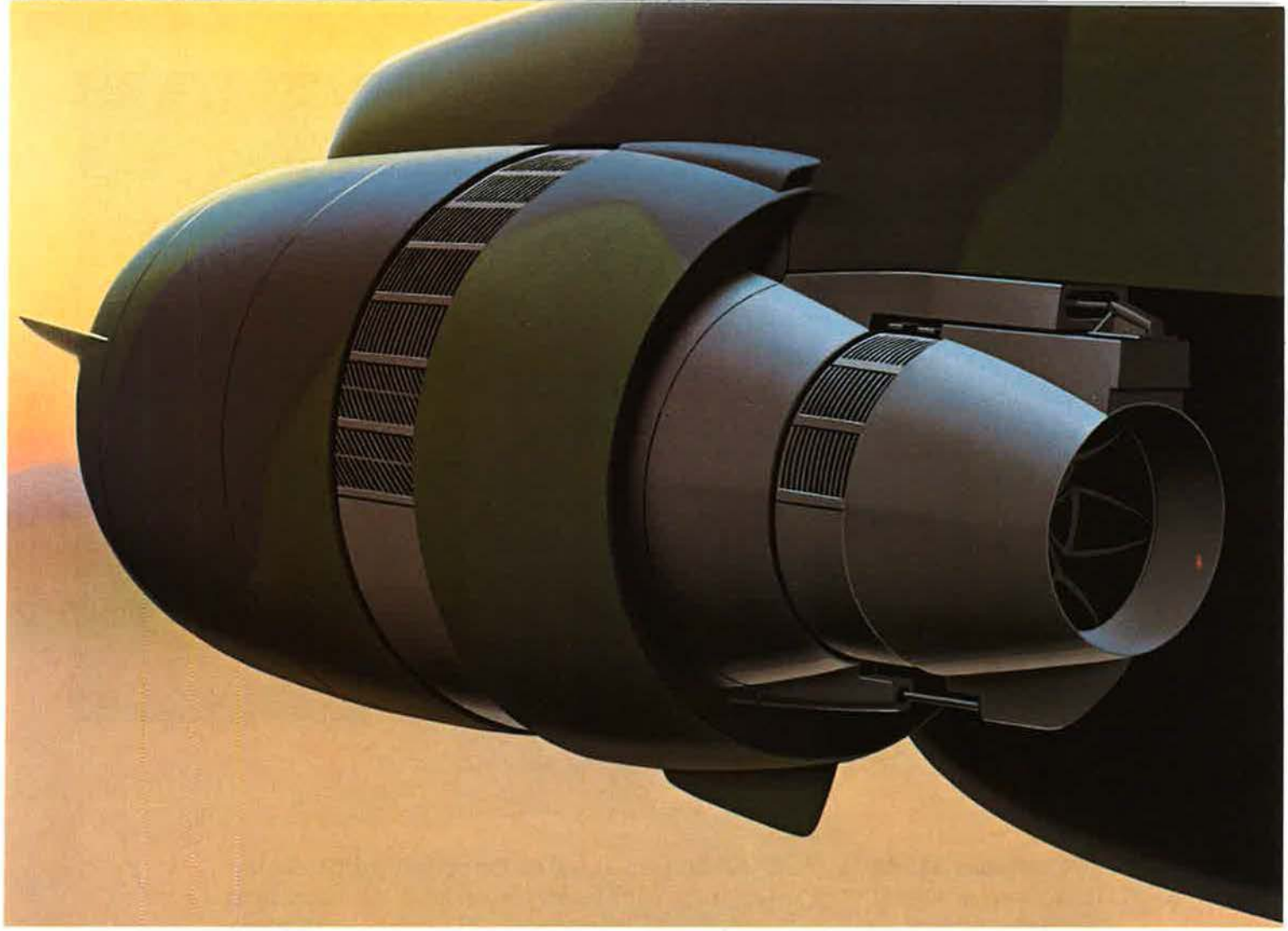
THE Air Force Office of Security Police (AFOSP) is a separate operating agency activated September 1, 1979, at Kirtland AFB, N. M. The Air Force Chief of Security Police, Brig. Gen. Frank K. Martin, is also the Assistant Inspector General for Security. He has a staff of ninety-four at Kirtland and forty-five at the Air Force Security Clearance Office in Rosslyn, Va.

AFOSP establishes Air Force policies for security, law enforcement, air-base ground defense, information security, and small arms training and maintenance. The agency plans, directs, and manages programs for 50,000 active-duty, reserve, and civilian DoD and contract security police and combat arms training personnel.

Programs include the security of combat systems and nuclear systems, maintenance of law and order, prisoner correction and rehabilitation, security education, personnel and industrial security, and the classification and safeguarding of information in the interest of national security.

During 1988, the AFOSP staff:

- Bolstered security for Air Force bases in Central America and the Philippines by initiating the deployment of security forces and the rapid delivery of new handheld thermal imagers, weapons, vehicles, and communications equipment.
- Evaluated air-base ground defense operations, new equipment, and the integration of almost 2,000 security police with forces from other services and nations in major Joint Chiefs of Staff exercises such as Re-



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For example, it makes non-stop missions of nearly 5,000 statute miles in about 9.5 hours a reality, even against prevailing winds. SAM would enjoy greater flexibility in flight planning and crew scheduling, as well as more cost-effective utilization of aircraft types, particularly on long overseas missions.

This amazing airplane has the most advanced technology in computerized flight management integrated with electronic flight instrument systems. As a result, SAM flight crews would command a transport aircraft with more capabilities for conducting safe, well-managed missions than most commercial airliners provide.

Operating cost savings also would compound at an even faster rate because of the increased fuel efficiency of its new Rolls-Royce Tay engines; the design improvements and reduced maintenance requirements of its many new aircraft systems; and the significant commonalities it has with the C-20 Gulfstream in maintenance procedures, spares supply and support programs.

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- Developed a new contingency security concept: contingency security elements (CSEs). CSEs are highly trained thirteen-member air-base ground defense squads that can deploy as quick-reaction forces to integrate into base security. Air Force Logistics Command, Air Training Command, Military Airlift Command, Strategic Air Command, and Tactical Air Command have each formed five CSEs.
- Led the way to bring Scope Shield advanced tactical communications equipment to the Air Force. Scope Shield radios were distributed to security police in Central America and in the Philippines and to the CSEs. Security police units worldwide will receive the radios by midsummer 1989.
- Continued to provide the US Secret Service, State Department, and other federal agencies with military working dog teams for explosives detection. The teams from major commands filled 500 requests to help ensure the safety of presidential candidates along the campaign trail through election day.
- Reviewed Air Force espionage cases of the past forty-one years and developed several initiatives to improve the protection of classified information and make espionage easier to discover.
- Laid the plans and established procedures for a five-year, Air Force-wide review and possible declassification of volumes of combat records from Vietnam.
- Began a one-year test of a new way to conduct security education. At three test bases, information security specialists, rather than supervisors or additional-duty security managers, conduct the training. The results will be evaluated and procedures devised for a new Air Force security education program.
- Worked with interservice and law enforcement organizations. General Martin is cochairman of the Air Base Operability General Officer Steering Committee. He and other security police leaders serve on International Association of Chiefs of Police committees to enhance cooperation between military and civilian law enforcement communities. ■

—Staff photo by Guy Aceto

Security policemen safeguard the alert complex at K. I. Sawyer AFB, Mich., during an intruder exercise. The Air Force Office of Security Police, headquartered at Kirtland AFB, N. M., is responsible for base and weapon security, law enforcement, air base defense, and security education.

Air Force Office of Special Investigations

THE Air Force Office of Special Investigations (AFOSI) has been the Air Force's major investigative service since August 1, 1948. Headquartered at Bolling AFB, D. C., its commander is Brig. Gen. Francis R. Dillon.

The primary responsibility of AFOSI is to provide investigative and counterintelligence information and services to commanders USAF-wide. The organization seeks to identify and stop espionage, subversion, terrorism, sabotage, and other criminal activities that may threaten Air Force resources. AFOSI commanders work closely with local wing/base commanders to direct effort to those commanders' priorities.

Local AFOSI detachments have a full range of on-call specialists and state-of-the-art techniques to assist them. Electronics, computer, forensic, and behavioral-science specialists routinely deploy worldwide to protect Air Force people and resources.

AFOSI's polygraph examiners provide valuable investigative support, screen those in special access programs, and meet requests by defense counsels, commanders, or military and federal agencies.

AFOSI has about 2,560 personnel, of whom two-thirds are special agents. Eighty-five percent of special agents are military, and fifteen percent are civilian. AFOSI recruits, selects, and trains its own special agents, who come from almost every Air Force specialty. Each year, about 240 officers, civilians, and noncommissioned officers attend the three-month-long investigators' course at the USAF Special Investigations Academy, located at Bolling AFB, D. C. Four hundred individual mobilization augmentees also bring a wealth of civilian experience through AFOSI's Reserve program.

Fighting economic crime at all levels is a major AFOSI priority, with special emphasis on programs designed to detect high-dollar procurement fraud. In central procurement and weapon systems acquisition, AFOSI's "Seven Pros" program, begun five years ago, continues to be a significant asset in combating fraud. This program assigns special agents to

each of the Air Force's Plant Representative Offices and has resulted in more than $69 million for the Air Force in recoveries, savings, and fines.

AFOSI also works closely with AFLC in investigating economic crimes involving the purchase of spare parts. In the past three years, AFOSI investigations of economic crime at all levels have produced more than $170.6 million in recoveries, savings, and fines.

Hostile intelligence-gathering and terrorist threats directed against Air Force people and resources continue unabated, requiring considerable activity in the counterintelligence area. In addition to analyzing data on this threat and producing numerous assessments, studies, and reports for commanders, major counterintelligence activity by AFOSI in 1988 included:

- Conducting 250 counterintelligence investigations concerning intelligence threats to USAF personnel.
- Presenting 4,940 defensive counterespionage awareness briefings to more than 223,000 USAF members.
- Providing AFOSI counterintelligence support to USAF elements involved with systems security, technology transfer, and operations security.
- Conducting about 300 Protective Service Operations for key USAF, DoD, and other US government officials and foreign dignitaries.

Investigating such major crimes as drug-trafficking, murder, theft, rape, and assault consumes the largest portion (forty percent) of AFOSI manhours.

As a result of AFOSI criminal and fraud investigations, USAF recovered or saved nearly $34 million in assets in 1988 and assessed almost $6.8 million in fines. ■

Air Force Operational Test and Evaluation Center

THE Air Force Operational Test and Evaluation Center (AFOTEC) is the Air Force's independent test agency responsible for operational testing of new or modified weapon systems and/or components being developed for Air Force and multiservice use.

AFOTEC is a separate operating agency under Hq. USAF. Its commander, Maj. Gen. Cecil W. Powell, reports directly to the Chief of Staff of the Air Force. The primary purpose of operational test and evaluation is to reduce risk in the acquisition process by determining how well systems perform when operated and maintained by Air Force personnel in a realistic operational environment. The results from the Center's tests are used at all levels of the Air Force and the Department of Defense to support program decisions that lead to the production and fielding of systems. The Center's efforts focus on evaluating the operational effectiveness and suitability of the Air Force's future weapon systems and supporting equipment.

The Center's activities address equipment used over the entire spectrum of Air Force missions, including aircraft, strategic missiles, munitions, space and command control communications, flight simulators, and intelligence systems. The Center is currently conducting tests that involve the Consolidated Space Operations Center, the Next-Generation Weather Radar, the B-1B, the F-15E, and the Peacekeeper missile.

The Center is also testing the Advanced Medium-Range Air-to-Air Missile, the Advanced Tactical Fighter, the Airborne Self-Protection Jammer, and simulator systems including the B-1B and F-15E weapon system trainers. The most recently completed tests include those on the Joint Tactical Information Distribution System program, the High-Speed Antiradiation Missile, and the Ground Wave Emergency Communications Network.

The Center has approximately 500 persons assigned to its headquarters at Kirtland AFB, N. M., and an additional 175 at five detachments and twenty-four test teams. The Center has detachments at Eglin AFB, Fla., Nellis AFB, Nev.; Edwards AFB, Calif.; Colorado Springs, Colo.; and Kapaun Barracks, West Germany.

AFOTEC personnel form the management cadre for test programs, while the major commands supplement the test teams with the majority of the evaluators. There are approximately 2,400 individuals under the Center's operational control. The additional personnel provide current operational experience to ensure that the evaluation reflects the needs of the ultimate users of the system—operators, maintainers, and support and training specialists. By testing under operationally realistic conditions, the Center ensures that the new equipment will meet users' requirements and will be ready for operational use in accomplishing the Air Force mission. ■

The primary purpose of the Air Force Operational Test and Evaluation Center is to reduce risk in the acquisition process by determining how well systems perform in a realistic environment. Here, Col. Bill Holtzman preflights an AIM-120 missile.

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Air Force Service Information and News Center

THE Air Force Service Information and News Center (AFSINC) serves as a clearinghouse for Defense Department and Air Force news on policies, activities, and people. The Center, headquartered at Kelly AFB, Tex., creates and furnishes public-affairs products and services to Air Force members and their families worldwide. Individual stories of soldiers and airmen are also produced and sent to civilian news media across the United States.

The Center is commanded by Col. Paul F. Heye and reports directly to the Air Force Director of Public Affairs. AFSINC has four mission elements: the Internal Information Directorate, the Army and Air Force Hometown News Service, the Air Force Broadcasting Service, and the Air Force Office of Youth Relations.

- Internal Information assists communication between commanders and their internal audiences with USAF-level information through print, film, and broadcast media. Products include *Airman* magazine, the Air Force News Service, the Air Force Policy Letter for Commanders, and general officer biographies.

This directorate originates a series of lithographs and theme posters, and it oversees the commander's call and the base newspaper programs. Internal Information also creates the Air Force Radio News releases and produces "Air Force Now" films and videos.

- The Army and Air Force Hometown News Service reports on soldiers and airmen through print and broadcast stories to Stateside civilian media. During 1988, more than 410,000 servicemen were highlighted in 1,600,000 releases to hometown newspapers.

The radio feature teams reached an additional 170,000,000 listeners through 2,402 radio stations. Television feature teams' Christmas Greetings program generated a viewing audience of 100,000,000. Print feature teams interviewed more than 4,200 servicemen, whose stories were read by 60,000,000 readers of civilian newspapers.

- The Air Force Broadcasting Service manages the Air Force functions of the Armed Forces Radio and Television Service. As direct support to commanders and their internal information needs, AFBS now operates 160 radio and television outlets in Europe, the Pacific, and the Arctic. More than 600 airmen, soldiers, sailors, Marines, and civilian employees serve in the worldwide command, bringing news, information, and entertainment to DoD people and their families around the world.
- The Air Force Office of Youth Relations acts as liaison between the Air Force and about twenty-five national youth organizations. It conducts special community relations activities to provide Air Force mission and career information to 35,000,000 of the nation's youth.

AFSINC provides its elements with administration, resources, communications, and computer support. The Center supplies the Chicago, Los Angeles, and New York City regional public-affairs offices with budget, manpower, and logistics support.

The same support is also given the Air Force Orientation Group in Dayton, Ohio. AFOG designs, builds, transports, and displays exhibits across the United States to inform Americans about the Air Force and its people, equipment, and national contributions.

AFSINC operates with a staff of 656 military and 186 civilians. ■

Air Reserve Personnel Center

THE Air Reserve Personnel Center (ARPC) in Denver, Colo., provides personnel support for the mobilization and demobilization of more than 500,000 Air National Guard, Air Force Reserve, and retired members. ARPC's mission is to assist in mobilization of the air reserve components, provide personnel support to individual members, and maintain master personnel records of all members not on extended active duty.

ARPC has a staff of more than 750 military and civilian workers who provide assignments, promotions, discharges, retirements at age sixty, career planning, school selections, orders, pay, SATO (Scheduled Airlines Ticket Office) support, VA entitlements, SGLI (Serviceman's Group Life Insurance), DEERS (Defense Enrollment/Eligibility Report System), and a myriad of other personnel support activities to reservists worldwide.

ARPC accomplishments during 1988 are indicative of the Center's dedicated employees. Two training programs initiated and developed entirely at ARPC—an Excellence in Management Program for first-line supervisors and a course, "AIDS in the Workplace," offered to all employees—are top-notch models for emulation in both the public and the private sector.

ARPC grew by two offices in 1988: the Directorate of Individual Mobilization Augmentee Management and the Directorate of Readiness and Mobilization. The new IMA directorate was created to establish a central programming focal point to analyze IMA functions and develop policy recommendations. One of the new office's first projects was to develop a civilian skills data bank so that all areas of reserve expertise would be available to augment active force requirements. The other new office increases ARPC's ability to integrate its actions with the Air Force readiness community. ARPC's efforts to procure Worldwide Military Command and Control System communications equipment became a reality in early 1989.

ARPC's Consolidated Reserve Personnel Office is the largest base-level CBPO in the Air Force, serving nearly 14,000 IMAs and participating individual ready reservists. Because IMAs train directly with the active force, their CBPO functions are handled at ARPC, mostly by mail and telephone.

ARPC also operates single-manager programs serving the special needs of nearly 1,620 medical, 1,060

legal, and 570 chaplain reserve personnel. In addition, ARPC provides this support to some 1,300 students working toward medical degrees under the Health Professions Scholarship Program and to nearly 270 chaplain candidates.

Since its inception in March 1954, ARPC has been called on to mobilize personnel of the Air Reserve components during three national emergencies—the Berlin crisis in 1961, the Cuban missile crisis in 1962, and the USS *Pueblo* incident in 1968. Today, continuing recall tests and exercises verify the effectiveness of ARPC mobilization procedures and ensure that the Center can respond rapidly during any national emergency.

The most important concern of the ARPC commander, Col. Joseph C. Ramsey, Jr., is the future of the organization. "I want ARPC to get and keep the best people, and I want our people to have the best tools with which to do their jobs. We're the best organization of its kind in the world. I want us to stay on top for as long as the need for a strong reserve force and a mobilization center like ARPC exists." ■

Air Force Reserve

"AIR Force Reserve combat readiness is at its highest level ever—both in flying and nonflying units." That's how Maj. Gen. Roger P. Scheer, chief of Air Force Reserve and Air Force Reserve (AFRES) commander, views the Reserve as we approach the 1990s.

Reservists from the 459th Military Airlift Wing, Andrews AFB, Md., were in the forefront of the Air Force effort to support the President's order to fly US troops to Honduras during Operation Golden Pheasant. An AFRES pilot from Andrews AFB, Md., landed the first USAF C-141 StarLifter at Palmerola AB, Honduras.

Associate unit reservists from the 349th MAW, Travis AFB, Calif., and the 315th MAW, Charleston AFB, S. C., deployed with their active-duty counterparts on MAC C-141s, and reservists from the 433d MAW, Kelly AFB, Tex., flew one of its C-5 Galaxies.

In all, the reservists airlifted 450 troops and some 140 tons of equipment and supplies from the 7th Infantry Division, Fort Ord, Calif., and the 82d Airborne Division, Fort Bragg, N. C.

AFRES units were also called on to support the United Nations' peacekeeping efforts in the Iran-Iraq ceasefire. Reservists and their C-5 aircraft from the 433d MAW at Kelly AFB and the 439th MAW, Westover AFB, Mass., along with associate unit reservists from the 512th MAW, Dover AFB, Del., and the 349th MAW took part in the MAC effort, dubbed Post Road. All the missions began with flights to Trenton, Ontario, to pick up Canadian troops and their equipment. In all, twenty C-5s took part in Operation Post Road.

In 1988, the Reserve displayed its combat readiness in many other real-world deployments, competitions, and training exercises such as Brim Frost, Maple Flag, Checkered Flag, Volant Oak, Team Spirit, and European Tanker Task Force. For example, reservists from the 419th Tactical Fighter Wing, Hill AFB, Utah, deployed to Denmark with F-16s, and other Reserve units took part in 963 deployments and fifty-eight exercises supporting the worldwide Total Force mission.

—USAF photo by MSgt. Ken Hammond

A large portion of the Air Force's total airlift capability is provided by Air Force Reserve units and their crews. This Reserve C-130 is banking over one of the drop zones at Fort Bragg, N. C., a place that almost every tactical airlift crew has seen at one time or another.

AFRES provided MAC with half of its combat-ready C-141 and C-5 aircrews, forty percent of its strategic airlift maintenance force, forty-seven percent of the aerial port force, nearly three-fourths of all MAC medical crews, half of all AC-130 gunship crews, and almost a quarter of all Air Force C-130 tactical airlift crews.

AFRES continued modernization with conversions to newer aircraft. The 928th Tactical Airlift Group, O'Hare ARFF, Ill., and the 907th TAG, Rickenbacker ANGB, Ohio, went from C-130A to E models. The 301st Tactical Fighter Wing, Carswell AFB, Tex., switched from F-4D to E fighters, and the 507th Tactical Fighter Group, Tinker AFB, Okla., began trading in its F-4Ds for F-16s.

Air Force Reserve day-to-day support of the Air Force mission totaled more than 134,000 hours in AFRES aircraft and a most 90,000 hours through the associate program in MAC- and SAC-owned aircraft.

Many of these hours were flown to help those in need. Reservists transported more than 880,000 pounds of humanitarian cargo to Caribbean and Central and Scuth American countries. A C-141 from the 459th MAW airlifted twenty-four tons of tents and cots to Armenia in the Soviet Union in December 1988 following a devastating earthquake.

Air Force Reserve and Air National Guard C-130 units took turns supporting US airlift requirements in Central and South America. Crews on Volant Oak missions transported people and cargo throughout the region; dropped troops and cargo into Panama Canal area training zones; performed search, rescue, and disaster relief operations; evacuated US citizens; and made regular shuttle runs to US embassies. ■

AIR FORCE RESERVE FLYING WINGS AND ASSIGNED UNITS

Air Force	Wing Hq.	Group	Squadron	Type Aircraft	Location	Gaining Command
			71st SOS	HH-3E, CH-3E	Davis-Monthan AFB, Ariz.	MAC
		919th SOG	711th SOS	AC-130A	Eglin AFB, Fla. (Aux. 3)	MAC
		939th ARRG	304th ARRS	HC-130H/UH-1N, HH-3E/CH-3E	Portland IAP, Ore.	MAC
			301st ARRS	HC-130H/N, HH-3E	Homestead AFB, Fla.	MAC
			305th ARRS	HC-130H/N, HH-3E	Selfridge ANGB, Mich.	MAC
	349th MAW (Assoc)		301st MAS (Assoc)	C-5A	Travis AFB, Calif.	MAC
			312th MAS (Assoc)	C-5A	Travis AFB, Calif.	MAC
			708th MAS (Assoc)	C-141B	Travis AFB, Calif.	MAC
Fourth Air Force			710th MAS (Assoc)	C-141B	Travis AFB, Calif.	MAC
(Hq. McClellan	403d TAW		815th TAS	C-130E, WC-130E/H	Keesler AFB, Miss.	MAC
AFB, Calif.)		934th TAG	96th TAS	C-130E	Minneapolis-St. Paul IAP, Minn.*	MAC
Maj. Gen. James	433d MAW		68th MAS	C-5A	Kelly AFB, Tex.	MAC
C. Wahleithner	302d TAW		731st TAS	C-130B	Peterson AFB, Colo.	MAC
Commander		943d TAG	303d TAS	C-130B	March AFB, Calif.	MAC
	440th TAW		95th TAS	C-130A	General Mitchell IAP, Wis.*	MAC
		927th TAG	63d TAS	C-130E	Selfridge ANGB, Mich.	MAC
		928th TAG	64th TAS	C-130H	O'Hare ARFF, Ill.*	MAC
	445th MAW (Assoc)		728th MAS (Assoc)	C-141B	Norton AFB, Calif.	MAC
			729th MAS (Assoc)	C-141B	Norton AFB, Calif.	MAC
			730th MAS (Assoc)	C-141B	Norton AFB, Calif.	MAC
	446th MAW (Assoc)		97th MAS (Assoc)	C-141B	McChord AFB, Wash.	MAC
			313th MAS (Assoc)	C-141B	McChord AFB, Wash.	MAC
	301st TFW		457th TFS	F-4E	Carswell AFB, Tex.	TAC
		924th TFG	704th TFS	F-4D	Bergstrom AFB, Tex.	TAC
	419th TFW		466th TFS	F-16A/B	Hill AFB, Utah	TAC
		507th TFG	465th TFS	F-4D	Tinker AFB, Okla.	TAC
		944th TFG	302d TFS	F-16C/D	Luke AFB, Ariz.	TAC
	434th AREFW (H)		72d AREFS (H)	KC-135E	Grissom AFB, Ind.	SAC
Tenth Air Force		98th AREFG (H)	78th AREFS (H) (Assoc)	KC-10A	Barksdale AFB, La.	SAC
(Hq. Bergstrom AFB, Tex.)		916th AREFG (H)	77th AREFS (H) (Assoc)	KC-10A	Seymour Johnson AFB, N. C.	SAC
	442d TFW		303d TFS	A-10A	Richards-Gebaur AFB, Mo.*	TAC
Brig. Gen. John J. Closner III		930th TFG	45th TFS	A-10A	Grissom AFB, Ind.	TAC
	917th TFW		47th TFS	A-10A	Barksdale AFB, La.	TAC
Commander			46th TFTS	A-10A	Barksdale AFB, La.	TAC
		926th TFG	706th TFS	A-10A	NAS New Orleans, La.	TAC
	452d AREFW (H)		336th AREFS (H)	KC-135E	March AFB, Calif.	SAC
			79th AREFS (H) (Assoc)	KC-10A	March AFB, Calif.	SAC
		940th AREFG (H)	314th AREFS (H)	KC-135E	Mather AFB, Calif.	SAC
	482d TFW		93d TFS	F-4D	Homestead AFB, Fla.	TAC
		906th TFG	89th TFS	F-4D	Wright-Patterson AFB, Ohio	TAC
		932d AAG (Assoc)	73d AAS (Assoc)	C-9A	Scott AFB, Ill.	MAC
	94th TAW		700th TAS	C-130H	Dobbins AFB, Ga.*	MAC
		907th TAG	356th TAS	C-130E	Rickenbacker ANGB, Ohio	MAC
		908th TAG	357th TAS	C-130H	Maxwell AFB, Ala.	MAC
	315th MAW (Assoc)		300th MAS (Assoc)	C-141B	Charleston AFB, S. C.	MAC
Fourteenth Air Force			701st MAS (Assoc)	C-141B	Charleston AFB, S. C.	MAC
			707th MAS (Assoc)	C-141B	Charleston AFB, S. C.	MAC
(Hq. Dobbins	439th MAW		337th MAS	C-5A	Westover AFB, Mass.*	MAC
AFB, Ga.)		911th TAG	758th TAS	C-130H	Greater Pittsburgh IAP, Pa.*	MAC
		914th TAG	328th TAS	C-130E	Niagara Falls IAP, N. Y.*	MAC
Brig. Gen. Dale	459th MAW		756th MAS	C-141B	Andrews AFB, Md.	MAC
R. Baumler		910th TAG	757th TAS	C-130B	Youngstown MAP, Ohio*	MAC
Commander		913th TAG	327th TAS	C-130E	Willow Grove ARF, Pa.*	MAC
	512th MAW (Assoc)		326th MAS (Assoc)	C-5A	Dover AFB, Del.	MAC
			709th MAS (Assoc)	C-5A	Dover AFB, Del.	MAC
	514th MAW (Assoc)		335th MAS (Assoc)	C-141B	McGuire AFB, N. J.	MAC
			702d MAS (Assoc)	C-141B	McGuire AFB, N. J.	MAC
			732d MAS (Assoc)	C-141B	McGuire AFB, N. J.	MAC

AAG	Aeromedical Airlift Group	ARRG	Aerospace Rescue and Recovery Group	TAS	Tactical Airlift Squadron
AAS	Aeromedical Airlift Squadron	ARRS	Aerospace Rescue and Recovery Squadron	TAW	Tactical Airlift Wing
AREFG	Air Refueling Group	MAS	Military Airlift Squadron	TFG	Tactical Fighter Group
AREFS	Air Refueling Squadron	MAW	Military Airlift Wing	TFS	Tactical Fighter Squadron
AREFW	Air Refueling Wing	SOG	Special Operations Group	TFTS	Tactical Fighter Training Squadron
ARF	Air Reserve Facility	SOS	Special Operations Squadron	TFW	Tactical Fighter Wing
ARRF	Air Reserve Forces Facility	TAG	Tactical Airlift Group	*	AFRES Base

Air National Guard

—Staff photo by Jeffrey P. Rhodes

Air National Guard units frequently do well in Air Force-sponsored competitions. Here, 1st Lt. Mark Baker (left) and Capt. Larry Austin check the tech order before flying their aircraft in last year's William Tell air-to-air competition. This 142d Fighter Interceptor Group F-4C Phantom was used in the downing of three North Vietnamese MiGs during 1967.

With both a state and a federal mission, the Air National Guard (ANG) is unique among the Air Reserve components. In 1989, Guardsmen and -women proudly celebrate 353 years of service to their communities, states, and nation.

Air Guard units in a nonmobilized status are commanded by the governors of the fifty states, the Commonwealth of Puerto Rico, the Territories of Guam and the Virgin Islands, and the Commanding General of the District of Columbia. All units in a state are responsible to the governor, who is represented in the state or territory chain of command by the adjutant general.

Units may be called to federal active duty by the President or by Congress to enforce federal authority, suppress insurrection, or repel invasion. During peacetime, all ANG units are assigned to gaining Air Force commands, which provide advisory assistance and evaluate unit training, safety, and readiness programs.

The Air National Guard today has 115,000 members and provides eighty-five percent of the fighter-interceptor force, fifty percent of the reconnaissance force, fifty-nine percent of the tactical air support, thirty-four percent of the tactical airlift, twenty-five percent of the tactical fighters, eighteen percent of the air refueling capability, seventeen percent of the rescue and recovery capability, and five percent of the strategic airlift capability of the total Air Force.

Of the approximately 280 ANG mission support units, 150 provide manpower and resources to the Air Force Communications Command. ANG combat communications units and engineering and installation units provide sixty-eight percent of the total Air Force resources in both mission areas.

ANG Prime RIBS (Readiness In Base Services) units provide forty percent of the Air Force's deployable contingency support requirement for food-service and base-services personnel. In all, Guard Prime RIBS, Prime BEEF, and RED HORSE units consist of 16,422 wartime-trained engineering, firefighting, and services people.

Additionally, there are ten ANG aeromedical evacuation units that account for twenty-four percent of that Air Force capability, and twenty-three Guard units provide eleven percent of the total USAF aerial port resources.

Many Air Guard units from all mission areas annually participate in deployments for training. Every day, somewhere around the world, ANG units are working alongside their active-duty counterparts. For example, Guard A-7s are on constant, year-round alert in Panama, maintaining an air defense commitment to the canal. The ANG and the Air Force Reserve also share the full-time responsibility for tactical airlift support throughout Central and South America.

Closer to home, ANG F-15, F-16, and F-4 air defense units perform a twenty-four-hour-a-day alert mission along the coasts of the US. The ANG F-15 unit in Hawaii is responsible for the entire air defense of that state. Guard KC-135E tanker units also have crews and aircraft on round-the-clock alert in support of strategic defense requirements.

Equipment modernization is another important element in maintaining a strong, vital Air National Guard. This year, the 142d Fighter Interceptor Group from Portland, Ore., is the fifth ANG unit since 1985 to convert to the F-15.

This year, the 130th Tactical Airlift Group from Charleston, W. Va., will be the ninth ANG unit to convert to the H-model C-130. In March 1989, the Guard accepted the first of ten C-26As that will replace some C-131 operational support airlift aircraft; C-12Js replace other C-131s. ■

THE AIR NATIONAL GUARD BY MAJOR COMMAND ASSIGNMENT

(As of January 1, 1989)

STRATEGIC AIR COMMAND

KC-135E Stratotanker

101st Air Refueling Wing	Bangor, Me.
126th Air Refueling Wing	Chicago, Ill.
141st Air Refueling Wing	Fairchild AFB, Wash.
171st Air Refueling Wing	Pittsburgh, Pa.
128th Air Refueling Group	Milwaukee, Wis.
134th Air Refueling Group	Knoxville, Tenn.
151st Air Refueling Group	Salt Lake City, Utah
157th Air Refueling Group	Pease AFB, N. H.
160th Air Refueling Group	Rickenbacker ANG Base, Ohio
161st Air Refueling Group	Phoenix, Ariz.
170th Air Refueling Group	McGuire AFB, N. J.
190th Air Refueling Group	Forbes Field, Kan.

TACTICAL AIR COMMAND

A-7D/K Corsair II

121st Tactical Fighter Wing	Rickenbacker ANG Base, Ohio
127th Tactical Fighter Wing	Selfridge ANG Base, Mich.
132d Tactical Fighter Wing	Des Moines, Iowa
140th Tactical Fighter Wing	Buckley ANG Base, Colo.
112th Tactical Fighter Group	Pittsburgh, Pa.
114th Tactical Fighter Group	Sioux Falls, S. D.
138th Tactical Fighter Group	Tulsa, Okla.
150th Tactical Fighter Group	Kirtland AFB, N. M.
156th Tactical Fighter Group	San Juan, Puerto Rico
162d Tactical Fighter Group*	Tucson, Ariz.
178th Tactical Fighter Group	Springfield, Ohio
180th Tactical Fighter Group	Toledo, Ohio
185th Tactical Fighter Group	Sioux City, Iowa
192d Tactical Fighter Group	Richmond, Va.

F-16A/B Fighting Falcon

149th Tactical Fighter Group	Kelly AFB, Tex.
169th Tactical Fighter Group	McEntire ANGB, S. C.
184th Tactical Fighter Group*	McConnell AFB, Kan.
187th Tactical Fighter Group	Montgomery, Ala.
188th Tactical Fighter Group	Fort Smith, Ark.

A-10A Thunderbolt II

128th Tactical Fighter Wing	Truax Field, Wis.
174th Tactical Fighter Wing	Syracuse, N. Y.
103d Tactical Fighter Group	Bradley, Conn.
104th Tactical Fighter Group	Barnes, Mass.
175th Tactical Fighter Group	Baltimore, Md.

F-4D Phantom

113th Tactical Fighter Wing	Andrews AFB, Md.
183d Tactical Fighter Group	Springfield, Ill.

F-4E Phantom

108th Tactical Fighter Wing	McGuire AFB, N. J.
122d Tactical Fighter Wing	Fort Wayne, Ind.
131st Tactical Fighter Wing	St. Louis, Mo.
163d Tactical Fighter Group	March AFB, Calif.
181st Tactical Fighter Group	Terre Haute, Ind.

RF-4C Phantom

117th Tactical Reconnaissance Wing	Birmingham, Ala.
124th Tactical Reconnaissance Group	Boise, Idaho
152d Tactical Reconnaissance Group	Reno, Nev.
155th Tactical Reconnaissance Group	Lincoln, Neb.
186th Tactical Reconnaissance Group	Meridian, Miss.

OA-37 Dragonfly

110th Tactical Air Support Group	Kellogg, Mich.
111th Tactical Air Support Group	Willow Grove ARF, Pa.
182d Tactical Air Support Group	Peoria, Ill.

F-15A/B Eagle

116th Tactical Fighter Wing	Dobbins AFB, Ga.
159th Tactical Fighter Group	New Orleans, La.

AIR DEFENSE UNITS (TAC)

F-15A/B Eagle

102d Fighter Interceptor Wing	Otis ANG Base, Mass.

F-4C Phantom

142d Fighter Interceptor Group	Portland, Ore.

F-4D Phantom

144th Fighter Interceptor Wing	Fresno, Calif.
107th Fighter Interceptor Group	Niagara Falls, N. Y.
119th Fighter Interceptor Group	Fargo, N. D.
147th Fighter Interceptor Group	Ellington Field AGS, Tex.
148th Fighter Interceptor Group	Duluth, Minn.
191st Fighter Interceptor Group	Selfridge ANGB, Mich.

F-16A/B Fighting Falcon

120th Fighter Interceptor Group	Great Falls, Mont.
125th Fighter Interceptor Group	Jacksonville, Fla.
158th Fighter Interceptor Group	Burlington, Vt.
177th Fighter Interceptor Group	Atlantic City, N. J.

MILITARY AIRLIFT COMMAND

C-130 Hercules

118th Tactical Airlift Wing	Nashville, Tenn.
123d Tactical Airlift Wing	Louisville, Ky.
133d Tactical Airlift Wing	Minneapolis/St. Paul, Minn.
136th Tactical Airlift Wing	Dallas, Tex.
137th Tactical Airlift Wing	Oklahoma City, Okla.
146th Tactical Airlift Wing	Channel Island, Calif.
109th Tactical Airlift Group	Schenectady, N. Y.
130th Tactical Airlift Group	Charleston, W. Va.
135th Tactical Airlift Group	Baltimore, Md.
139th Tactical Airlift Group	St. Joseph, Mo.
143d Tactical Airlift Group	Quonset Point, R. I.
145th Tactical Airlift Group	Charlotte, N. C.
153d Tactical Airlift Group	Cheyenne, Wyo.
164th Tactical Airlift Group	Memphis, Tenn.
165th Tactical Airlift Group	Savannah, Ga.
166th Tactical Airlift Group	Wilmington, Del.
167th Tactical Airlift Group	Martinsburg, W. Va.
176th Tactical Airlift Group	Anchorage, Alaska
179th Tactical Airlift Group	Mansfield, Ohio
189th Tactical Airlift Group	Little Rock, Ark.

HC-130 Hercules/HH-3 Jolly Green Giant

106th Aerospace Rescue & Recovery Group	Suffolk, N. Y.
129th Aerospace Rescue & Recovery Group	NAS Moffett, Calif.

C-141B StarLifter

172d Military Aircraft Group	Jackson, Miss.

C-5A Galaxy

105th Military Airlift Group	Newburgh, N. Y.

EC-130E

193d Special Operations Group	Middletown, Pa.

PACIFIC AIR FORCES

F-15A/B Eagle

154th Composite Group	Hickam AFB, Hawaii

*Replacement Training Unit (RTU). The 162d TFG serves also as an RTU for the F-16 Fighting Falcon.

AF Civilian Personnel Management Center

THE mission of the Air Force Civilian Personnel Management Center (AFCPMC) is to manage, operate, and/or support Air Force civilian personnel programs and information systems. These programs affect more than 250,000 civilian employees, including foreign nationals, at Air Force installations worldwide.

The Air Force Civilian Personnel Management Center was established as a direct reporting unit of the Air Force Directorate of Civilian Personnel on January 1, 1986. Its forerunner, the Office of Civilian Personnel Operations, had been in existence at Randolph AFB, Tex., since July 1, 1976.

The Center is organized into two divisions: Integrated Systems Management and Career Management. Each plays an integral role in the personnel life-cycle management of the civilian resource.

In addition to managing the white-collar employee pool through career programs, the Career Management Division recruits individuals with college degrees in many technical or professional career fields. The staff also conducts quality-of-worklife studies and performs research into performance appraisal and selection improvements. Additionally, the division is responsible for acting as liaison with the Air Staff in the development and administration of the Air Force civilian education and training budgets. It helps civilian personnel managers find the right school or course for employees' educational needs.

Eighteen career programs are now in effect, including Comptroller; Engineering and Services and Commissary; Historian; Public Affairs; Logistics; Manpower and Personnel, which encompasses Education, Technical Training, and Morale, Welfare, and Recreation; Acquisition; Information Systems; Safety, Security, and Special Investigations; Administration; and Scientist and Engineer. Civilians involved in the programs can receive a combination of government, academic, and industry training. They have the opportunity to attend armed forces college programs and to participate in courses in executive development and may be selected for Education With Industry assignments.

• *The Integrated Systems Management Division* is the Air Force focal point for civilian personnel information systems management. It provides automated data-processing (ADP) support to the civilian personnel community by determining requirements and ensuring that requirements are met, either by developing systems in-house or arranging for their development and maintenance by other organizations. It supervises civilian personnel systems management staff worldwide. It keeps abreast of changing ADP and communications technology to plan and improve civilian personnel management support.

• *The Career Management Division* helps identify civilian executive positions that need to be centrally managed for job referral and training. Its goal is to satisfy Air Force needs by providing a pool of career employees with strong skills in professional, technical, management, and administrative fields.

The Air Force Civilian Personnel Management Center serves as a landmark organization for the Department of Defense and federal government commitment to effective and efficient personnel life-cycle management of the Air Force's valued civilian resources. ■

Air Force Cost Center

THE Air Force Cost Center (AFCSTC) is a direct reporting unit, acknowledged as the "center of excellence" for advancing the state of the art in cost and economic analysis applications throughout the Air Force. Its primary mission is to develop and distribute analytical "tools," to propose new techniques and methodologies, and to develop automated models and databases. Together, these mission tasks ensure that the Air Force has valid, reliable, and high-quality analytical "tools" to estimate accurately the cost of acquiring, operating, and supporting major weapon systems.

Established in 1985, AFCSTC became fully operational in 1987 as a DRU responsible to the Air Force Chief of Staff. The Center is led by its Director, Dr. T. Stan Dunn, who is also the Director, Cost Applications, on the staff of the Comptroller of the Air Force. Commander of AFCSTC is Col. David G. Olsen, who is also Deputy Comptroller of the Air Force for Cost and Economics.

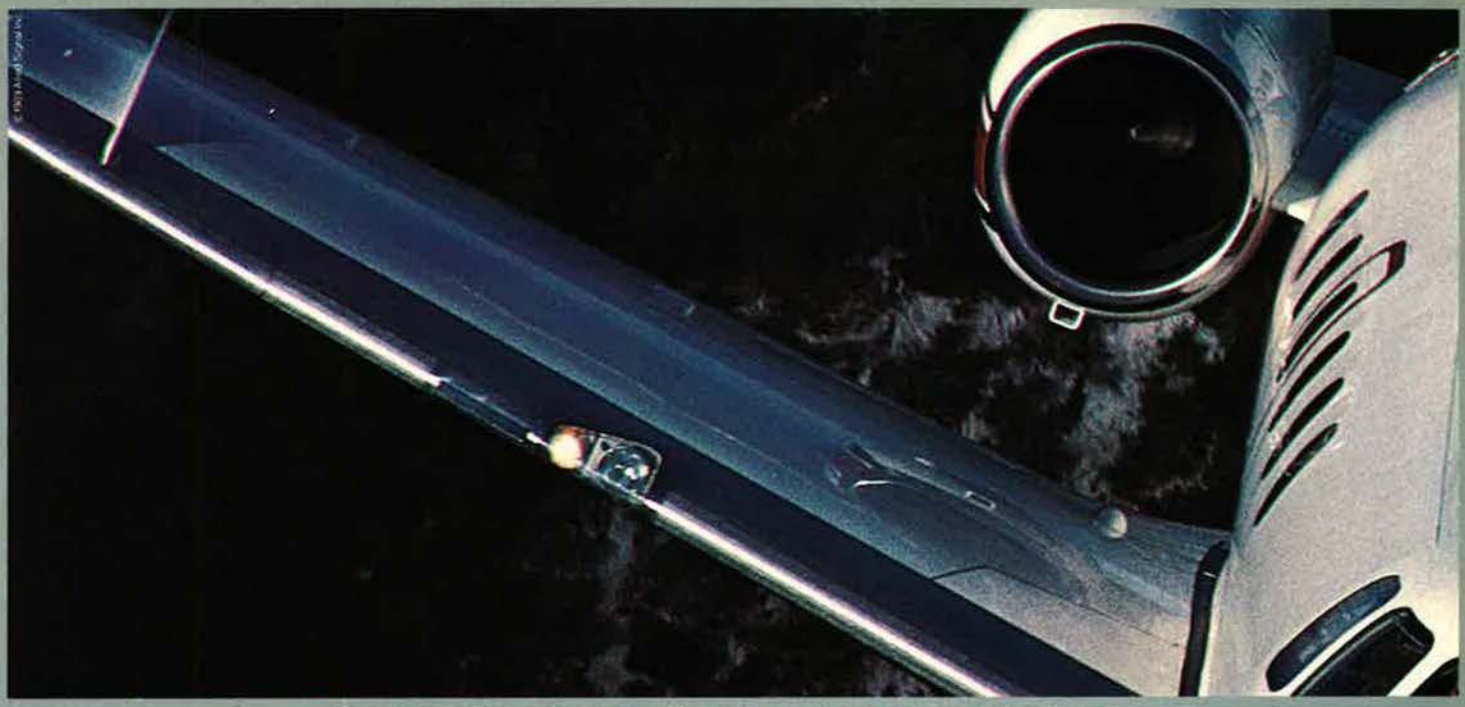
The Center has three divisions: Acquisition, Operations and Support, and Information Systems.

The Acquisition Division concentrates on the cost issues associated with the research, development, and production of new weapon systems. It is concerned with how to improve USAF's capability to estimate the costs of future weapon systems in an environment that is rapidly changing with the emergence of new and advanced technologies, coupled with the increased demand for improved fiscal responsibility and control over acquisition costs.

The Operations and Support Division's main objective is to meet the financial challenges associated with the operational phase of a system's life cycle. To do this, it develops and publishes the Air Force cost and planning factors that affect approximately twenty percent of the Air Force's budget; identifies the key high cost "drivers" and links to programmatic/budgetary impacts; and manages the congressionally mandated Visibility and Management of Operating and Support Costs system.

With its development of a base realignment model and assistance to Air Staff and MAJCOM planners and cost analysts, the Operations and Support Division played a key role in support of the base closure study.

The Information Systems Division is responsible for the computer and communications support of the Cost Center and provides worldwide connectivity through the Cost Bulletin Board and Defense Data Network host interface. The division's Applications Branch is responsible for the development of cost-oriented "artificial intelligence"-based applications known as "expert systems" and "decision support systems." The branch pioneered the development of computer-based training modules to



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With the Military Airlift Command's inventory of C-130, C-141 and C-5A airlifters, the addition of the C-5B fleet gives the U.S. Military the best transport system in the world. Whether it's 120 tons of tanks moved to Europe, or 120 tons of relief supplies delivered to Armenia, the Galaxy has the muscle to do the job.

The credit for the know-how behind all that brawn goes to the men and women of Lockheed and the Air Force. Their prudent, high-caliber and quality-conscious performance has produced an airlift giant that has been successfully proven in the field.

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be used in analyst training programs.

The Information Systems Division pioneered the development of computer-based training modules to be used in analyst training programs. This division also plays an active leadership role in integrating cost research within the Air Force and chairing the OSD Cost Research Working Group. This young organization of approximately fifty technically and operationally oriented cost analysts is dedicated to enhancing the Air Force's ability to estimate and analyze weapon systems costs. ■

Air Force District of Washington

THE Air Force District of Washington (AFDW) is the single manager for support of Air Force activities in the National Capital Region, which includes Washington, D. C., and vicinity. Although its headquarters is located at historic Bolling AFB, D. C., AFDW covers a much broader area. Subordinate units, detachments, and operating locations are at the Pentagon, Andrews AFB, Md., and Fort Meade, Md.

Two major units form the majority of AFDW. They are the 1100th Air Base Group (ABG) and the 1100th Resource Management Group (RMG).

The 1100th ABG is the host unit for Bolling AFB. It has the squadrons and support agencies usually found at the base level. These support functions serve numerous tenant units on Bolling, such as the Air Force Office of Scientific Research, Hq. Air Force Office of Special Investigations, and the Defense Intelligence Analysis Center. The Surgeon General, the Office of Air Force History, and the Chief of Chaplains are among Bolling's Air Staff tenants.

The 1100th RMG has many personnel activities, including command personnel, education office programs, and military personnel offices at Bolling, Fort Meade, and the Pentagon.

The 1100th RMG also contains the AFDW plans and operations branch. This includes a diverse group of responsibilities, such as engineering services, audiovisual production for the Air Staff, and management of more than 800 Pentagon parking spaces and 1,500,000 square feet of leased building space.

Contracting and financial services for all Air Force activities in the Washington area are provided by two 1100th RMG organizations—the 1100th Contracting Squadron and the AFDW Accounting and Finance Office. With 43,977 military and civilian customers, the latter constitutes the Air Force's largest base-level accounting and finance office.

The AFDW is responsible for Air Force ceremonial events in the nation's capital. Two of its most visible ambassadors are the US Air Force Honor Guard and the US Air Force Band, both based at Bolling.

The Honor Guard represents the Air Force at arrival and departure ceremonies for visiting dignitaries at the White House, the Pentagon, and Andrews AFB. It also participates in military funerals at Arlington National Cemetery and in memorial ceremonies at the Tomb of the Unknowns. The Honor Guard Drill Team, an elite component, performs nationwide.

Some of the nation's best musicians make up the Air Force Band. Its varied components, including the Concert Band, String Orchestra, Singing Sergeants, Airmen of Note jazz ensemble, Spectrum pop band, and Ceremonial Brass provide a musical product that is acclaimed around the world.

Last year, AFDW introduced a new "Drug-Free" program that has appeared at National Capital Region schools and is expanding to larger national performance arenas. This program emphasizes Air Force concern over drug abuse and features performances by the Honor Guard's drill team and the band's Spectrum group.

Though only three years old, the AFDW has become an innovative Air Force showcase in the National Capital Region. ■

The Air Force District of Washington, headquartered at Bolling AFB, D. C., is home to the Air Force Honor Guard, shown here on the steps of the US Capitol. This elite unit represents the Air Force at many ceremonial functions, and its Drill Team performs the world over.

USAF Historical Research Center

THE USAF Historical Research Center is the repository for Air Force historical documents. The Center's collection, begun in Washington, D. C., during World War II, moved to Maxwell AFB, Ala., in 1949. It consists today of more than 60,000,000 pages devoted to the history of the service and constitutes the largest and most valuable organized collection of documents on US military aviation in the world.

In 1979, the Center became a direct reporting unit of the Air Force, receiving technical direction and guidance from the Chief, Office of Air Force History. It is collocated with the Air University Library and provides research facilities for professional military education students, the faculty, and visiting scholars.

More than eighty-five percent of the Center's pre-1955 holdings have been declassified. Almost the entire collection is recorded on 16-mm microfilm, with copies deposited at the National Archives and Record Administration, Washington, D. C., and the Office of Air Force History, Bolling AFB, D. C.

Center holdings consist largely of periodic unit histories prepared by the major commands, numbered air forces, and other subordinate organizations. These histories provide comprehensive coverage of Air Force activities beginning in 1942, when the President authorized the program. Extensive primary source material is attached to the histories, greatly enhancing their value.

Special collections complement the unit histories. Among them are historical monographs, end-of-tour reports, joint and combined command documents, aircraft record cards, and materials from the US Army, British Air Ministry, and German Air Force. The Center also houses the personal papers of key retired Air Force leaders and a substantial collection of their oral history interviews. About 6,000 acquisitions of documents and collections of all types are recorded annually.

In 1974, the Center adopted automated data processing as a finding aid and began in 1980 to enter abstracts of its documents into a computer. The Inferential Retrieval Index System, or IRIS, became operational in 1983 when the Center acquired an IBM 4341 computer. IRIS became accessible in 1987.

The Center's main functions include:

- *Reference.* The Center maintains documents and microfilm, answers inquiries about holdings, produces bibliographies, collects personal papers, reviews records for possible downgrading or declassification, and provides other reference services to users.
- *Research.* Center personnel write books and papers; prepare lineage and honors of Air Force units; maintain records of the Air Force seal and flag, records of unit and establishment emblems and flags, and records of Air Force organizations; determine aerial victory credits; and perform various other research and teaching services.
- *Oral History.* The Center conducts oral history interviews and provides a training course for oral historians.
- *Technical Services.* This division processes, catalogs, abstracts, and indexes documents and conducts automated data processing and microfilming for the Center. ■

Air Force Technical Applications Center

THE Air Force Technical Applications Center (AFTAC), a direct reporting unit, operates and maintains the US Atomic Energy Detection System (USAEDS). USAEDS is a worldwide system with operations in more than thirty-five countries. In operating USAEDS, AFTAC is responsible for detecting events in the atmosphere, underwater, underground, and in space; determining if such events are nuclear; and reporting the events to national command authorities through Hq. USAF.

Specific responsibilities assigned to AFTAC include implementing Safeguard (d) of the 1963 Limited Test-Ban Treaty and monitoring the Threshold Test-Ban Treaty of 1974 and the Peaceful Nuclear Explosions Treaty of 1976. AFTAC also supports the On-Site Inspection Agency in verifying compliance with the Intermediate-range Nuclear Forces (INF) Treaty.

AFTAC conducts an active research and development program to contribute to the nation's ability to monitor international test-ban agreements. Because of its capabilities, from time to time AFTAC is also tasked with unique missions in response to world events.

AFTAC was responsible for tracking debris from the Soviet reactor accident at Chernobyl in 1986. The command worked closely with the Environmental Protection Agency, the Federal Aviation Administration, and other executive agencies to document the radiological health hazard to Americans overseas and at home.

To accomplish its mission, AFTAC has approximately 1,400 men and women operating and maintaining a worldwide system of satellite, electromagnetic pulse, hydro-acoustic, seismic, laboratory, sampling, and airborne operations facilities.

AFTAC headquarters at Patrick AFB, Fla., includes a complex of operations centers to monitor the USAEDS network and receive data twenty-four hours a day. These centers are primarily responsible for the detection and identification of nuclear events anywhere in the world.

To manage the USAEDS, AFTAC has three intermediate headquarters units that supervise and support the Center's eleven detachments, six operating locations, and approximately seventy equipment locations.

The largest subordinate is the Technical Operations Division at McClellan AFB, Calif. This major complex contains the McClellan Central Laboratory (the central analysis facility of USAEDS) and a centralized logistics depot for the engineering, maintenance, and provisioning of the USAEDS network. In addition, an airborne operations directorate pro-

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Hq. Pacific Technical Operations Area, located at Wheeler AFB, Hawaii, and Hq. European Technical Operations Area, Lindsey AB, Germany, provide logistics and administrative support to subordinate activities in their geographic areas.

AFTAC's people possess a wide range of technical expertise, and many hold advanced degrees in chemistry, physics, nuclear engineering, and electrical engineering. Complementing an impressive scientific capability is an experienced and talented operational force of skilled, handpicked technicians. ■

United States Air Force Academy

—Photo by J. Gaffney

In addition to providing a top-flight education, the Air Force Academy in Colorado Springs, Colo., also gives its cadets a chance to experience top flight through its glider and parachute-jumping programs. The Academy has also become a national power on the athletic fields in recent years.

THE mission of the US Air Force Academy (USAFA) is "to provide instruction and experience to all cadets so they graduate with knowledge and character essential to leadership and motivation to become career officers in the US Air Force." A Department of the Air Force agency, the Academy stands on an 18,000-acre site in the foothills of the Rocky Mountains near Colorado Springs, Colo.

Air Force Academy cadets take four years of academic studies leading to a bachelor of science degree. They also take professional military training to earn regular commissions in the US Air Force. When cadets enter the Academy, they agree to serve four years as cadets and, upon graduation, to serve five years or longer as active-duty Air Force officers, depending on their career fields. While they are at the Academy, the cadets are provided food, housing, and medical care. In addition, they receive a monthly salary to pay for uniforms, textbooks, and personal expenses.

In 1947, with the establishment of a separate Air Force, the issue of educating Air Force professionals became crucial. In 1949, the Secretary of Defense appointed a service academy board to study the need for another academy. Colorado Springs was selected to be its site.

Congress authorized creation of the Air Force Academy in 1954. The first class of 306 cadets entered temporary facilities at Lowry AFB, Denver, in July 1955. The cadet wing moved into its permanent home in August 1958. Nine months later, 207 cadets graduated.

In 1964, President Lyndon B. Johnson signed legislation that increased the Academy's strength from 2,500 cadets to its present size of 4,417. Women first entered the Academy in 1976, graduating with the class of 1980.

The four-year program of instruction averages 186 semester hours and consists of military training, academics, athletics, and character development.

Academics includes studies in the basic sciences, engineering, the humanities, and the social sciences. Within this framework, all cadets complete a core curriculum with a balance from these four areas. They also select additional courses in one or more available majors. Cadets may visit other Air Force or government installations to participate in various research projects. Cadets can compete with students from other universities for fellowships and scholarships.

The Cadet Honor Code is the centerpiece of moral and ethical development. Cadets pledge: "We will not lie, steal, or cheat, nor tolerate among us anyone who does." All cadets take a formal course in ethics and receive honor and ethics instruction. They are encouraged to participate in voluntary religious services and programs offered at the Academy.

Candidates for appointment to the Academy must be citizens of the United States, at least seventeen but not yet twenty-two years old on July 1 of the year of entry, unmarried with no legal dependents, and of good moral character. They must also pass qualifying medical examinations, the candidate fitness test, and college entrance examinations to qualify for appointment.

Full information, including preparation and admission procedures, can be obtained from the Director of Admissions, USAFA, Colo. 80840-5651. ■

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Gallery of USAF Weapons

BY SUSAN H. H. YOUNG
EDITED BY JOHN W. R. TAYLOR

Bombers

B-1B

On April 30, 1988, the final production B-1B was delivered to USAF, completing a significant phase in SAC's reequipment program. Described as "essentially a large computer system surrounded by fuel and engines," this strategic bomber is smaller than the B-52, but carries a considerably greater weapons load because of improved engine performance and advanced aerodynamic technology. Ninety of the 97 currently available B-1Bs are assigned to a dual-role nuclear/theater mission, each with three weapons bays providing the flexibility to carry long- and short-range nuclear air-to-surface missiles, nuclear or conventional gravity bombs, mines, other weapons, or fuel, as required. A movable bulkhead in the forward weapons bay, to allow for the carriage of a wide range of different-size weapons, including air-launched cruise missiles, was incorporated from the ninth production airframe onward and retrofitted to earlier aircraft.

The B-1B is equipped with electronic jamming equipment, infrared countermeasures, radar location and warning systems, and other devices intended to defeat enemy defensive systems. To facilitate very low-level penetration of hostile territory, it has a radar system that allows it to follow "the nap of the earth" at near supersonic speeds. This would make it extremely difficult for enemy radar systems to track the B-1B, as hills, mountains, towers, buildings, and even trees would clutter the radar screens. The use of radar-absorption materials reduces further the aircraft's radar signature. Flying low at high speeds would also negate the effectiveness of enemy interceptors because it is difficult to acquire and track B-1Bs flying close to the ground. This will give the B-1B the capability to penetrate sophisticated enemy defenses well into the 1990s and to operate within less heavily defended areas into the next century.

The B-1B has a blended wing-body configuration, with variable-geometry wings. The unswept wing setting would permit rapid takeoff from a base threatened by imminent attack or operation from shorter runways or less sophisticated airfields; the fully swept position is used in supersonic flight and for the primary role of high-subsonic, low-level penetration. Structural modifications compared with the original B-1A prototypes permitted increases of 82,000 lb in gross weight and 75,000 lb in fuel/payload capacity. Ejection seats replace the crew ejection capsule of the B-1A. Other changes include fixed engine inlets instead of variable inlets, new engine nacelles, and simplified overwing fairings.

Highly advanced offensive and defensive electronics systems were specified. The offensive avionics include a modern forward-looking and terrain-following radar, an extremely accurate inertial navigation system, strategic Doppler radar, and radar altimeter. The defensive avionics package is built around the ALQ-161 electronic countermeasures (ECM) system with wide frequency coverage and a tail warning function, supplemented by such expendables as chaff and flares. Development of the full potential of this system has proved difficult and is continuing. Kevlar, a tough synthetic fiber, is being attached to vulnerable areas of the bomber to prevent repetition of an accident that occurred in 1987 when a B-1B was lost through birdstrike.

Dyess AFB, Tex., received the first operational B-1B in June 1985 and achieved IOC in October 1986. With deliveries now complete, Dyess AFB has 27 B-1Bs, Ellsworth AFB, S. D., has 34, and Grand Forks AFB, N. D., and McConnell AFB, Kan., each have 17 aircraft.

In 1987, a series of international speed and distance with payload records was set by the B-1B. On July 4, a 2,000-km closed circuit was covered at a speed of 1,078.2 km/h (669.96 mph) with a payload of 30,000 kg (66,140 lb). On September 17, a similar payload was carried around a 5,000-km circuit at 1,054.206 km/h (655.05 mph).

B-1B

B-2A

B-52G

Contractors: Rockwell International, North American Aircraft Operations; Eaton Corporation, AIL Division; Boeing Military Airplanes; and General Electric.

Power Plant: four General Electric F101-GE-102 turbofans; each 30,780 lb thrust.

Accommodation: four: pilot, copilot, and two systems operators (offensive and defensive).

Dimensions: span spread 136 ft 8½ in, fully swept 78 ft 2½ in, length 147 ft, height 34 ft.

Weights: empty, equipped 192,000 lb, gross 477,000 lb.

Performance: max speed at low level high subsonic (supersonic at altitude); range intercontinental.

Armament: three internal weapons bays capable of accommodating in a nuclear role 24 AGM-69 SRAMs, 12 B-28 or 24 B-61 or B-83 free-fall nuclear bombs; in a nonnuclear role up to 84 Mk 82 (500 lb) bombs or Mk 36 (500 lb) mines. Provisions exist for the internal carriage of eight cruise missiles on a Common Strategic Rotary Launcher (CSRL) and external carriage of up to 12 cruise missiles on six underfuselage stores stations.

B-2A (ATB)

Regarded as a program of the highest priority, the Advanced Technology Bomber (ATB), or B-2 as it is now officially known, was rolled out during ceremonies at Air Force Plant 42 in Palmdale, Calif., on November 22 last year. Of "flying wing" configuration, the B-2 has a central "fuselage" bulge accommodating a two- or three-man crew and the main weapons bay; on each side are mounted two nonafterburning turbofans, with streamlined overwing intake ducts and shielded overwing trailing-edge nozzles. Internal weapon capacity will be smaller than that of the B-1B.

The date for the first flight remains classified, but the first operational aircraft will be delivered to Whiteman AFB, Mo., in mid-1991, with the B-2 assuming the high-threat penetration role of the B-1B during the final years of that decade. Sophisticated technologies, in particular the use of low-observable (stealth) techniques, provide a low probability of engagement by currently projected Soviet air defenses, ensuring the system's effectiveness well into the next century. The Air Force plans to deploy 132 B-2s in the 1990s at a program cost of $42.5 billion (FY '81 dollars).

Prime Contractor: Northrop Corporation, with Boeing, LTV, and General Electric as key members of the development team.

Power Plant: four General Electric F118-GE-100 turbofans.

Dimensions (approx): span 172 ft, length 69 ft, height 17 ft.

B-52G/H Stratofortress

Although the B-1B is operational and the B-2 under development, the B-52 remains a vital element in the SAC inventory. The 261 B-52s currently operational are capable of delivering a wide range of weapons, including conventional and nuclear bombs, air-launched cruise missiles, and nuclear-tipped air-to-surface short-range attack missiles. Apart from their primary nuclear mission, the B-52s can be deployed in various conventional roles, including show of force, maritime interdiction, precision strikes, and defense suppression. Other collateral missions in recent years have included sea-surveillance flights, aerial minelaying and antisurface warfare operations in cooperation with the US Navy, and support for NATO exercises.

The two versions still in service are the **B-52G,** which introduced important changes, including a redesigned wing containing integral fuel tanks, fixed underwing external tanks, a new tail fin of reduced height and broader chord, and a remotely controlled tail gun turret that allowed the gunner to be repositioned with the rest of the crew; deliveries began in February 1959, and 193 were built; and the **B-52H,** the final version, which switched to TF33 turbofans, providing increased unre-

fueled range, and which has improved defensive armament, including a 20-mm Vulcan multibarrel tail gun; 102 were built, with deliveries starting in May 1961.

During the early 1970s, all B-52Gs and Hs were modified to carry AGM-69A short-range attack missiles (SRAMs). Additionally, all Gs and Hs have been equipped with an AN/ASQ-151 electro-optical viewing system (EVS), using forward-looking infrared (FLIR) and low-light-level TV sensors to improve low-level flight capability. Under USAF improvement programs begun in 1974, these models have been progressively updated with Phase VI avionics. These include ALQ-122 SNOE (smart noise operation equipment) and AN/ALQ-155(V) advanced ECM; an AFSATCOM kit permitting worldwide communications via satellite; a Dalmo Victor ALR-46 digital radar warning receiver; Westinghouse ALQ-153 pulse-Doppler tail warning radar; and an improved ITT Avionics ALQ-117 Pave Mint or ALQ-172 ECM jamming system. The G/Hs have also been fitted with a digital-based solid-state offensive avionics system (OAS) that includes inertial guidance, Tercom (terrain comparison) guidance, and microprocessors to upgrade their navigation and weapons delivery systems. This program was completed in 1986.

Because of the long range and diversified payload capabilities of their aircraft, two B-52G ALCM wings have been assigned to support conventional operations by employing airpower over great distances on short notice. With the continued improvement of Soviet defenses and the development and deployment of USAF's next-generation bombers, the role of the B-52 is changing to ALCM (AGM-86) carrier. A typical profile would see multiple ALCM launches at high altitude, often followed by B-52 low-level descent to attack additional targets using gravity weapons or SRAMs. USAF completed deployment of AGM-86s on 98 on-line B-52Gs, each with 12 external cruise missiles, in December 1984. As B-1Bs entered service, USAF also began deployment of ALCMs on 95 B-52Hs. Completion of this program is scheduled for FY '90. Full-scale production of the Common Strategic Rotary Launcher (CSRL), which will permit internal carriage of eight additional AGM-86s in the B-52H, is under way. This will allow a total ALCM offensive weapon load of 20 cruise missiles. Full operational capability for this system at all SAC B-52H bases is scheduled for late summer 1993.

All 69 non-ALCM modified B-52Gs, equipping four SAC units, had, by October 1 last year, assumed a primary conventional role. They achieved full operational capability in June 1985 in support of naval antisurface warfare operations through Harpoon employment. Two full squadrons are equipped for this role, based at Loring AFB, Me., for Atlantic operations, and at Andersen AFB, Guam, for Pacific operations.

Additionally, flight testing began in 1986 of an integrated conventional stores management system (ICSMS) for installation on the 69 non-ALCM B-52Gs. The ICSMS enables aircraft normally configured for the carriage of nuclear weapons to carry conventional weapons by rearranging data stored in the weapon systems computer, using a preprogrammed removable software cassette. IOC for the system was scheduled for last year. Future plans call for an increase in the number of B-52G/Hs assigned to the dual-role mission, capable of both nuclear and theater warfare, although the FY '90 budget proposals call for the deactivation of one squadron beginning in FY '90. *(Data for B-52G, except where noted.)*

Contractor: Boeing Military Airplanes.
Power Plant: eight Pratt & Whitney J57-P-43WB turbojets; each 13,750 lb thrust.
Accommodation: two pilots, side by side, plus navigator, radar navigator, electronic warfare officer, and fire control system operator (gunner).
Dimensions: span 185 ft 0 in, length 160 ft 10.9 in, height 40 ft 8 in.
Weight: G/H models gross more than 488,000 lb.
Performance (approx): max level speed at high altitude 595 mph, service ceiling 55,000 ft, range more than 7,500 miles.

FB-111A (J. Gaffney)

Armament: G model has four 0.50-caliber guns in tail turret; H model has 20-mm gun. G/H models carry eight SRAMs and nuclear free-fall bombs internally and 12 AGM-86B ALCMs instead of SRAMs externally. Provision for eight more ALCMs instead of SRAMs internally on H model. Alternatively, modified G models can carry eight to 12 Harpoons in underwing clusters.

FB-111A

Capable of providing high-precision, low-altitude weapons delivery in all weather, day or night, the FB-111A is a two-seat, medium-range, supersonic strategic bomber version of the swingwing F-111, developed originally to provide SAC with a replacement for early versions of the Stratofortress and supersonic B-58A Hustlers. The first of 76 production aircraft flew in July 1968, and the initial delivery was made in October 1969 to the 340th Bomb Group; 61 aircraft remain. Although the FB-111A primary mission is nuclear deterrence, its conventional weapons capability suits it to dual-role use. FB-111s will remain operational into the next century. Operational units equipped with FB-111As are the 380th and 509th Bomb Wings.

Contractor: General Dynamics Corporation.
Power Plant: two Pratt & Whitney TF30-P-7 turbofans; each 20,350 lb thrust with afterburning.
Accommodation: two, side by side.

F-4D

F-4E

F-4G

Dimensions: span spread 70 ft 0 in, fully swept 33 ft 11 in, length 73 ft 6 in, height 17 ft 1.4 in.
Weight (approx): gross 100,000 lb.
Performance: max speed at 36,000 ft Mach 2.5, service ceiling more than 60,000 ft, range 4,100 miles with external fuel.
Armament: up to four AGM-69A SRAM air-to-surface missiles on external pylons, plus two in the weapons bay, or six nuclear bombs, or combinations of these weapons; provision for up to 31,500 lb of conventional bombs.

Fighters

F-4 Phantom II

Although the F-4 continues to be replaced by the F-15 and F-16 in active USAF units, many hundreds are still operational. Designed in the mid-1950s, the F-4 has moved to a predominantly air-to-ground role, although it retains residual air-to-air capability. Continuous updating has maintained the effectiveness of the F-4, and under a 1986 contract the navigation and weapons delivery systems on some USAF and ANG F-4s will be modified. First version supplied to USAF was the **F-4C**, a two-seat twin-engine all-weather tactical fighter with J79-GE-15 turbojets, dual controls, an inertial navigation system, and boom flight refueling. F-4Cs still equip a few Air National Guard units. The **F-4D** introduced major systems changes, including new weapon ranging and release computers to increase accuracy in air-to-air and air-to-surface weapon delivery. F-4Ds equip both Air Force Reserve and Air National Guard units. All AFRES F-4s will be repainted gray-on-gray by 1990 to make them less visible at high altitudes. The **F-4E** was developed as a multirole fighter capable of performing counterair, close support, and interdiction missions. A 20-mm Vulcan multibarrel gun is fitted, together with an improved fire-control system and an additional fuselage fuel tank. Leading-edge slats, to improve maneuverability, were retrofitted to all USAF F-4Es. In addition, from early 1973, some were fitted with Northrop's target-identification system electro-optical (TISEO) as an aid to positive long-range visual identification of airborne or ground targets. System improvements include the Pave Tack system, which provides a day/night adverse weather capability to acquire, track, and designate ground targets for laser, infrared, and electro-optically guided weapons; the Pave Spike day tracking/laser ordnance designator pod, for use with "smart" weapons; and a digital intercept computer that includes launch computations for USAF AIM-9 and AIM-7 missiles. All ANG F-4Ds and Es are being modified to carry AIM-9L/M Sidewinder missiles; the F-4E version will also be equipped with improved AGM-65D Maverick TV-guided missiles and a new area-denial submunition, the CBU-87/89. The **F-4G "Advanced Wild Weasel"** is a modified F-4E with its gun replaced by AN/APR-38 electronic warfare equipment that enables it to detect, identify, and locate enemy radars and then direct against them weapons for their destruction or suppression. A performance upgrade program (PUP) is currently under way, aimed at upgrading the system's signal processor (Phase I) and extending the frequency range (Phase II). Installation of Phase I computers began last year. Primary armament includes Shrike (AGM-45) and HARM (AGM-88). *(Data for F-4E.)*

Contractor: McDonnell Aircraft Company, Division of McDonnell Douglas Corporation.
Power Plant: two General Electric J79-GE-17A turbojets; each 17,900 lb thrust with afterburning.
Accommodation: pilot and weapon systems operator in tandem.
Dimensions: span 38 ft 7½ in, length 63 ft 0 in, height 16 ft 5½ in.
Weights: empty 30,328 lb, gross 61,795 lb.
Performance: max speed at 40,000 ft Mach 2.0 class, range with typical tactical load 700 miles.
Armament: one 20-mm M61A1 multibarrel gun; provision for up to four AIM-7E Sparrow, AGM-45A Shrike, AGM-88A HARM, or AIM-9 Sidewinder missiles on four underfuselage and four underwing mountings, or up to 16,000 lb external stores.

F-5E/F Tiger II

Developed as the successor to Northrop's F-5A export fighter, the Tiger II was intended primarily to provide America's allies with an uncomplicated air-superiority tactical fighter that could be operated and maintained relatively inexpensively. The single-seat **F-5E**, first flown in August 1972, is basically a VFR day/night fighter with limited all-weather capability. Design emphasis is on maneuverability rather than high speed, notably through the use of maneuvering flaps. Well over 1,000 F-5Es and two-seat **F-5Fs** were delivered through early 1987, when the last two aircraft were delivered to an export customer.

TAC, assisted by ATC, trains pilots and technicians of user air forces. For this purpose, 20 F-5Es were supplied

to USAF, beginning in April 1973, before deliveries to foreign governments began the following year. TAC also operates two "aggressor squadrons" of camouflaged F-5Es, simulating late-model MiG threat aircraft, in "Red Flag" exercises at Nellis AFB, Nev. Similar training is provided by F-5Es of the 527th Tactical Fighter Training Aggressor Squadron, USAFE, at RAF Alconbury, England; and by PACAF's 26th Tactical Fighter Training Squadron, located at Clark AB, Philippines. However, this year, F-16s will begin replacing the F-5s for the aggressor mission.

In a program planned to upgrade USAF's 74 F-5Es and Fs, the current APQ-153 radar will be replaced by a new AN/APQ-159(V)5 or AN/APQ-159(V)6 radar, respectively, doubling detection range and incorporating off-boresight target acquisition and track-while-scan.

Contractor: Northrop Corporation, Aircraft Division.

Power Plant: two General Electric J85-GE-21B turbojets; each 5,000 lb thrust with afterburning.

Accommodation: pilot only.

Dimensions: span 26 ft 8 in, length 47 ft 4¾ in, height 13 ft 4¼ in. (F-5F length 51 ft 4 in, height 13 ft 2 in.)

Weights: empty 9,723 lb, gross 24,722 lb.

Performance (at 13,350 lb): max level speed at 36,000 ft Mach 1.64, service ceiling 51,800 ft, range with max fuel, with reserve fuel for 20 min at S/L (with external tanks retained), 1,543 miles.

Armament: two AIM-9 Sidewinder missiles on wingtip launchers; two M39-A2 20-mm cannon in nose, with 280 rounds per gun (one 20-mm in F-5F); up to 7,000 lb of mixed ordnance on four underwing attachments and one underfuselage station. Optional armament and equipment includes AGM-65 Maverick, laser-guided bombs, and centerline multiple ejector rack.

F-15 Eagle

As USAF's primary air-superiority fighter, the F-15 has been replacing the F-4 progressively since the mid-1970s. The original single-seat **F-15A** and two-seat **F-15B** were followed in June 1979 by the **F-15C** and **F-15D,** respectively, with 2,000 lb of additional internal fuel and provision for carrying conformal fuel tanks (CFTs). Basic F-15 equipment included a Hughes Aircraft APG-63 lightweight X-band pulse-Doppler radar for long-range detection and tracking of small high-speed objects down to treetop level. Under ongoing contracts initiated in February 1983, the F-15 is undergoing a multistage improvement program (MSIP). Improvements include a programmable armament control set (PACS), improved central computer, MIL-STD 1760 incorporation, an expanded tactical electronic warfare system (TEWS) providing improvements to the ALR-56C radar warning receiver and ALQ-135 countermeasures set, and provision for AMRAAM air-to-air missiles, augmenting the existing AIM-7 and AIM-9 air-to-air capability. Delivery of MSIP-equipped F-15s began in June 1985. An overload warning system, permitting safe maneuver to 9*g* throughout most of the flight envelope at flight design gross weights, is now being delivered in F-15C/Ds and is being retrofitted to earlier aircraft.

The **F-15E** is USAF's new two-seat, dual-role, totally integrated fighter for all-weather air-to-air and deep interdiction missions. The demonstrator was a modified two-seat F-15B with the rear cockpit upgraded to include four multipurpose CRT displays for radar, weapon selection, and monitoring of enemy tracking systems. Production F-15Es also have front cockpit modifications, including redesigned controls, a wide field of view head-up display, and three CRT multipurpose displays. The F-15E is capable of carrying up to 24,500 lb of ordnance. The digital, triple-redundant Lear Siegler flight-control system permits coupled automatic terrain following, and navigational accuracy is improved by a Honeywell ring laser gyro INS. For low-altitude, high-speed penetration and precision attack on tactical targets at night and in adverse weather, the F-15E carries a high-resolution Hughes APG-70 radar and LANTIRN (Low-Altitude Navigation and Targeting Infrared for Night) pods, with wide-field forward-looking infrared (FLIR).

To accommodate the new avionics, internal fuel capacity is reduced slightly, but the F-15E is fitted with CFTs, adapted to carry ordnance tangentially to reduce drag. In addition to its primary load of guided and unguided bombs and other air-to-ground weapons, the F-15E retains its air-superiority performance and weapons. Armament options include AIM-7F and M Sparrow, AIM-9J, L, M, and P Sidewinder, and AIM-120A AMRAAM, as well as AGM-65 Maverick, GBU-12/-24 laser-guided bombs, and GBU-15 glide bombs. A new engine bay has been developed by McDonnell Douglas to allow installation of either General Electric F110 or Pratt & Whitney F100 engines, and Pratt & Whitney's improved F100-PW-220 engines. Other improvements include foam filled fuel tanks for greater survivability, higher-rated generators, and an improved environmental control system. The first of three prototypes flew in December 1986, and the first production F-15E was delivered to the 405th TTW at Luke AFB, Ariz., in April last year. The first operational F-15E wing will be the 4th TFW at Seymour Johnson AFB, N. C., which received its first aircraft on December 29, 1988. Procurement of 392 F-15E Eagles is planned, with 134 already procured, and a further 36 planned for FY '90. Multiyear procurement is envisaged for FY '90–93. IOC is scheduled for later this year.

F-15A

F-15E

Planned production of all models of the F-15 totals 1,266 aircraft for USAF, plus the original 20 R&D models, by the mid-1990s. Units already equipped with Eagles include TAC's 57th FWW, 325th and 405th TTWs, and 1st, 33d, and 49th TFWs; USAFE's 32d TFS and 36th TFW; and PACAF's 18th TFW. First US air defense squadron to receive Eagles was the 48th FIS at Langley AFB, Va., followed by the 318th FIS at McChord AFB, Wash., and the 5th FIS at Minot AFB, N. D. In addition, the 57th FIS at NAS Keflavik, Iceland, received its first aircraft for the air defense role in July 1985. AAC's base at Elmendorf has been operational since 1982 in support of air defense.

Equipment of ANG units with F-15A/B aircraft began in 1985 with the 159th TFG, followed by the 116th TFW in 1986, the 154th Composite Group in 1987, and the 102d FIW in 1988.

In response to a USAF request made in 1983, McDonnell Douglas is developing and flight testing an advanced technology version of the F-15 with short takeoff and landing (STOL) and new maneuvering capabilities, designated **F-15 S/MTD** (STOL/Maneuvering Technology Demonstrator). Flight trials began on September 7 last year, initially to explore basic handling with active canards installed forward of the wings. Rectangular two-dimensional jet nozzles have been added in recent months, to evaluate their usefulness in vectoring engine thrust during takeoff and in-flight maneuvers, and for thrust reversal to shorten the landing run. The aircraft is expected to be capable of takeoff with full internal fuel and a 6,000 lb external payload from a 1,500 ft runway; landing run with payload expended is expected to be under 1,250 ft on a wet runway. Flying control, engine, steering, and braking functions are integrated with existing F-15 controls through a digital fly-by-wire system to take optimum advantage of the aircraft's added capability while reducing the pilot's work load. Radar, infrared, and inertial navigation systems will generate data to locate the runway and furnish guidance cues. *(Data for F-15C, except where stated.)*

Contractor: McDonnell Aircraft Company, Division of McDonnell Douglas Corporation.

Power Plant: two Pratt & Whitney F100-PW-100 turbofans; each approx 23,830 lb thrust. Improved F100-PW-220 will equip new F-15s.

F-16C

Accommodation: pilot only in F-15A/C; two seats in F-15B/D/E.

Dimensions: span 42 ft 9¾ in, length 63 ft 9 in, height 18 ft 5½ in.

Weights: empty 27,300 lb, gross 68,000 lb in F-15A/B/C/D; gross 81,000 lb in F-15E.

Performance: max speed Mach 2.5, service ceiling 60,000 ft, ferry range, with external fuel tanks, more than 2,878 miles; with CFTs, 3,570 miles.

Armament: one internally mounted M61A1 20-mm six-barrel cannon; four AIM-9L/M Sidewinder and four AIM-7F/M Sparrow air-to-air missiles, or eight AMRAAMs, carried externally. Provision for carrying up to 24,500 lb of ordnance on weapon stations on F-15E.

F-16 Fighting Falcon

The F-16 was developed to replace F-4s in the active force and to modernize the air reserve forces. Advanced technologies incorporated from the start in the single-seat **F-16A** and two-seat **F-16B** versions made them two of the most maneuverable fighters ever built. The advances include decreased structural weight through the use of composites, decreased drag resulting from reduced static stability margin, fly-by-wire flight controls with side stick controller, high *g* tolerance/high visibility cockpit with a 30-degree reclined seat and single-piece bubble canopy, blended wing-body aerodynamics with forebody strakes, and automatically variable wing leading-edge flaps. The F-16 is powered by a single afterburning turbofan. Equipment includes a multimode radar with clutter-free look-down capability, advanced radar warning receiver, a head-up display, internal chaff and flare dispensers, and a 500-round 20-mm internal gun. The aircraft also has provisions for ECM.

The F-16 entered operational service with TAC's 388th TFW at Hill AFB, Utah, in January 1979. Production of the F-16A and B for USAF ended in 1985. However, USAF and NATO operators are cooperating in an operational capabilities upgrade (OCU) program. The OCU program improves the radar, fire control computer, stores management computer, and avionics software, giving F-16A/Bs the ability to utilize next-generation air-to-air and air-to-surface weapon systems.

A forward-looking plan for the aircraft, known as the Multinational-Staged Improvement Program (MSIP), was implemented by USAF in February 1980 to assure the aircraft's capability to accept systems under development, thereby minimizing retrofit costs. As a first stage, all F-16s delivered since November 1981 have had built-in structural and wiring provisions and systems architecture that expand the single-seater's multirole flexibility. Stage two was applicable to the improved **F-16C** (single-seat) and **F-16D** (two-seat) versions, of which deliveries to USAF began in July 1984. Current aircraft have a Westinghouse APG-68 multimode radar with increased range and advanced ECCM, and advanced cockpit displays including a wide-angle head-up display with FLIR video. Shrike antiradiation missiles and multitarget AMRAAM compatibility were recently added to the F-16C/Ds. Also introduced were system improvements that include installation of a LANTIRN nav/attack system, GPS, EEGS, digital flight controls, automatic terrain following, advanced IFF, increased T-O weight and maneuvering limits, an 8,000-hour airframe and 9*g* capability. The airborne self-protection jammer (ASPJ), ALR-74 or ALR-56M advanced radar warning receiver, ALE-47 improved defensive countermeasures, increased performance F100-PW-229 and F110-GE-129 IPE engines, and full HARM/Shrike missile capability will follow.

A sophisticated research variant of the F-16, known as the **AFTI/F-16,** continues in use at Edwards AFB, Calif., to test and evaluate advanced fighter technologies, including flight control systems, pilot/vehicle interface, an automated maneuvering attack system, an advanced weapon interface, and close air support technologies.

Up to 270 of the original F-16As are being modified to **F-16 (ADF)** standard under a contract awarded in October 1986, to meet USAF's requirement for an air defense

F-111F

fighter to replace aging F-106s and F-4s in eleven ANG continental air defense squadrons. The APG-66 radar of these aircraft will be upgraded with an AMRAAM data link, provisions for AIM-7 Sparrows, improved ECCM, and improved capability against cruise missiles. New equipment will include HF radio, an IFF interrogator, ID light, a crash-survivable flight data recorder, and provisions for GPS. Armament will include the M61 gun and up to six missiles, including combinations of Sparrows, AMRAAMs, and Sidewinders. The F-16 (ADF) enters service this year, with the last modified aircraft due in 1991.

A further version, known as **Agile Falcon** or **MSIP IV,** with 25 percent larger composite wings, minor aerodynamic changes, and the IPE engine, is being pursued in the co-predevelopment stage, with the possibility of conducting a codevelopment and coproduction program with the European Participating Governments (EPG) of the F-16 Multinational Fighter Program (MNFP). A parallel effort is under way for an F-16A/B mid-life upgrade (MLU). The F-16 MLU will further enhance the capability of the F-16A/Bs while achieving maximum avionics commonality to the Agile Falcon.

Derivative F-16s are also being considered as close air support/battlefield air interdiction (CAS/BAI) aircraft (A-16) and as tactical air reconnaissance platforms. Future development and applications of the F-16 will be monitored under a program known as Falcon Century. USAF plans a total buy of 2,609 F-16s through FY '94. To date, 1,859 have been funded, with 1,562 to be delivered by the end of FY '89.

F-16s are standard equipment with 27 TAC, USAFE, and PACAF units and are progressively replacing older aircraft in the AFRES and ANG. F-16As also equip USAF's Thunderbirds air demonstration squadron. Over 1,100 more have been delivered to, or ordered for, the air forces of Bahrain, Belgium, Denmark, Egypt, Greece, Indonesia, Israel, the Netherlands, Norway, Pakistan, Singapore, South Korea, Thailand, Turkey, Venezuela, and the US Navy. Japan is planning to produce, in conjunction with the USG, a variant of the F-16 to be called **FSX.** *(Data for F-16C.)*

Contractor: General Dynamics Corporation.

Power Plant: one augmented turbofan. General Electric F110-GE-100 (27,600 lb thrust) and Pratt & Whitney F100-PW-220 (23,450 lb thrust) are alternative standard engines.

Accommodation: pilot only.

Dimensions: span over missiles 32 ft 9¾ in, length overall 49 ft 4 in, height 16 ft 8½ in.

Weights: empty (F100-PW-220) 18,335 lb, (F110-GE-100) 19,100 lb; gross 42,300 lb.

Performance: max speed Mach 2 class, service ceiling more than 50,000 ft, ferry range more than 2,000 miles.

Armament: one M61A1 20-mm multibarrel cannon, with 500 rounds, mounted in fuselage; wingtip-mounted infrared missiles; seven other external stores stations for fuel tanks and air-to-air and air-to-surface munitions.

ATF (YF-22A and YF-23A)

The aim of the Advanced Tactical Fighter (ATF) program is to produce the next-generation air-superiority fighter as a follow-on to the F-15 to counter the threat projected for the mid-1990s and beyond. ATF will be designed to penetrate high-threat enemy airspace and support AirLand Battle forces with a first-look, first-kill capability against multiple targets. It will combine a highly maneuverable airframe at both sub- and supersonic speeds with low-observable "stealth" technologies, sustained supersonic cruise capability without the use of afterburners, and advanced, significantly integrated avionics and weapon systems, permitting simultaneous engagement of multiple targets. To this end, VHSIC common signal processors are being developed to communicate with and tie together such avionics elements as radar, infrared search and track, and collections of major offensive and defensive functions. Projected armament includes such existing and planned

F-117A

weapons as AIM-9 Sidewinder and AMRAAM air-to-air missiles as well as an internal gun. Program emphasis from the outset has been on achieving a proper balance of reliability/supportability, affordability, survivability, and performance.

In 1986, the program was restructured to incorporate the development of prototype vehicles, implement Packard Commission recommendations, emphasize "fly before buy" competition, and reduce technical/cost risk for full-scale development (FSD). In October of the same year USAF awarded contracts to the Lockheed and Northrop Corporations to enter the 50-month demonstration/validation phase of the program. First flight of the prototype aircraft (Lockheed **YF-22A** and Northrop **YF-23A**) is expected in early 1990. FSD is scheduled to begin in FY '91. USAF has a stated requirement for 750 ATFs, with IOC by the mid-1990s. Lockheed has teamed with Boeing and General Dynamics, Northrop with McDonnell Douglas. Simultaneous demonstration and validation of ground-based avionics prototypes and development of ground-test General Electric YF120 and Pratt & Whitney YF119 prototype engines are also under way. Both aircraft will be required to fly with GE and P&W engines.

F-111

Maintaining USAF's around-the-clock, long-range, interdiction mission, four versions of this pioneer variable-geometry tactical aircraft were built. Deliveries of production **F-111As** to the first operational wing began in October 1967, and 141 were built. This version served with distinction in SEA in 1972–73 and currently equips the 366th TFW. The A was superseded in production by the **F-111E,** with modified air intakes that improved engine performance above Mach 2.2. Ninety-four were built, and most of these serve with the 20th TFW, based at RAF Upper Heyford in the UK, in support of NATO. The replacement of current analog bombing and navigation systems with digital equipment is scheduled to begin this year, with completion expected in 1993. This will enable F-111A/E aircraft to handle modern guided munitions and advanced sensors as well as future systems, such as the Global Positioning System (GPS). The **F-111D** was designed with advanced avionics, offering improvements in navigation and air-to-air weapon delivery. Ninety-six were built and equip the 27th TFW at Cannon AFB, N. M. The **F-111F,** of which 106 were built, has uprated turbofans. Equipping the 48th TFW at RAF Lakenheath, this version can carry in its weapons bay the Pave Tack system, which provides a day/night capability to acquire, track, and designate ground targets for laser, infrared, and electro-optically guided weapons.

Production of the F-111 was completed in 1976. Its EW capabilities are being updated with the ALQ-131/184 ECM pod system, and future improvements will include AIM-9L/M self-defense capability. In addition to its nuclear and conventional bombing and missile attack capability, the F-111 can carry up to twelve French Durandal parachute-retarded, rocket-boosted, runway attack bombs for low-altitude high-speed delivery, and Gator, USAF's first air-delivered mine system, which is compatible also with the A-7, A-10, F-4, F-15, F-16, and B-52.

The **EF-111A** is an ECM conversion of the F-111A *(see p. 138).* SAC has a strategic bomber version, designated **FB-111A** *(see p. 134).* The Royal Australian Air Force acquired 24 **F-111Cs** for strike duties, four of which were subsequently modified for tactical reconnaissance.

Contractor: General Dynamics Corporation.

Power Plant: F-111A/E: two Pratt & Whitney TF30-P-103 turbofans; each 18,500 lb thrust with afterburning. F-111D: two TF30-P-109 turbofans; each 19,600 lb thrust with afterburning. F-111F: two TF30-P-111 turbofans; each approx 25,100 lb thrust with afterburning.

Accommodation: crew of two side by side in escape module.

Dimensions: span spread 63 ft 0 in, fully swept 31 ft 11.4 in, length 73 ft 6 in, height 17 ft 1.4 in.

Weights (F-111F): empty 47,481 lb, gross 100,000 lb.

Performance (F-111F): max speed at S/L Mach 1.2, max speed at altitude Mach 2.5, service ceiling more than 59,000 ft, range with max internal fuel more than 2,925 miles.

Armament: two nuclear bombs in internal weapon bay; four swiveling wing pylons carrying total external load of up to 25,000 lb of bombs, rockets, missiles, or fuel tanks.

F-117A

Years of secrecy were ended on November 10, 1988, when USAF released a first, heavily retouched photograph of Lockheed's long-rumored "Stealth fighter." It proved very different in form from any of the artists' impressions that had appeared since the program was launched in 1978. Even the designation F-19 favored by most commentators proved to be incorrect, as the aircraft is known officially as the F-117A. Few details have yet been given officially, except that the F-117A is a single-seat twin-engine aircraft operated by the 4450th Tactical Group based at the Tonopah Test Range airfield, Nev. It first flew in June 1981 and achieved IOC in October 1983, according to the Pentagon. Fifty-nine have been ordered to date, of which 52 were delivered by last November. They had been restricted mainly to night flying, to maintain secrecy, and three were lost in much-publicized accidents. Eighteen specially equipped A-7Ds had also been assigned to the 4450th TG as companion trainers.

The F-117A's designers, in the famous Lockheed "Skunk Works" at Burbank, Calif., have relied on the completely new concept of "faceting" to give the aircraft its all-important minimal radar signature. The skin panels of the arrowhead-shape airframe are divided into many small perfectly flat surfaces, which reflect away at a variety of angles all signals from probing hostile ground or airborne radars. Much of the aircraft's external surface is made of radar-absorbent composite materials. The engine air intakes and exhaust nozzles are above the wings and stubby rear fuselage, respectively, to shield them from infrared seekers.

It is known that the F-117A can be carried on board a C-5 Galaxy with its wings folded or removed. Span has been quoted as about 40 ft, and the power plant is reported to comprise two General Electric F404 nonafterburning turbofans, implying low noise emissions and subsonic performance. Fly-by-wire flight controls and a powerful stability augmentation system are said to be fitted, and to be vital features of an aircraft known to pilots as the "Wobbly Goblin." Its primary role is almost certainly low-level precision attack on high-priority targets, using internally-stowed air-to-surface missiles.

Attack and Observation Aircraft

A-7D/K Corsair II and YA-7F

Operated by ANG units in ten states and Puerto Rico, the **A-7D Corsair II** is a single-seat subsonic close air support and interdiction aircraft, of which 459 were delivered between 1968 and 1976. Thirty-one **A-7K** combat-capable two-seat training models were delivered from April 1981. The A-7Ds have demonstrated outstanding target kill capability, initially in Southeast Asia. This is achieved with the aid of a continuous-solution navigation and weapon-delivery system, including all-weather radar bomb delivery, and is undergoing continuous update. Pave Penny laser target-designation pods were installed on 383 A-7Ds. LTV is modifying 75 A-7Ds and eight A-7Ks for low-altitude night attack (LANA) capability, with a wide-angle head-up display, forward-looking

infrared (FLIR), and automatic terrain following (ATF) systems to provide round-the-clock effectiveness. The first LANA-equipped A-7 was delivered in July 1987 to the 150th TFG. LTV has also tested augmented wing flaps and spoilers to enhance flight control characteristics. A new single-piece windscreen that offers increased visibility and greater protection against birdstrike is currently being tested by the 162d TFG.

Under a contract awarded in May 1987, LTV is upgrading two LANA-equipped A-7Ds to supersonic "A-7 Plus" configuration, under the official designation **YA-7F.** The aim is to provide the Air Force with a close air support/battlefield air interdiction (CAS/BAI) aircraft to support the Army's AirLand Battle concept into, and beyond, the next decade. Modifications include a lengthened fuselage to accommodate a new afterburning engine and additional fuel; an airframe-mounted accessory drive unit for self-contained ground operations; wing strakes, an extended vertical tail, automatic maneuvering flaps, trailing-edge flap augmentors, and lift dump spoilers to enhance maneuverability; upgraded avionics; and provision for AGM-65 Maverick and AIM-9 Sidewinder missile operation. Flight testing is scheduled to begin at Edwards AFB, Calif., this spring and will continue until 1990. Around 335 A-7Ds and Ks could be modified to A-7F standard. *(Data for A-7D.)*

Contractor: LTV Aerospace and Defense Company (formerly Vought Corporation).
Power Plant: one Allison TF41-A-1 nonafterburning turbofan; 14,500 lb thrust.
Accommodation: pilot only.
Dimensions: span 38 ft 9 in, length 46 ft 1½ in, height 16 ft 0¾ in.
Weights: empty 19,781 lb, gross 42,000 lb.
Performance: max speed at S/L 698 mph, ferry range with external tanks 2,871 miles.
Armament: one M61A1 20-mm multibarrel gun; up to 15,000 lb of air-to-air or air-to-surface missiles, bombs, Gator mines, rockets, or gun pods on six underwing and two fuselage attachments.

A-10A/OA-10A Thunderbolt II

Designed specifically for the close air support (CAS) mission, the **A-10** offers a combination of large military load, long loiter, and wide combat radius. In a typical antiarmor close air support mission, the A-10, affectionately nicknamed "Warthog," could fly 150 miles and remain on station for an hour. It can carry up to 16,000 lb of mixed ordnance with partial fuel or 12,086 lb with full internal fuel. The 30-mm GAU-8/A gun can fire 2,100 or 4,200 rds/min and provides a cost-effective weapon with which to defeat the whole array of ground targets encountered in the CAS role, including tanks. The A-10 achieves its survivability through a combination of high maneuverability and design features that make it a "hard" aircraft. Equipment includes an inertial navigation system, head-up display, laser seeker, ECM, target penetration aids, self-protection systems, and associated equipment for Maverick missiles and air-to-air missiles.

Delivery of 713 A-10s was completed in March 1984. The first operational squadron was activated at Myrtle Beach AFB, S. C., in June 1977, and achieved operational capability in October. Pave Penny laser target-designation pods, introduced in 1978, are standard equipment for the aircraft. The first IR Maverick-equipped A-10 squadron became fully operational at RAF Bentwaters, UK, in February 1986. Introduction of the AIM-9 missile system for self-defense has begun by configuring the aircraft to accommodate dual rail adapters with associated launchers.

Recently, two squadrons from USAF's 81st TFW at RAF Bentwaters moved to the 10th TFW at RAF Alconbury, leaving RAF Bentwaters and Woodbridge with four A-10 squadrons. TAC A-10 units are the 23d and 354th TFWs and the 355th TTW. The 57th FWW, Nellis AFB, Nev., also has some A-10s. AAC's 18th TFS at Eielson AFB, Alaska, and PACAF's 25th TFS at Suwon AB, Korea, are also A-10 equipped.

A-10s were the first first-line aircraft to be assigned to the ANG; they equip the 128th and 174th TFWs and the 103d, 104th, and 175th TFGs. A-10s also equip the 442d and 917th TFWs and the 926th and 930th TFGs of AFRES.

In October 1987, the first of 24 operational and two backup **OA-10s** entered the inventory of the 23d Tactical Air Support Squadron for use in the forward air control (FAC) mission. These aircraft are A-10s that have been redesignated and are intended to be used also for combat escort, search and rescue, and visual reconnaissance. The 30-mm GAU-8/A gun is retained as well as some or all of the 16,000 lb of ordnance.

Contractor: Fairchild Republic Company, Division of Fairchild Industries.
Power Plant: two General Electric TF34-GE-100 turbofans; each 9,065 lb thrust.
Accommodation: pilot only.
Dimensions: span 57 ft 6 in, length 53 ft 4 in, height 14 ft 8 in.
Weights: empty 24,959 lb, max gross 50,000 lb.

A-7D (J. Rhodes)

A-10A

AC-130H

Performance: combat speed at S/L, clean, 439 mph; range with 9,500 lb of weapons and 1.7 hr loiter, 20 min reserve, 288 miles.
Armament: one 30-mm GAU-8/A gun; eight underwing hard points and three under fuselage for up to 16,000 lb of ordnance, including various types of free-fall or guided bombs, combined effects munition (CEM) dispensers, gun pods, six AGM-65 Maverick missiles, or four AIM-9 Sidewinder missiles, and jammer pods. Chaff and flares carried internally to counter radar- or infrared-directed threats. The centerline pylon and the two flanking fuselage pylons cannot be occupied simultaneously.

AC-130A/H/U Spectre

Two versions of the AC-130 gunship are currently in USAF service. **AC-130As** are operated by the Air Force Reserve's 711th SOS at Eglin AFB, Fla.; **AC-130Hs** continue in active service with US Special Operations Command's 1st Special Operations Wing's 16th SOS. AC-130As are equipped with two 40-mm cannon, two 20-mm Vulcan cannon, and two 7.62-mm Miniguns. AC-130Hs are similar, except that one 40-mm cannon is replaced with a 105-mm howitzer and the 7.62-mm Miniguns are deleted. Both models are equipped with sensors and target-acquisition systems, including forward-looking infrared and low-light-level TV. AC-130Hs are equipped for in-flight refueling. Under an improvement program announced in spring 1987, AC-130Hs will be fitted with new fire control computers, navigation equipment, and sensors by FY '92.

In July 1987, Rockwell was awarded a contract to cover research and development of a new **AC-130U** side-firing gunship to replace the aging and increasingly unsupportable AC-130A version. A total of twelve AC-130Us will be procured, using new C-130H airframes supplied by Lockheed, with the aim of producing aircraft capable of combining intense firepower with the latest methods of target location and increased loiter capability. AC-130Us will have a highly accurate suite of 105-mm, 40-mm, and 25-mm guns that can be slaved to FLIR, low-light-level television (LLLTV), or strike radar, permitting night and/or adverse weather operations. ECM will enhance survivability in a low-to-medium threat environment. Apart from their primary precision fire support mission, the air-refuelable AC-130Us will be capable of performing other special operations roles, including escort, surveillance, and reconnaissance/interdiction. Rollout of the first aircraft is expected next year, and it is hoped to complete delivery of all twelve aircraft to the 16th SOS by the end of 1992, with full IOC by 1993. *(Data basically as for C-130; see p. 142.)*

OV-10A

OA-37B Dragonfly

A-37B Dragonfly ground support aircraft withdrawn from operational service with AFRES have been adapted for forward air control duty, replacing O-2As in ANG's 110th, 111th, and 182d Tactical Air Support Groups. There are some OA-37Bs in TAC's 602d TACW at Davis-Monthan AFB, Ariz., and at 24th Composite Wing, Howard AFB, Panama. Those at Davis-Monthan are being replaced by OA-10s.

Contractor: Cessna Aircraft Company.
Power Plant: two General Electric J85-GE-17A turbojets; each 2,850 lb thrust.
Accommodation: two, side by side.
Dimensions: span over tip-tanks 35 ft 10½ in, length excluding fuel probe 28 ft 3¼ in, height 8 ft 10½ in.
Weights: empty 6,211 lb, gross 14,000 lb.
Performance: max level speed at 16,000 ft 507 mph, service ceiling 41,765 ft, range with max payload, including 4,100 lb ordnance, 460 miles.
Armament: one GAU-2B/A 7.62-mm Minigun installed in forward fuselage, four pylons under each wing able to carry various combinations of rockets and bombs.

OV-10A Bronco

This counterinsurgency combat aircraft, first flown in August 1967, was acquired by USAF for use in the forward air control role and for limited quick-response ground support pending the arrival of tactical fighters. A total of 157 was delivered to USAF before production for the US services ended in April 1969; these equip TAC, PACAF, and AAC units. Versions are also in service with USN, US Marine Corps, and foreign air forces.

Contractor: Rockwell International Corporation, Aircraft Operations.
Power Plant: two Garrett T76-G-416/417 turboprops; each 715 hp.
Accommodation: two, in tandem.
Dimensions: span 40 ft 0 in, length 41 ft 7 in, height 15 ft 2 in.
Weights: empty 6,893 lb, overload gross weight 14,444 lb.
Performance: max speed at S/L, without weapons, 281 mph; service ceiling 24,000 ft; combat radius with max weapon load, no loiter, 228 miles.
Armament: four fixed forward-firing M60C 7.62-mm machine guns; four external weapon attachment points under short sponsons, for up to 2,400 lb of rockets, bombs, etc.; fifth point, capacity 1,200 lb, under center fuselage. Provision for carrying one Sidewinder missile on each wing and, by use of a wing pylon kit, various stores, including rocket and flare pods and free-fall ordnance. Max weapon load 3,600 lb.

Reconnaissance and Special-Duty Aircraft

SR-71A/B "Blackbird"

Assigned to the 9th Strategic Reconnaissance Wing at Beale AFB, Calif., the multisensored **SR-71A** Blackbird remains the fastest, highest-flying production aircraft yet built, despite more than twenty years of service. Its mission is to respond to national and strategic requirements and to support theater commanders throughout the spectrum of conflict. Advanced equipment is capable of specialized coverage of up to 100,000 sq miles of territory in one hour, by day and night, and in all weather. In July 1976, flown by three USAF crews, the SR-71 set an absolute world speed record of 2,193.167 mph over a 15/25 km straight course, a speed of 2,092.294 mph around a 1,000-km closed circuit, and a sustained altitude of 85,069 ft in horizontal flight. Another SR-71A flew from New York to London, England, in 1 hr 54 min 56.4 sec in September 1974 at an average speed of 1,806.987 mph. The prototype flew for the first time in December 1964, and delivery of production aircraft began in January 1966. The **SR-71B** is a two-seat training version, with elevated rear cockpit. Current plans call for withdrawal of the Blackbird from service this fall.

Contractor: Lockheed Corporation.
Power Plant: two Pratt & Whitney JT11D-20B (J58) turbojets; each 34,000 lb thrust with afterburning.
Accommodation: crew of two in tandem.
Dimensions: span 55 ft 7 in, length 107 ft 5 in, height 18 ft 6 in.
Weights (estimated): empty 60,000 lb, gross 170,000 lb.
Performance (estimated): max speed at 78,750 ft more than Mach 3, operational ceiling above 80,000 ft.
Armament: none.

U-2 and TR-1

Production of the basic U-2 began in the late 1950s. It is essentially a powered glider, with high aspect ratio wings and lightweight structure, designed to carry out strategic reconnaissance for long periods at very high altitudes. Fifty-five are believed to have been built, in various forms. All have similar dimensions except for the **U-2R,** which has much increased span and length. This is now the primary version. A further two U-2Rs, equipped with "superpods," are due for delivery this year. Air Force U-2s have performed important nonmilitary missions, including flights for the Department of Agriculture land management and crop estimate programs; photographic work in connection with flood, hurricane, and tornado damage; data gathering for a geothermal energy program; and search missions for missing boats and aircraft.

A derivative of the U-2R, the **TR-1A,** is a single-seat tactical reconnaissance aircraft designed for high-altitude standoff surveillance missions in Europe. Initial funding was provided by the FY '79 budget. A total of 26 aircraft (including one ER-2 for NASA) was ordered through FY '86, leaving three to be funded to complete the planned inventory of 26 TR-1As for USAF, plus two two-seat **TR-1Bs.** Each TR-1 is equipped with electronic sensors to provide continuously available, day or night, all-weather surveillance of the battle area, or potential battle area, in direct support of US and allied ground and air forces during peace, crises, and war situations. They include an advanced synthetic aperture radar system in side-looking airborne radar (SLAR) form and modern ECM. The first TR-1A flew on August 1, 1981, and pilot training at Beale AFB, Calif., began later that year. The first of 14 TR-1s now stationed with USAF's 95th Reconnaissance Squadron at RAF Alconbury in the UK arrived in February 1983. Although operating in Europe, they remain under the jurisdiction of SAC. *(Data for TR-1A/U-2R.)*

Contractor: Lockheed Corporation.
Power Plant: one Pratt & Whitney J75-P-13B turbojet; 17,000 lb thrust.
Dimensions: span 103 ft 0 in, length 63 ft 0 in, height 16 ft 0 in.
Weight: gross 40,000 lb.
Performance: max cruising speed at over 70,000 ft more than 430 mph, range more than 3,000 miles.
Armament: none.

RF-4C

This unarmed multisensor version of the F-4C Phantom II was developed to replace the day-only RF-101 for day/night, all-weather reconnaissance operations. The first production RF-4C flew in May 1964, and 505 were built before manufacture ended in December 1973. They are operated by four TAC, USAFE, and PACAF tactical reconnaissance squadrons and by five squadrons of the ANG. The RF-4 was the first tactical aircraft equipped with a forward-looking radar capable of simultaneous terrain-following and low-altitude navigation. The basic aircraft is configured with conventional optical cameras for day operations and infrared (IR) sensors for night. Both the radar and the camera systems are housed in a modified nose, which increases the length of the aircraft by 33 compared with the fighter version. Twenty-four RF-4Cs were fitted with a tactical electronic reconnaissance (TEREC) sensor for locating electronic emitters. Other equipment includes the ARN-101 digital avionics system for improved navigation accuracy and greater reconnaissance capability; and data link transmission of TEREC intelligence in near real time to enhance timeliness of information to tactical decision-makers. An advanced radar warning receiver is currently being developed for the RF-4C, but proposals to replace the aircraft's cameras with electro-optical sensors, under the joint-service Advanced Tactical Air Reconnaissance System (ATARS) program, have been abandoned due to the limited long-term survivability of these aircraft. *(Data similar to F-4.)*

RF-4C (A. Lloyd)

TR-1A

SR-71 being refueled by a KC-10A

EC-130

Several variants of the basic C-130 have been produced for specialized missions, including the **EC-130E ABCCC** (known until 1977 as C-130E-II) used as an airborne battlefield command and control center by the 7th Airborne Command and Control Squadron at Keesler AFB, Miss., a geographically separated unit of the 28th Air Division, Tinker AFB, Okla.; the **EC-130E "Volant Solo II"** electronic surveillance version operated by the 193d Special Operations Group, ANG, from Middletown, Pa.; and the **EC-130H "Compass Call"** enemy communications jammer operated by the 41st Electronic Combat Squadron at Davis-Monthan AFB, Ariz., also a geographically separated unit of the 28th Air Division, and the 66th Electronic Combat Wing at Sembach AB, West Germany. Altogether, 16 EC-130Hs are in service. An upgrade program was scheduled to start in FY '88. *(Data basically as for C-130.)*

EC-135, etc.

Several aircraft in the KC-135 Stratotanker series were modified for specialized missions during production or at a later date. Thirty-nine are modified for strategic airborne command and control missions. Five KC-135A tankers were converted for airborne command post use by SAC in 1960. Additional aircraft were modified in 1962, and 17 new production KC-135B turbofan aircraft entered the system in 1965. Currently, **EC-135A/C/G/H/J/L/P** aircraft are assigned to SAC, TAC, PACAF, and USAFE. They are fitted with extensive communications equipment to support strategic command and control missions of their respective CINCs. At least one SAC EC-135C is airborne at all times, accommodating a flight crew of four, a general officer, and a staff of 18. EC-135Cs can be refueled by SAC tankers. Thirteen are in service and have been adapted to provide control of Minuteman ICBMs. TAC provides overseas deployment control of tactical fighters with the **EC-135K.** Planned modifications to the EC-135 aircraft in FY '89 include continuing the ultrahigh frequency line-of-sight system replacement, the initial Milstar transition satellite communications terminals, and the Peacekeeper upgrades to airborne launch control aircraft. Future enhancements include full Milstar capability and improved low- and very low-frequency radios and antennas.

Three **EC-135N Advanced Range Instrumentation Aircraft (ARIA)** are operated by ASD's 4950th Test Wing as telemetry and voice relay stations to supplement land and sea receiver stations for DoD and NASA space and missile programs. The aircraft's distinctive bulbous nose houses the world's largest airborne steerable antenna.

Versions of the C-135 Stratolifter series used for reconnaissance include turbofan **RC-135Vs** and **RC-135Ws,** equipped also for electronic reconnaissance with SAC, **RC-135Ss,** and **RC-135Us. WC-135Bs,** converted C-135Bs, provide MAC with atmospheric sampling capability. In addition, a highly instrumented version, designated **NKC-135** ALL (Airborne Laser Laboratory), has been utilized by USAF as a test-bed in support of the HEL (High Energy Laser) research program. The primary objective was to acquire technology data on laser operations that might have combat potential in the airborne environment. The NKC-135 has been retired to the Air Force Museum.

In order to minimize the cost of retrofitting the special-purpose 135s with more efficient turbofan engines, USAF has installed in some aircraft refurbished Pratt & Whitney JT3D-3Bs taken from Boeing 707-100B aircraft purchased as surplus from commercial air carriers. *(Data basically as for C-135.)*

EF-111A Raven

The EF-111A Raven is a conversion of the basic General Dynamics F-111A airframe fitted with mainly off-the-shelf components that enable it to accomplish important defense suppression missions in worldwide support of US tactical strike forces. Its ALQ-99E primary jammer is a modification of the Navy ALQ-99 and is carried internally. This very powerful system's frequency coverage, reliability, and effective use of available jamming power enable the EF-111A to suppress extremely dense electronic defenses. Other equipment includes self-protection systems from the F/FB-111 (ALQ-137, ALR-62). The crew capsule is revised, and a new vertical stabilizer houses the ALQ-99E receivers. An upgrade program for the EF-111A is currently under way with improvements to the ALQ-99E being undertaken to enable the system to counter advanced electronic defenses for the 1990s and beyond.

Forty-two EF-111As were produced for missions that include barrier surveillance jamming, degradation of acquisition radars during close air support operations, and escort jamming for deep strike missions. Flight testing began in March 1977, and the first "production" EF-111s were delivered in late 1981 to the 366th TFW at Mountain Home AFB, Idaho, where they achieved initial operational capability with the 390th Electronic Combat Squadron in December 1983. Second operational location was at RAF Upper Heyford in the UK, where the first EF-111 arrived in February 1984 for the 42d ECS. Aircraft from this unit took part in the attack on Libyan targets in April 1986.

Contractor: Grumman Aerospace Corporation.
Power Plant: two Pratt & Whitney TF30-P-103 turbofans; each 18,500 lb thrust with afterburning.
Accommodation: crew of two, side by side in escape module.
Dimensions: span spread 63 ft 0 in, fully swept 31 ft 11.4 in, length 76 ft 0 in, height 20 ft 0 in.
Weights: empty 55,275 lb, gross 88,948 lb.
Performance: max combat speed 1,377 mph, service ceiling with afterburning at combat weight 45,000 ft, combat radius with reserves 230–929 miles, according to mission.
Armament: none.

E-3 Sentry (AWACS)

AWACS is a mobile, flexible, survivable, and jamming-resistant surveillance and command control and communications (C^3) system capable of all-weather, long-range, high- or low-level surveillance of all air vehicles, manned or unmanned, above all kinds of terrain. A modified Boeing 707-320B (AWACS) carries an extensive complement of mission avionics, including computer, radar, IFF, communications, display, and navigation systems. The capability of AWACS is provided by its Westinghouse Electric Corporation look-down radar, which makes possible all-altitude surveillance over land or water, thus correcting a serious deficiency in earlier surveillance systems.

The E-3 serves a dual role within USAF: as a command and control center to support quick reaction deployment and tactical operations by TAC units, and as a survivable early warning command and control center for identification, surveillance, and tracking of airborne enemy forces and for the command and control of NORAD forces over the continental USA.

Deliveries of the basic production version, designated **E-3A Sentry,** began in March 1977, when the first aircraft was handed over to TAC's 552d Airborne Warning and Control Wing at Tinker AFB, Okla. Twenty-four were built. Twenty-two of them, plus two prototypes, have been upgraded to **E-3B** configuration. Improvements include much enhanced computer capabilities, antijam communications, an austere maritime surveillance capability, additional radio communications, and five additional display consoles. The first E-3B was redelivered to the 552d AWACW in July 1984.

A **US/NATO Standard E-3A** configuration was introduced starting with the 25th production USAF Sentry, delivered in December 1981. In this version, the data processing capability is improved and a maritime detection capability included. Nine were built for USAF, and one of the original E-3As was upgraded to this standard. NATO operates a further 18, purchased as part of a cooperative program to upgrade the command and control of NATO's air defense forces. Saudi Arabia has five E-3s; Britain's Royal Air Force and the French Air Force have also selected the E-3 for future service.

In 1984, the ten US Standard E-3A aircraft began their upgrade to **E-3C**, with additional command and control capability.

A $425 million multistage improvement program (MSIP) for the E-3 was proposed by ESD, to be phased over five years. Eventually, all USAF and NATO E-3s will be equipped with the Joint Tactical Information Distribution System (JTIDS) for antijam digital communications. As a first step, Boeing was awarded a contract in May 1987 for E-3 improvements that include full-scale development and integration into US and NATO aircraft of an ESM system that will detect signals emitted by both hostile and friendly targets. Additional enhancements to US E-3s will include upgrading of JTIDS to TADIL-J (tactical digital information link-J) capability, computer upgrade, and ability to employ the GPS. Full-scale development of a major radar upgrade under the Radar System Improvement Program (RSIP) was due to start last August, to improve capability against low radar cross section fighters, cruise missiles, and jammers. IOC for these improvements is scheduled for FY '93.

E-3s assumed a US continental air defense role in January 1979, when NORAD personnel began augmenting TAC E-3 flight crews on all operational NORAD missions by 28th Air Division's 552d AWACW from Tinker AFB. Overseas units of the 28th Air Division include the 960th, 961st, and 962d AWAC Squadrons based, respectively, at NAS Keflavik, Iceland, Kadena AB, Japan, and Elmendorf AFB, Alaska. Deployments have been made to the Pacific, the Middle East, Southwest Asia, the Mediterranean area, and Europe. AWACS aircraft are also used in support of the US drug enforcement program.

EC-135J (J. Gaffney)

EF-111A

E-3

E-8A

E-9A

Contractor: Boeing Aerospace.
Power Plant: four Pratt & Whitney TF33-PW-100/100A turbofans; each 21,000 lb thrust.
Accommodation: basic operational crew of 20, including 16 AWACS mission specialists.
Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 41 ft 9 in.
Weight: gross 325,000 lb.
Performance: max speed 530 mph, service ceiling above 29,000 ft, endurance six hr on station 1,000 miles from base.

E-4B

SAC is the Air Force single resource manager for the E-4 airborne command post aircraft, the main operating base for which is Offutt AFB, Neb. Three **E-4As** were built initially to support the National Emergency Airborne Command Post (NEACP). Each had a modified Boeing 747 airframe and provided an interim capability by utilizing existing EC-135 command control and communications (C^3) equipment. Four fully developed **E-4B** Airborne Command Post aircraft (three of them converted from E-4A) now support the NEACP mission. They are hardened against the effects of nuclear explosions, including electromagnetic pulse, equipped for in-flight refueling, contain a 1,200kVA electrical system designed to support advanced electronics, and have a wide variety of communications equipment. This includes a more powerful LF/VLF system, improved satellite communications system, and communications processing equipment. These systems have antijam features and will support operations in a nuclear environment over extended ranges. The E-4B system is capable of tying in to commercial telephone and radio networks and could, potentially, be used for radio broadcasts to the general population. Additional improvements, to include a data processing capability and more survivable C^3, including initial Milstar modification, are planned for FY '89. The first E-4B entered service with SAC in January 1980, and the first operational mission was flown in March of that year.

Contractor: Boeing Aerospace.
Power Plant: four General Electric CF6-50E2 turbofans; each 52,500 lb thrust.
Dimensions: span 195 ft 8 in, length 231 ft 4 in, height 63 ft 5 in.
Weight: gross 800,000 lb.
Performance: unrefueled endurance in excess of 12 hours.

E-8A Joint STARS

In September 1985, Grumman received a $657 million contract for full-scale development of the USAF/US Army Joint Surveillance and Target Attack Radar System (Joint STARS). Boeing has modified two 707-320 airframes as vehicles for the airborne equipment. Grumman is responsible for subsystems installation, integration, and flight testing of the equipment, which will include a Norden multimode side-looking radar antenna, some 25 ft long, faired into the belly of each aircraft. The radar will operate in synthetic aperture radar (SAR) mode to detect and locate stationary objects, such as parked tanks, and will alternate between SAR and Doppler to locate and track slow-moving targets. The Joint STARS system will then direct attack on the targets, via the Joint Tactical Information Distribution System (JTIDS).

The first modified airframe was delivered to Grumman in August 1987, with the second delivered in November 1988. First flight of a Joint STARS aircraft took place in April 1988. The system will be temporarily deployed in Europe in FY '90 and '91 to demonstrate its capabilities in the NATO environment. After this, a decision will be taken on whether or not to proceed to production of about 22 operational E-8As and 88 ground stations to receive data from the aircraft. Each E-8A is expected to carry a crew of 19 US Army and USAF specialists.

Contractor: Grumman Melbourne Systems Division.

E-9A

Under this designation, two highly modified Boeing Canada (de Havilland) DHC Dash 8M aircraft are operated by the Air Force Air Defense Weapons Center at Tyndall AFB, Fla., as airborne platform telemetry relay aircraft. Each is equipped with a sensor suite developed by the Sierra Research Division of LTV, including an AN/

APS-128D sea surveillance radar in a ventral radome and a five-beam, electronically steerable, 75-square-foot phased-array telemetry antenna, in a starboard side fuselage fairing. This is capable of automatically detecting, tracking, and relaying data simultaneously from five distinct sources traveling at speeds of Mach 5 or more. It will be used for low-altitude over-the-horizon telemetry gathering during missile tests and for sea surveillance in order to keep boats out of the Gulf Test Range during tests.

Contractor: de Havilland Division of Boeing Canada.
Power Plant: two Pratt & Whitney Canada PW120A turboprops; each 1,800 shp. (No military designation on these engines).
Accommodation: three: pilot, copilot, and systems operator.
Dimensions: span 85 ft 0 in, length 73 ft 0 in, height 24 ft 7 in.
Weight: gross 33,000 lb fully fueled.
Performance: max speed at 25,000 ft 245 mph, max operational altitude 25,000 ft, loiter time 5 hr.

EC-18B/D

The **EC-18B Advanced Range Instrumentation Aircraft (ARIA)** is a modified former American Airlines Boeing 707-320 series transport, of which four have replaced some of the EC-135N ARIAs that were operated by ASD's 4950th Test Wing. In common with the EC-135 ARIAs, the 707s are converted to house the world's largest airborne steerable antenna in a bulbous nose, with a probe antenna on each wingtip, and a completely new cockpit configuration. Range, cabin space, and fuel efficiency are all increased to provide greater support for the expanding ARIA mission, including DoD and NASA space and missile programs. Following conversion, the first EC-18B was flown for the first time in February 1985 and entered operational service in January 1986. All four were expected to be fully operational last year. A sonobuoy missile impact location system (SMILS) of the kind fitted on some USN P-3s is currently under development for the EC-18B.

A $42.6 million contract was recently awarded to Electrospace Systems Inc. to modify two Boeing 707s for use as dedicated Cruise Missile Mission Control Aircraft (CMMCA). Designated **EC-18D**, they will, after the completion of flight tests in early 1991, be flown by the 4750th TW at Wright-Patterson AFB, Ohio, in support of USN and SAC missile testing. They will also be capable of monitoring and controlling unmanned aerial vehicles.
Contractor: Boeing Military Airplanes.

WC-130E/H

Modified C-130 Hercules transports, designated **WC-130E** and **H**, are equipped for weather reconnaissance duties, including penetration of tropical storms to obtain data for forecasting of storm movements. They are assigned to the 41st Rescue and Weather Reconnaissance Wing of MAC's 23d Air Force and the 403d TAW of AFRES. *(Data similar to C-130.)*

X-29A Forward Swept Wing Demonstrator

Flight testing of the unique X-29 Forward Swept Wing (FSW) multitechnology demonstrator has been under way at NASA's Dryden Flight Research Center at Edwards AFB, Calif., since December 1984. A reexamination of the FSW principle was made both practical and feasible by the introduction of advanced lightweight composite materials that eliminate many of the problems encountered with conventional metal construction. Day-to-day management of the program was handed over to NASA following acceptance of the aircraft by USAF's Aeronautical Systems Division in March 1985. USAF manages flight-test support.

The two X-29 demonstrators were built by Grumman. A standard Northrop F-5A forward fuselage and nose landing gear and many off-the-shelf components, such as F-16 main landing gear and control surface actuators, were utilized on each aircraft to reduce costs. Integrated with a triplex fly-by-wire flight-control system, the X-29's forward-swept wings, made of strong, lightweight graphite composites, and its stubby canards, which act as its main control surfaces, combine to enhance lift and reduce drag. In flight, the wings' trailing-edges change shape continuously to match flight conditions. The canards, flaperons, and strake flaps at the tail work together to enhance maneuverability.

The early phase of the flight program, following the installation of an improved backup flight-control system in the fall of 1985, was aimed at testing stability and control loads, flutter, and wing divergence up to 40,000 ft and at speeds up to Mach 1.5. The first supersonic flight took place in December 1985, when preliminary data showed Mach 1.03 airspeed at an altitude of 40,000 ft. This phase ended in December 1986 after 104 flights. Before commencement of the second phase, a calibrated engine with two thrust measuring systems for performance data, a NASA noseboom calibrated for air

EC-18B

X-29A

data measurements, and upgraded instrumentation, were installed. On June 8, 1988, this first X-29 made its 200th flight, a record for a single X-series aircraft. Performance and asymmetric load testing have been completed, after a total of 242 flights.

Following allocation of the necessary funding, work on design modification and installation of flight test instrumentation on the second X-29 began in the summer of 1987. It was expected to begin exploring the low-speed, high-angle-of-attack side of the envelope in the spring of this year.

Contractor: Grumman Corporation.
Power Plant: one General Electric F404-GE-400 turbofan; 16,000 lb thrust class.
Accommodation: pilot only.
Dimensions: span 27 ft 2½ in, length overall 53 ft 11¼ in, height 14 ft 3½ in.
Weights: empty 13,800 lb, gross 17,800 lb.
Performance: max level speed approx Mach 1.6.

NASP/X-30A

A **National Aerospace Plane (NASP)** research program, initiated jointly by DoD and NASA, could lead to a new-generation, economical, reusable, hypersonic aircraft/space-launch vehicle for military and civilian purposes in the twenty-first century. The NASP will take off and land horizontally on a runway, like a conventional aircraft, and will employ ramjet/scramjet engines burning liquid or slush hydrogen. The Air Force has been assigned overall responsibility for the NASP research program, with participation from Navy, SDIO, DARPA, and NASA.

The current technology development phase (Phase II) of the program began in April 1986, when DoD and NASA announced the award of seven contracts for propulsion and airframe development. The original propulsion contracts were awarded to General Electric and Pratt & Whitney; original airframe contractors were Boeing, Lockheed, General Dynamics, McDonnell Douglas, and Rockwell International. Following engine and airframe concept reviews in 1987, Pratt & Whitney and Rocketdyne were selected to continue engine development and General Dynamics, McDonnell Douglas, and Rockwell were selected to continue airframe design and component development, with each contractor working openly on different areas of materials research.

An experimental aircraft, designated **X-30**, will be used in the third phase of the program to develop, prove, and demonstrate aerospace plane technologies throughout the flight envelope for hypersonic cruise and acceleration to low earth orbit. Selection of contractors for X-30 fabrication is expected in late 1990 with a first flight anticipated in the mid-1990s. Demonstration of single-stage-to-orbit could occur as early as 1996.

C-5B

Transports and Tankers

C-5A/B Galaxy

This long-range, air-refuelable, heavy logistics transport flew for the first time in June 1968. Delivery of 81 basic **C-5As** began in December 1969 and was completed by May 1973. Each aircraft is capable of airlifting loads up to 291,000 lb, such as two M60 tanks or three CH-47 Chinook helicopters, over transoceanic ranges. Under a major modification program, initiated in 1978, Lockheed produced component kits to extend the service life of the C-5A's wings by 30,000 flight hours, without load restrictions. These kits replaced only the five main load-carrying wing boxes, to which other existing components were transferred. The use of 7175-T73511 aluminum alloy provided greater strength and resistance to corrosion. Installation of production kits began in 1982, and modification of all 77 aircraft in the inventory was complete by July 1987. In December 1984, the 433d MAW at Kelly AFB, Tex., became the first AFRES unit to be equipped with "AFRES-owned" C-5As. ANG's 105th MAG at Newburgh, N. Y., received its first C-5As in July 1985. In October 1987, AFRES's 439th MAW at Westover AFB, Mass., also began replacing its C-130s with C-5As.

To meet an urgent need for additional heavy airlift capacity, USAF is acquiring 50 **C-5Bs**, generally similar to the C-5A, but embodying all the improvements that have been introduced since completion of C-5A production. These include the strengthened wings, General Electric TF39-GE-1C turbofans, and updated avionics, including Bendix color weather radar and Delco triple INS. The original MADAR (MAlfunction Detection Analysis and Recording) instrument units are replaced by the more advanced MADAR II. The first C-5B flew for the first time on September 10, 1985, and was delivered to Altus AFB, Okla., on January 8, 1986. Deliveries are scheduled for completion this year, the two operational C-5B units (each with 23 aircraft) being the 60th MAW at Travis AFB, Calif., and the 436th MAW at Dover AFB, Del. As "Bs" are delivered, the earlier "A" models are being transferred to the ANG and AFRES. Eighty-five C-5s are now within the purview of the US Transportation Command (USTRANSCOM), which was activated in October 1987. *(Data for C-5B.)*

Contractor: LASC Georgia Division of Lockheed Corporation.
Power Plant: four General Electric TF39-GE-1C turbofans; each 43,000 lb. thrust.
Accommodation: crew of five, rest area for 15 (relief crew, etc.); 75 troops and 36 standard 463L pallets or assorted vehicles, or additional 270 troops.
Dimensions: span 222 ft 8½ in, length 247 ft 10 in, height 65 ft 1½ in.
Weights: empty 374,000 lb, max operational payload 291,000 lb, gross (for 2*g*) 837,000 lb.
Performance: max speed at 25,000 ft 571 mph, service ceiling (at 615,000 lb) 35,750 ft, range with max payload 3,434 miles, range with max fuel 6,469 miles.

C-9A/C Nightingale

Derived from the DC-9 Srs 30 commercial airliner, the **C-9A** is an aeromedical airlift transport, in service since August 1968. Modifications include a special-care compartment with separate atmospheric and ventilation controls. Delivery of 21 to MAC's 375th Aeromedical Airlift Wing was completed by February 1973; this unit is now augmented by the 73d AAS (Assoc) of AFRES, collocated at Scott AFB, Ill. The Nightingale also performs overseas theater aeromedical evacuation missions in Europe and the Pacific. Three specially configured **C-9Cs** were delivered to the 89th Military Airlift Wing at Andrews AFB, Md., in 1975 for Presidential and other US governmental duties. *(Data for C-9A.)*

Contractor: Douglas Aircraft Company, Division of McDonnell Douglas Corporation.
Power Plant: two Pratt & Whitney JT8D-9 turbofans; each 14,500 lb thrust.
Accommodation: crew of three; 40 litter patients or 40 ambulatory patients, or a combination of both, plus five medical staff.
Dimensions: span 93 ft 3 in, length 119 ft 3 in, height 27 ft 6 in.
Weight: gross 108,000 lb.
Performance: max cruising speed at 25,000 ft 565 mph, ceiling 35,000 ft, range more than 2,000 miles.

C-12 Huron

Thirty military versions of the Beechcraft Super King Air 200 were delivered to USAF under the designation **C-12A.** Their role is to support attaché and military assistance advisory missions throughout the world. MAC uses two C-12As to train aircrews and to supplement support airlift. C-12As refitted with PT6A-42 engines are redesignated **C-12E.**

MAC uses 40 passenger/cargo-capable Super King Air B200Cs (**C-12Fs**) at eleven bases throughout CONUS, PACAF, and USAFE for the time-sensitive movement of people and cargo. The C-12Fs, along with the C-21A aircraft, replaced the CT-39 fleet. The ANG has six **C-12Js** (military versions of the 19-passenger Beechcraft 1900C) ordered in FY '85, the first of which was delivered in September 1987. *(Data for C-12A.)*

Contractor: Beech Aircraft Corporation.

Power Plant: two Pratt & Whitney Canada PT6A-38 turboprops; each 750 shp. (C-12F: 850 shp PT6A-42s.)

Accommodation: crew of two; up to eight passengers or 4,764 lb of cargo. Convertible to aeromedical evacuation configuration.

Dimensions: span 54 ft 6 in, length 43 ft 9 in, height 15 ft 0 in.

Weight: gross 12,500 lb.

Performance: max speed at 14,000 ft 301 mph, service ceiling 31,000 ft, range at max cruising speed 1,824 miles.

C-17A

Funding for the first six production versions of the C-17 heavy-lift, air-refuelable cargo transport has been approved. Developed to meet US force projection requirements, the C-17 will provide intertheater and intratheater airlift of all classes of military cargo, including outsize. It will be able to operate routinely into small, austere airfields (3,000 ft × 90 ft) previously restricted to C-130s and provide the first capability to airland or airdrop/extract outsize cargo in the tactical environment. The C-17 will not only enhance US airlift capability across the board but will provide much needed force structure modernization. The C-17 will be based at active-duty locations as well as at Air Force Reserve and Air National Guard bases.

McDonnell Douglas was announced as the selected prime contractor in August 1981 and received a low-level research and development contract the following July. This was intended to cover C-17 technologies that would also benefit other airlift programs while preserving the option to proceed to full-scale development (FSD) work on the C-17. FSD was approved in February 1985. Initial procurement funding was authorized in the FY '87 budget, together with continued R&D. The first two production aircraft were funded in FY '88. The FY '89 budget approved $941.1 million for continued R&D as well as procurement of four more production aircraft. Six are requested in the FY '90 budget proposals. A new plant at Macon, Ga., has begun producing major subassemblies. Subcontractors for the C-17 program include Beech Aircraft Corporation (composite winglets); Delco Electronics Corporation (mission computer and electronic display system); Grumman Aerostructures (ailerons, rudder, and elevators); GEC Avionics (advanced HUD); Lockheed (wing components); LTV Aircraft Products (vertical and horizontal stabilizers, engine nacelles); and Honeywell Inc. (support equipment, electronic flight control system, and air data computers).

Current plans envisage first flight in FY '90, with IOC for 12 aircraft in FY '92. Delivery of the planned buy of 210 C-17s would be completed by the year 2000. The 437th MAW at Charleston AFB, S. C., has been designated as the first C-17 unit.

Prime Contractor: Douglas Aircraft Company, Division of McDonnell Douglas Corporation.

Power Plant: four Pratt & Whitney F117-PW-100 turbofans; each 40,700 lb thrust.

Accommodation: normal flight crew of two, plus loadmaster. Provisions for the full range of military airlift missions.

Dimensions: span 165 ft 0 in, length 175 ft 2 in, height 58 ft 0 in.

Weights: max payload (2.25*g*) 172,200 lb, gross 580,000 lb.

Performance (estimated): normal cruising speed at height 518 mph (Mach 0.77), range with 167,000 lb payload 2,765 miles.

C-20A/B Gulfstream III

USAF has acquired eleven off-the-shelf Gulfstream III transports, each with accommodation for five crew and 14 passengers, for VIP duties, to replace aging, fuel-inefficient C-140Bs. Three **C-20As** and one **C-20B**, delivered to the 89th Military Airlift Wing in FY '83 and FY '84 under a lease/purchase agreement, were subsequently purchased. Another seven C-20Bs, with advanced mission communications equipment and revised interior, were ordered in January 1986. As these were delivered to Andrews AFB, Md., the original three C-20As were transferred to Ramstein AB, West Germany, in support of 58th MAS's special airlift mission in Europe. The C-20s provide the Special Airlift Mission (SAM) fleet with intercontinental range and ability to operate from short runways.

Contractor: Gulfstream Aerospace Corporation.

Power Plant: two Rolls-Royce F113-RR-100 turbofans; each 11,400 lb thrust.

Accommodation: crew of five; 14–18 passengers.

Dimensions: span 77 ft 10 in, length 83 ft 1 in, height 24 ft 4½ in.

C-17A

C-20

C-21A

C-26A

Weight: gross 69,700 lb.

Performance: max cruising speed 561 mph, service ceiling 45,000 ft, range 4,050 miles.

C-21A

USAF operates 78 C-21A aircraft (military versions of the Learjet 35A). These aircraft, together with the C-12Fs, replaced the CT-39 fleet and are used to provide operational support airlift from 16 bases for time-sensitive movement of people and cargo throughout the United States and the Pacific and European theaters, including aeromedical missions if required. In 1987, the ANG acquired four C-21As to replace its T-39s based at Andrews AFB, Md.

Contractor: Learjet Corporation.

Power Plant: two Garrett TFE731-2A turbofans; each 3,500 lb thrust.

Accommodation: crew of two and up to eight passengers or 3,153 lb cargo. Convertible to aeromedical evacuation configuration.

Dimensions: span 39 ft 6 in, length 48 ft 8 in, height 12 ft 3 in.

Weight: gross 18,500 lb.

Performance: cruising speed Mach 0.81, service ceiling 45,000 ft, range with maximum passenger load 2,420 miles, with maximum cargo load 1,653 miles.

C-22B

Under the designation C-22B, four Boeing 727 commercial transports have been purchased and are being modified for use by ANG on operational support airlift missions. Two aircraft will be further modified to accommodate an additional 1,100 gallons of fuel and landing gear rated for 170,000 lb gross landing weight.

C-23A Sherpa

Eighteen Sherpa light transports were delivered to USAF between November 1984 and December 1985. They are operated by MAC and controlled by CINCUSAFE, primarily to ferry aircraft spares and complete engines to bases throughout Europe.

First flown on December 23, 1982, the Sherpa is an all-freight version of the Shorts 330 regional airliner, with a 6 ft 6 in square cabin section over an unimpeded hold length of 29 ft. Through loading is provided via a large forward freight door, a full-width hydraulically operated rear ramp door, and removable roller conveyors. The USAF aircraft are used in the European Distribution System (EDS) aircraft program, centered on Zweibrücken AB, Germany, with main warehousing facilities at RAF Kemble in the UK and Torrejon AB in Spain. In peacetime, the Sherpas service at least 20 USAF bases, in a system analogous with the civil air freight operation carried out by Federal Express in the US. They have reduced transit time on delivery of parts from as long as a week to only one to four days.

Contractor: Short Brothers PLC.

Power Plant: two Pratt & Whitney Canada PT6A-45R turboprops; each 1,198 shp.

Accommodation: crew of three; up to 7,000 lb of freight, including four LD3 containers, and engines the size of the F100 series.

Dimensions: span 74 ft 8 in, length 58 ft 0½ in, height 16 ft 3 in.

Weight: gross 22,900 lb.

Performance: max cruising speed at 10,000 ft 218 mph, range 789 miles with 2,800 lb payload.

VC-25A

USAF has assigned the military designation VC-25A to the two specially equipped presidential aircraft, based on Boeing 747-200B airframes, that will replace the current primary and backup "Air Force One" transports (C-137Cs). The new aircraft will have a Bendix Aerospace EFIS-10 electronic flight instrument system and state-of-the-art on-board communications equipment. Delivery to USAF is scheduled for November of this year and late 1990 respectively.

Contractor: Boeing Military Airplanes.

Power Plant: four General Electric CF6-80C2B1 turbofans, each 56,750 lb thrust.

Accommodation: crew of 23; up to 70 passengers.

Dimensions: span 195 ft 8 in, length 231 ft 10 in, height 63 ft 5 in.

Weight: gross 833,000 lb.

Performance: high speed cruise Mach 0.88–0.91, normal cruising speed Mach 0.84, unrefueled range in excess of 7,140 miles.

C-26A

In March 1988, Fairchild received an order for six of its Metro III commuter transport aircraft, with an option on seven more, to replace ANG C-131s, under the designation C-26A. The aircraft are being delivered between March and August of this year, to serve in the ANGOSTA (Air National Guard Operational Support Transport Aircraft) role. They have a quick-change interior, enabling passenger seats to be replaced by a medevac or cargo carrying configuration.

Contractor: Fairchild Aircraft Corporation.

Power Plant: two Garrett TPE331-11U-612G turboprops, each 1,100 shp.

Accommodation: crew of two; 19–20 passengers.
Dimensions: span 57 ft 0 in, length 59 ft 4¼ in, height 16 ft 8 in.
Weights: empty 9,180 lb, gross 16,000 lb.
Performance: max cruising speed 320 mph, service ceiling 27,500 ft, range with 19 passengers, 1,324 miles.

C-29A

Six British Aerospace 125-800 business-jet type aircraft, equipped with a state-of-the-art LTV-Sierra flight inspection system, are being acquired. The MAC flight inspection mission provides worldwide, all-weather, certified instrument approaches, traffic control and landing system equipment, and air-ground communications evaluation during contingency or wartime operations. The six C-29As will replace the aging C-140s and T-39As currently accomplishing the mission. The BAe 125-800 is also a contender in USAF's Tanker Transport Training System (TTTS) competition *(see p. 144).*
Contractor: British Aerospace PLC.
Power Plant: two Garrett TFE731-5R-1H turbofans, each 4,300 lb thrust.
Accommodation: crew of two on flight deck.
Dimensions: span 51 ft 4½ in, length 51 ft 2 in, height 17 ft 7 in.
Weight: gross 27,400 lb.
Performance: max level speed and max cruising speed at 29,000 ft 525 mph, service ceiling 43,000 ft, range with max payload 3,305 miles.

CT-39A/B Sabreliner

Acquired in the late 1950s and early 1960s, the CT-39 Sabreliner became increasingly less cost-effective and has been replaced in MAC by the C-12F and C-21A. The few CT-39A/B basic utility and training aircraft still in the inventory are in service with AFSC and with MAC facility checking squadrons, which use two Sabreliners, together with three C-140As, to evaluate communications and navigation aids at Air Force bases. In addition, ATC has acquired CT-39As in support of the Air Force Instrument Flight Center.
Contractor: Sabreliner Division of Rockwell International Corporation.
Power Plant: two Pratt & Whitney J60-P-3 turbojets; each 3,000 lb thrust.
Accommodation: crew of two; four to seven passengers.
Dimensions: span 44 ft 5 in, length 43 ft 9 in, height 16 ft 0 in.
Weights: empty 9,300 lb, gross 17,760 lb.
Performance: max speed at 36,000 ft 595 mph, service ceiling 39,000 ft, range 1,950 miles.

C-130 Hercules

Remarkably, still in production almost 40 years after TAC issued its original design specification, basic and specialized versions of the aptly named C-130 Hercules continue to perform a diversity of roles worldwide, including airlift support, DEW Line and Arctic ice cap resupply, aeromedical missions, aerial spray missions, and fire-fighting duties for the US Forest Service. The initial production model was the **C-130A**, first flown in April 1955, with 3,750 ehp Allison T56-A-11 or -9 turboprops; 219 were ordered, and deliveries began in December 1956. Specially modified C-130As of the 356th TAS, AFRES, based at Rickenbacker ANGB, Ohio, are used for aerial spraying, typically to suppress a possible epidemic of dengue hemorrhagic fever in San Juan, caused by a specific type of mosquito. Two **DC-130As** (originally GC-130As) were built as drone launchers/directors for ARDC (now AFSC), carrying up to four drones on underwing pylons. All special equipment was removable, permitting the aircraft to be used as freighters, assault transports, or ambulances, as required. The **C-130B** introduced 4,050 ehp Allison T56-A-7 turboprops; the first of 134 entered USAF service in April 1959. Six C-130Bs were modified in 1961 for airsnatch recovery of classified USAF satellites by the 6593d Test Squadron at Hickam AFB, Hawaii. Twelve **C-130Ds** were modified C-130As for use in the Arctic, with wheel-ski landing gear, increased fuel capacity, and provision for JATO. The **C-130E** is an extended-range development of the C-130B, with large underwing fuel tanks; 389 were ordered for MAC and TAC, with deliveries beginning in April 1962. A wing modification recently completed to correct fatigue and corrosion on USAF's current force of 492 C-130B/Es will extend the life of the aircraft well into the next century. Ongoing modifications include a self-contained navigation system (SCNS) to enhance navigation capabilities, especially in the low-level environment. SCNS incorporates an integrated communications navigation management system that features the USAF standard laser-gyro inertial navigation unit and the 1553B databus. Installation was scheduled to begin early this year on 477 aircraft. Other modifications include enhanced station-keeping equipment (ESKE), 50kHz VOR/ILS receivers, secure voice capability, and replacement radar for the adverse weather air delivery system (AWADS). Another major modification installs a state-of-the-art autopilot that incorporates a ground proximity warning system (GPWS). Fourteen C-130Es were modified to **MC-130E (Combat Talon I)** standard and equipped for use in low-level deep-penetration tactical missions by the 1st, 7th, and 8th Special Operations Squadrons based in the Philippines, West Germany, and Florida, respectively. Eleven are scheduled for an extensive modification to enhance their Special Operations Low Level (SOLL) capability. The MC-130E is being supplemented by the improved, night/adverse weather, low-level **MC-130H (Combat Talon II),** of which 18 had been funded by FY '88. By 1991 the inventory is expected to include 22 of these aircraft, equipped with terrain-following radar, precision navigation/airdrop, in-flight refueling, the Fulton STAR midair recovery system, and self-protection systems. First flight was in December 1987, and the initial operational unit will receive the first four aircraft in early FY '90, following completion of the qualification and operational flight test and evaluation program. Generally similar to the "E," the basic **C-130H** has uprated T56-A-15 turboprops, a redesigned outer wing, updated avionics, and other, minor improvements; delivery began in April 1975; by last year 337 C-130Hs and derivatives had been ordered for the US services. Four **LC-130Hs**, modified with wheel-ski gear, have been acquired by the ANG. Other variants include **HC-130H/N/P** for MAC's 23d Air Force and MAC-gained units of the ANG and Reserve, and the **AC-130A/H/U** and **WC-130E/H**, described separately. ANG C-130s acquired a new role in 1987, when about nine aircraft were assigned to ANG fighter wings and groups to provide support for jet fighter units on deployments. *(Data for C-130H.)*
Contractor: LASC Georgia Division of Lockheed Corporation.
Power Plant: four Allison T56-A-15 turboprops; each 4,508 ehp.
Accommodation: crew of five; up to 92 troops, 64 paratroops, 74 litter patients, or up to five 463L standard freight pallets, etc.
Dimensions: span 132 ft 7 in, length 97 ft 9 in, height 38 ft 3 in.
Weights: operating empty 76,469 lb, max payload 50,000 lb, gross 175,000 lb.
Performance: max cruising speed at 20,000 ft 374 mph, service ceiling (at 130,000 lb) 33,000 ft, range with max payload 2,356 miles.

KC-135R

MC-130H

MC-130E

HC-130

Constituting a major element of MAC's 23d Air Force, the **HC-130H** is an extended-range version of the C-130, ordered in 1963, with uprated T56-A-15 engines and specialized search and rescue equipment for the recovery of aircrews and retrieval of space hardware. This includes advanced direction-finding equipment and air-to-air recovery (ATAR) systems. Initial flight was made in December 1964, and 43 were delivered. Crew complement is ten to 12. An update program announced in spring 1987 includes a self-contained navigation system (SCNS), night vision goggles lighting, and new communications and navigation equipment for 31 HC-130Hs, 21 of which will also be equipped for in-flight refueling. Seventeen **HC-130Ps** are similar, but adapted to refuel helicopters in flight. Four **JHC-130H** conversions were fitted with equipment for aerial recovery of reentering space capsules. Under a 1974 USAF contract, another HC-130H was modified by LAS to **DC-130H** standard, with four pylons each capable of carrying a 10,000 lb new-generation RPV. Fifteen **HC-130Ns,** a search-and-rescue version of the HC-130P with advanced direction-finding equipment, were ordered in 1969; these aircraft are also capable of in-flight refueling of helicopters. *(Other data similar to C-130.)*

C-131 Samaritan

The very last thirty-year-old-plus Convair C-131 twin-engine transports are used by ANG for support airlift. However, the type has been almost entirely replaced by C-130 Hercules aircraft.

KC-135 Stratotanker

As single manager of all USAF KC-135 tanker aircraft, SAC supports its own refueling requirements as well as aerial refueling requirements of other Air Force commands, the US Navy and Marines, and other nations. In particular, the KC-135 is an integral part of the Single Integrated Operational Plan (SIOP), providing mission-critical fuel to the strategic bomber force. Although similar in size and appearance to commercial 707 aircraft, the KC-135 was designed to military specifications, incorporates different structural details and materials, and was designed to operate at high gross weights. The KC-135 fuel tankage is located in the "wet wings" and in fuel tanks below the floor in the fuselage. First flight of the **KC-135A** was in August 1956, and by 1966 a total of 732 had been built. Five hundred and ninety-four remain in operational service, though many have been modified to later standards in three programs initiated to enhance the KC-135's capability and extend its operational utility well into the next century. First, the selection of 22,000 lb thrust General Electric/SNECMA F108-CF-100 (CFM56) fuel-efficient engines for retrofit of the KC-135 fleet was announced in 1980. Reengined aircraft are designated **KC-135R** and have a gross weight of 322,500 lb. They embody modifications to 25 major systems/subsystems and not only carry more fuel farther but also have reduced maintenance costs, are able to operate from shorter runways, and are less pollution-prone. The first KC-135R flight was in August 1982, and first deliveries were to SAC in July 1984; the 134th reengined aircraft was delivered in November 1988. USAF plans to acquire 375 modification kits by FY '92. Second, the JT3D reengining program upgraded the 134 KC-135As serving in thirteen ANG and three AFRES units to **KC-135E** standard; the JT3D turbofans, removed from surplus commercial 707s, permit an increased gross weight of 299,000 lb. The last KC-135E was redelivered in January

1988. Finally, the Life Extension Structural Modification has provided for renewal of the lower wing skin, enabling the fleet of KC-135s to remain fully operational past the year 2020. Development of new and improved aerial refueling systems is also under way. The first camouflaged KC-135 made its debut in 1987. *(Data for KC-135A.)*

Contractor: Boeing Military Airplanes.
Power Plant: four Pratt & Whitney J57-P-59W turbojets; each 13,750 lb thrust.
Accommodation: crew of four or five; up to 80 passengers.
Dimensions: span 130 ft 10 in, length 136 ft 3 in, height 38 ft 4 in.
Weights: empty 98,466 lb, gross 297,000 lb.
Performance: max speed at 30,000 ft 585 mph, service ceiling 50,000 ft, range with 120,000 lb of transfer fuel 1,150 miles, ferry mission 9,200 miles.

C-135 Stratolifter

Thirteen C-135 transports and variants, without the KC-135's refueling equipment, remain operational with MAC. They were ordered originally to serve as interim jet passenger/cargo transports, pending delivery of C-141s. Three converted KC-135s were followed by 45 production Stratolifters in two versions: the **C-135A** with J57-P-59W turbojets and **C-135B** with Pratt & Whitney TF33-P-5 turbofans. Eleven "Bs" were retrofitted with revised interior for VIP transportation; others became **WC-135Bs** and **RC-135E/Ms.** Additionally, two C-135s belonging to ASD's 4950th Test Wing were permanently modified as Laser Communications Airborne Test-beds for the Have Lace program. Data similar to KC-135, except:

Dimension: length 134 ft 6 in.
Weights (C-135B): operating weight empty 102,300 lb, gross 275,500 lb.
Accommodation (C-135B): 60 passengers.
Performance (C-135B): max speed 600 mph, range with 54,000 lb payload 4,625 miles.

C-137 Stratoliner

Six specially modified Boeing 707 transports are operated by MAC's 89th Military Airlift Wing from Andrews AFB, Md., for VIP duties. Best known is "Air Force One," a **C-137C** for use by the President. It is basically a 707-320B with a special VIP interior. Two other C-137Cs are also operated, together with three smaller 707-120s, originally designated VC-137As but later modified to **C-137B** standard by the installation of turbofan engines. Both "Air Force One" and its backup are to be replaced by modified Boeing 747-200Bs (VC-25As) in November of this year and late next year.

Contractor: The Boeing Company.
Power Plant: four Pratt & Whitney JT3D-3 turbofans; each 18,000 lb thrust.
Dimensions: C-137B span 130 ft 10 in, length 144 ft 6 in, height 42 ft 0 in; C-137C span 145 ft 9 in, length 152 ft 11 in, height 42 ft 5 in.
Weights: C-137B gross 258,000 lb; C-137C gross 322,000 lb.
Performance (C-137C): max speed 627 mph, service ceiling 42,000 ft, range 5,150 miles.

C-140 JetStar

Just three C-140A JetStars remain in service, used by MAC to evaluate landing systems, navigational aids, and radar approach and control equipment.

Contractor: Lockheed-Georgia Company.
Power Plant: four Pratt & Whitney J60-P-5A turbojets; each 3,000 lb thrust.
Accommodation: crew of five.
Dimensions: span 54 ft 11 in, length 60 ft 5 in, height 20 ft 5 in.
Weight: gross 40,920 lb.
Performance: max cruising speed at 20,000 ft 550 mph, ceiling above 45,000 ft, range with reserves 2,280 miles.

C-141A/B StarLifter

The **C-141A** began operations with MAC in April 1965. Two hundred and eighty-five were built, some of which were structurally modified to accommodate the 82,207 lb Minuteman ICBM. During operational use it became clear that the cargo compartment was often fully loaded without the aircraft's maximum payload capability being utilized. In order to realize the C-141's full potential, USAF funded modification of the entire force of 270 (now 266) aircraft to **C-141B** standard, except for four AFSC aircraft used for test purposes. The fuselage was lengthened by 23 ft 4 in, and an in-flight refueling capability was added. The first production C-141B was delivered to USAF in December 1979, and the final modified StarLifter was obtained in June 1982, ahead of schedule and below projected cost. The modification significantly increased MAC's airlift capability, giving USAF the equivalent of 90 additional C-141A aircraft. Under the Pacer Center program initiated in 1987, a center wing structural modification is under way, aimed at extending the C-141's flying life by 15,000 hours. Plans call for the modification of the entire fleet. Other C-141 modification plans include provision of 50kHz VOR/ILS receivers, secure voice capability on UHF and HF radios, permanently mounted SATCOM antennas, and a digital display fuel indicating system. A program to install a state-of-the-art autopilot and all-weather landing system with enhanced flight display instrumentation is a major modification to enhance maintenance supportability. In addition, thirteen 437th MAW C-141Bs are scheduled for modifications to increase their Special Operations Low Level (SOLL) capability and survivability.

During 1986–87, 16 C-141s were transferred from the active force, eight to AFRES's 459th TAW at Andrews AFB, Md., and eight to ANG's 172d TAG at Jackson MAP, Miss. A total of 80 aircraft will be transferred by 1997. Meanwhile, 234 C-141Bs have moved under the purview of the US Transportation Command (USTRANSCOM). *(Data for C-141B.)*

Contractor: Lockheed-Georgia Company.
Power Plant: four Pratt & Whitney TF33-P-7 turbofans; each 21,000 lb thrust.
Accommodation: crew of five; cargo on 13 standard 463L pallets. Alternative freight or vehicle payloads, 200 fully equipped troops, 155 paratroops, or 103 litter patients plus attendants.
Dimensions: span 159 ft 11 in, length 168 ft 3½ in, height 39 ft 3 in.
Weights: operating 149,000 lb, max payload 89,000 lb, gross 343,000 lb.
Performance: max cruising speed 566 mph, range with max payload 2,293 miles without air refueling.

KC-10A Extender

The KC-10 was conceived to meet USAF requirements for an Advanced Tanker/Cargo Aircraft (ATCA). It is based on the commercial DC-10 Series 30CF, modified to include fuselage fuel cells, a boom operator's station with aerial refueling boom and integral hose reel/drogue unit, a receiver refueling receptacle, and military avionics. In its primary role of enhancing worldwide air mobility, the KC-10A combines the tasks of tanker and cargo aircraft in a single unit. With this capability the Extender supports fighter deployments, strategic airlift, strategic reconnaissance, and conventional operations. Since it has both types of tanker refueling equipment installed, the KC-10A can service USAF, USN, USMC, and allied aircraft on the same mission.

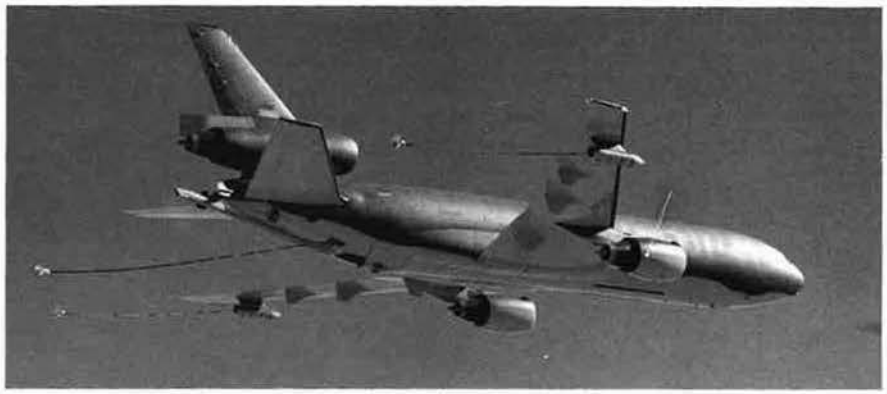
C-137B

C-141B

For deployment, the KC-10A's refueling capabilities and long range will, in many situations, dispense with the need for forward bases, while also leaving vital fuel supplies in the theater of operations untouched. Aircraft maintenance is performed under the contractor logistics support concept, where flight line maintenance is provided by USAF while intermediate and depot level maintenance is supported by a contractor. In addition, extensive commonality with the commercial DC-10 allows USAF to capitalize on a worldwide network of spares and maintenance facilities.

The KC-10A made its maiden flight in July 1980, and the first service usage by SAC took place in March 1981. USAF units equipped with KC-10As include the 6th and 9th AREFS at March AFB, Calif., the 2d and 32d AREFS at Barksdale AFB, La., and the 344th and 911th AREFS at Seymour Johnson AFB, N. C. AFRES also crews the aircraft under the Associate Reserve concept. Associate units include the 79th AREFS at March AFB, the 78th AREFS at Barksdale AFB, and the 77th AREFS at Seymour Johnson AFB.

Fifty-nine KC-10As are in the USAF inventory. The final production aircraft was delivered with wing-mounted air refueling pods to supplement the standard fuselage hose reel/drogue unit and refueling boom. Following testing of the multipoint tanker configuration, fleet retrofit of pods will begin. Currently, 20 aircraft are scheduled for modification to accept the wing-mounted pods. An additional modification, to utilize an on-board loader, will allow pallet handling without prepositioning wide-body cargo loading equipment. Installation should be complete by 1992.



KC-10A with wing-mounted refueling pods

Contractor: Douglas Aircraft Company, Division of McDonnell Douglas Corporation.
Power Plant: three General Electric CF6-50C2 turbofans; each 52,500 lb thrust.
Accommodation: crew of four; additional seating possible for up to 75 persons; max 27 pallets; max cargo payload approx 170,000 lb.
Dimensions: span 165 ft 3½ in, length 181 ft 7 in, height 57 ft 7 in.
Weight: gross 590,000 lb.
Performance: cruising speed Mach 0.825, service ceiling 42,000 ft, range with max cargo 4,370 miles.

Trainers

T-37B Tweet

USAF's first purpose-built jet trainer, the T-37 is Air Training Command's standard two-seat primary trainer. The original T-37A was superseded in November 1959 by the T-37B, and all "A" models were converted subsequently to "B" standard. Following the cancellation of the T-46A, planning was initiated for a complete service life extension program (SLEP) of the T-37 fleet, and $11.8 million was requested in the FY '88 budget. Well over 1,000 T-37s were built, of which more than 600 remain in the USAF's inventory; all are being repainted in a distinctive dark blue and white to help formation training and to ease maintenance.

Contractor: Cessna Aircraft Company.
Power Plant: two Continental J69-T-25 turbojets; each 1,025 lb thrust.
Accommodation: two, side by side.
Dimensions: span 33 ft 9.3 in, length 29 ft 3 in, height 9 ft 2.3 in.
Weights: empty 3,870 lb, gross 6,600 lb.
Performance: max speed at 25,000 ft 426 mph, service ceiling 35,100 ft, range at 360 mph with standard tankage 870 miles.

T-38A and AT-38B Talon

Almost identical in structure to the F-5A export tactical fighter, the **T-38A** lightweight twin-jet advanced trainer is capable of flying well above supersonic speed in level flight. First flown in April 1959, it was in continuous production from 1956 to 1972 and entered operational service in March 1961. Of 1,187 T-38s built, more than 1,100 were delivered to USAF, and some 800 remain in service throughout the Air Force. Most are used by ATC; others fly with SAC and with the 479th Tactical Training Wing at Holloman AFB, N. M., where a slightly different version designated **AT-38B,** with a gunsight and practice bomb dispensers, is used for Lead-In Fighter Training (LIFT).

An ongoing program called Pacer Classic, the T-38 SLEP (service life extension program), is integrating ten modifications, including major structural renewal, into one program. As a result, the service life of the T-38s should extend to the year 2010. Additionally, introduction of the Tanker/Transport Training System (TTTS) *(see below)* will significantly relieve the T-38's training work load.

Contractor: Northrop Corporation.
Power Plant: two General Electric J85-GE-5 turbojets; each 2,680 lb thrust dry, 3,850 lb thrust with afterburning.
Accommodation: student and instructor, in tandem.
Dimensions: span 25 ft 3 in, length 46 ft 4½ in, height 12 ft 10½ in.

T-38A

T-41C (J. Gaffney)

T-43A

Weights: empty 7,164 lb, gross 12,093 lb.
Performance: max level speed at 36,000 ft more than Mach 1.23 (812 mph), ceiling above 55,000 ft, range, with reserves, 1,093 miles.

T-41A/C Mescalero

The **T-41A** trainer is a standard Cessna Model 172 light aircraft acquired by USAF for use in a preliminary flight screening program for USAF pilot candidates. An initial order for 170 aircraft in 1964 was supplemented by a further 34 in July 1967. More powerful **T-41Cs,** based on the Cessna Model R172E, are used for cadet flight training at the USAF Academy. Around 100 T-41s remain in USAF service. *(Data for T-41A.)*

Contractor: Cessna Aircraft Company.
Power Plant: one Continental O-300-C piston engine; 145 hp. (210 hp Continental O-360-D in T-41C).
Accommodation: crew of two, side by side.
Dimensions: span 35 ft 10 in, length 26 ft 11 in, height 8 ft 9½ in.
Weights: empty 1,285 lb, gross 2,300 lb.
Performance: max speed at S/L 139 mph, service ceiling 13,100 ft, range 720 miles.

T-43A

Derived from the commercial Boeing Model 737-200, the T-43A navigation trainer made its first flight in April 1973. It was developed as a replacement for the piston-engined T-29 and was equipped with the same on-board avionics as the most advanced USAF operational aircraft of that time, including celestial, radar, and inertial navigation systems, LORAN, and other radio systems. Deliveries of the 18 aircraft ordered for ATC were completed in July 1974. Fourteen remain in the ATC inventory; the other four are assigned to the ANG.

Contractor: Boeing Aerospace Company.
Power Plant: two Pratt & Whitney JT8D-9 turbofans; each 14,500 lb thrust.
Accommodation: crew of two, 12 students, five advanced students, and three instructors.
Dimensions: span 93 ft 0 in, length 100 ft 0 in, height 37 ft 0 in.
Weight: gross 115,500 lb.
Performance: econ cruising speed at 35,000 ft Mach 0.7, operational range 2,995 miles.

UV-18B Twin Otter

The UV-18B is a military version of the DHC-6 Twin Otter STOL utility transport. Two were procured in FY '77 for use as parachute jump training aircraft at the Air Force Academy.

Contractor: The de Havilland Aircraft of Canada Ltd.
Power Plant: two Pratt & Whitney Canada PT6A-27 turboprops; each 620 ehp.
Accommodation: crew of two and up to 20 passengers.
Dimensions: span 65 ft 0 in, length 51 ft 9 in, height 19 ft 6 in.
Weight: gross 12,500 lb.
Performance: max cruising speed 210 mph, service ceiling 26,700 ft, range with 2,500 lb payload 806 miles.

Tanker/Transport Training System (TTTS)

USAF's ATC is to acquire 211 off-the-shelf business jets to support the specialized advanced training of undergraduate pilots destined for tanker and transport aircraft. Currently at the RFP (Request for Proposals) stage, selection of a Tanker/Transport Training System (TTTS) is expected this year, with a request for funding for 14 aircraft in the FY '90 budget proposals, following approval for a single example in FY '89.

UH-1N

Helicopters

HH-1H Iroquois

Basically a military version of the Bell Model 205, the HH-1H is a general-purpose helicopter first ordered by USAF in 1970 and used for missile site support duties.

Contractor: Bell Helicopter Textron Inc.
Power Plant: one Textron Lycoming T53-L-13B turboshaft; 1,400 shp.
Accommodation: two pilots and 12 passengers; or two crew and 2,400 lb of cargo.
Dimensions: rotor diameter 48 ft 4 in, length of fuselage 42 ft 0 in, height 13 ft 0 in.
Weight: gross 9,500 lb.
Performance: max speed 120 mph, service ceiling 13,450 ft, range with max fuel 347 miles.

UH-1N Iroquois

The UH-1N is a twin-engine version of the UH-1 utility helicopter. Seventy-nine were ordered for USAF, most of which remain in the inventory for missile site support duties and administrative airlift.

Contractor: Bell Helicopter Textron Inc.
Power Plant: Pratt & Whitney Canada T400-CP-400 Turbo "Twin-Pac," consisting of two PT6 turboshafts coupled to a combining gearbox with a single output shaft; flat-rated to 1,290 shp.
Accommodation: pilot and 14 passengers or cargo; or external load of 4,000 lb.
Dimensions: rotor diameter (with tracking tips) 48 ft 2¼ in, length of fuselage 42 ft 4¾ in, height 14 ft 10¼ in.
Weight: gross and mission weight 11,200 lb.
Performance: max cruising speed at S/L 115 mph, service ceiling 13,000 ft, max range, no reserves, 261 miles.
Armament (optional): two General Electric 7.62-mm Miniguns or two 40-mm grenade launchers; two seven-tube 2.75-in rocket launchers.

CH-3E

This twin-engine amphibious transport helicopter, based on the US Navy's SH-3A Sea King, incorporates important design changes that permit speedier cargo handling and ease of maintenance, with built-in equipment for the removal and replacement of all major components in remote areas. The initial version was the CH-3C. Introduction of uprated engines led to the designation CH-3E in February 1966, applicable to 42 new production aircraft and 41 reengined CH-3Cs, of which 50 were adapted subsequently as HH-3Es *(see below).* CH-3 missions include Special Operations duties, natural disaster relief, and evacuation.

Contractor: Sikorsky Aircraft, Division of United Technologies Corporation.
Power Plant: two General Electric T58-GE-5 turboshafts; each 1,500 shp.
Accommodation: crew of two or three; 25 fully equipped troops, 15 litters, or 5,000 lb of cargo.
Dimensions: rotor diameter 62 ft 0 in, length of fuselage 57 ft 3 in, height 18 ft 1 in.
Weights: empty 13,255 lb, gross 22,050 lb.
Performance: max speed at S/L 162 mph, service ceiling 11,100 ft, max range, with 10% reserve, 465 miles.
Armament: General Electric 7.62-mm machine gun.

HH-3E Jolly Green Giant

Modified version of the CH-3E for USAF's Aerospace Rescue and Recovery Service, originally to facilitate penetration deep into North Vietnam on rescue missions. Additional equipment includes self-sealing fuel tanks, armor, defensive armament, a rescue hoist, and a retractable in-flight refueling probe. HH-3s are now assigned primarily to rescue units of the Reserve and ANG. *(Data basically similar to CH-3E above.)*

HH-53B Super Jolly

This twin-turbine heavy-lift helicopter was ordered in September 1966 for USAF's Aerospace Rescue and Recovery Service to supplement the HH-3E. The HH-53B carries the same general equipment as the HH-3E, including the in-flight refueling probe and armament, but is faster and larger. It first flew in March 1967; delivery began in June the same year. After extensive use for rescue operations in Southeast Asia, HH-53Bs continue in first-line service, but are being converted to MH-53J Pave Low III "Enhanced" standard *(see below).*

Contractor: Sikorsky Aircraft, Division of United Technologies Corporation.
Power Plant: two General Electric T64-GE-7A turboshafts; each 4,325 shp.
Accommodation: crew of five; basic accommodation for 38 combat-equipped troops or 24 litters and four attendants.
Dimensions: rotor diameter 72 ft 3 in, length of fuselage (without refueling probe) 67 ft 2 in, height 24 ft 11 in.
Weights: empty 23,125 lb, gross 42,000 lb.

Performance: max speed at S/L 186 mph, service ceiling 18,400 ft, max range, with 10% reserve, 540 miles.

HH-53C and CH-53C

The **HH-53C,** an improved version of the HH-53B, was first delivered to USAF in August 1968. With a maximum speed of 196 mph, it can transport 38 passengers or 18,500 lb of freight and has an external cargo hook of 20,000 lb capacity. Other data basically as for HH-53B above. A total of 72 HH-53B/Cs was built. Eight generally similar **CH-53Cs** are used to provide battlefield mobility for the Air Force mobile Tactical Air Control System. All 33 remaining H/CH-53s are being converted to MH-53J Pave Low III "Enhanced" standard *(see below).*

MH-53H/J Pave Low

Under USAF's Pave Low III program, nine HH-53Cs were modified for night and adverse weather operations and redesignated **MH-53H;** two lost in accidents in 1984 were subsequently replaced. Equipment includes a stabilized FLIR installation mounted below the refueling boom, an inertial navigation system, a new Doppler navigation system, and the computer-projected map display and radar from the A-7D, with the radar installed in an offset "thimble" fairing on the nose. The first of the MH-53Hs was delivered to Hurlburt Field, Fla., in 1979, and the last in 1980, for Special Operations duties.

In a program initiated in 1986 to upgrade the Special Operations Forces, Sikorsky is undertaking a major modification of the 33 remaining HH/CH-53B/C helicopters. Designated **MH-53J,** these **Pave Low III "Enhanced"** aircraft are equipped with an integrated digital avionics suite that includes terrain-following and terrain-avoidance radar, GPS terminals, secure communications, an advanced ECM system, titanium armor plating, and mounts for .50-caliber machine guns and/or 7.62-mm Miniguns. The first was delivered in summer 1987; deliveries are due for completion by the end of this year. It is planned to bring the eight remaining MH-53Hs to "J" standard.

MH-60G Pave Hawk

As an interim remedy for a shortfall in its rescue helicopter inventory, USAF acquired 20 UH-60A Black Hawks in standard US Army configuration, including a rescue hoist, deicing system, and winterization and air transportability kits. Beginning in 1982–83, these were delivered to the 55th Aerospace Rescue and Recovery Squadron at Eglin AFB, Fla. Sikorsky Support Services of Troy, Ala., has since been contracted to modify these helicopters to MH-60G Pave Hawk standard, by installing an aerial refueling probe, auxiliary fuel tank, and fuel management panel. All will be upgraded further to have Doppler/INS, an electronic map display, Tacan, a lightweight weather/ground mapping radar, secure HF and Satcom, .50-caliber machine guns, and Pave Low III FLIR, as installed in the MH-53J. The MH-60Gs will be suitable for precision low-level combat rescue missions in day/night VMC, including marginal weather.

Contractor: Sikorsky Aircraft, Division of United Technologies Corporation.
Power Plant: two General Electric T700-GE-700 turboshafts; each 1,560 shp.
Accommodation: crew of two or three; 11–14 troops, up to six litters, or internal or external cargo.
Dimensions: rotor diameter 53 ft 8 in, length of fuselage 50 ft 0¾ in, height 16 ft 10 in.
Weights: empty 10,624 lb, gross 16,260–20,250 lb.
Performance: max speed 184 mph, service ceiling 19,000 ft, max range, with reserves, 373 miles (internal fuel), 1,380 miles (external tanks.)

CV-22A Osprey

Under a contract awarded in May 1986, Boeing Helicopters and Bell Helicopter Textron are prime contractors in a seven-year full-scale development (FSD) program for the V-22 Osprey, which resulted from the US government's Joint Services Advanced Vertical Lift Aircraft (formerly JVX) proposal. The USN and USAF are currently participating in the program, with the former as executive service. This tilt-rotor, multimission aircraft, based on Bell's XV-15, is designed to have the maneuverability and lift capability of a helicopter and speed of a fixed-wing aircraft. Boeing has overall responsibility for the aircraft's tail unit, overwing fairings, and fuselage, while Bell provides the wing, nacelles, transmissions, and rotor hub assemblies. Under subcontracts, Grumman is responsible for design and manufacture of the V-22's tail unit, General Electric the digital fly-by-wire flight-control system, LMSC-Georgia the wing control surfaces and fixed trailing-edge, and Menasco of Canada and Dowty of Canada, respectively, the nose and main landing gear. Allison provides the aircraft's two 6,000 shp T406-AD-400 turboshaft engines.

USAF requires 55 long-range versions of the aircraft for special operations, to carry 12 troops or up to 2,880 lb of internal cargo over a 600-mile mission radius at 288 mph, with capability to hover OGE at 4,000 ft at 95°F.

MH-53H

MH-60G

V-22 prototype

First flight of the V-22 Osprey prototype was made on March 19 of this year, with production deliveries to the Marine Corps expected to begin in 1992 (MV-22). Deliveries to the USN (HV-22) and USAF (CV-22) will follow about one year later. Specification data are provisional:
Dimensions: rotor diameter (each) 38 ft 0 in, length 57 ft 4 in, height over tail fins 17 ft 7¾ in.
Weights: normal mission weight: VTO 47,500 lb, STO 55,000 lb.
Performance: max cruising speed 391 mph, service ceiling 26,000 ft, range VTO 1,382 miles, STO 2,073 miles.

LGM-30G

LGM-118A

Strategic and Tactical Nuclear Missiles

LGM-30F/G Minuteman

More than two decades into its operational life, Minuteman remains a key element of the US strategic deterrent posture. It is a three-stage, solid-propellant ICBM, housed in underground silos for which an upgrade program was completed in 1980 to provide increased launch facility protection. Minuteman silos and launch control centers are currently undergoing a depot level maintenance refurbishment, known as Rivet Mile, to correct existing, and retard future, age-related deterioration of facilities. The current versions are:

LGM-30F Minuteman II: similar in configuration to the original Minuteman I, Minuteman II has increased range and targeting coverage; also increased accuracy and payload capacity. Operational since 1965, it is based at Malmstrom AFB, Mont.; Ellsworth AFB, S. D.; and Whiteman AFB, Mo. In late summer of 1986, Minuteman IIs at Malmstrom and Whiteman AFBs were equipped with a command data buffer capability to permit remote targeting, as in Minuteman III.

LGM-30G Minuteman III: third-stage motor with fluid-injection thrust vector control gives longer range and, allied to MIRV capability, enables this version to place warheads on three targets with a high degree of accuracy. First test launch was made in 1968, and Minuteman III is operational at Minot AFB, N. D.; F. E. Warren AFB, Wyo.; Grand Forks AFB, N. D.; and Malmstrom AFB, Mont. A command data buffer system permits rapid missile retargeting. Deployment of the larger-yield Mk 12A RV was completed in 1983.

Of the original force of 450 Minuteman IIs and 550 Minuteman IIIs, 50 have been displaced by Peacekeeper missiles. However, enhancements and modifications under way will maintain the viability of the force well beyond the year 2000. On the missile itself, the second-stage motors on both versions are being washed out and repoured; the third-stage motors on Minuteman III are being remanufactured. In addition, improvements to the Minuteman II's missile guidance set are continuing under the Accuracy Reliability Supportability Improvement Program; and Minuteman III's guidance has been upgraded to improve its accuracy by almost 30 percent. The Rapid Execution and Combat Targeting (REACT) Program will ensure long-term supportability of the aging electronics components, and will modify the launch control center, enabling real-time status information on the weapons and communications nets to correct operability problems, improve responsiveness to launch directives, and provide rapid retargeting capability. A program to provide penetration aids for Minuteman III was terminated as "not affordable."

Assembly and Checkout: Boeing Aerospace.
Power Plant: first stage: Thiokol M-55 solid-propellant motor, 210,000 lb thrust; second stage: Aerojet-General SR19-AJ-1 solid-propellant motor, 60,300 lb thrust; third stage: LGM-30F: Hercules, Inc., solid-propellant motor; LGM-30G: Thiokol SR73-AJ-1 solid-propellant motor: 17,000 lb thrust (LGM-30F), 34,400 lb thrust (LGM-30G).
Guidance: Autonetics Division of Rockwell International inertial guidance system.
Dimensions: length LGM-30F 55 ft 10 in; LGM-30G 59 ft 10 in, diameter of first stage 5 ft 6 in.
Weights: launch weight (approx) LGM-30F 73,000 lb, LGM-30G 78,000 lb.
Performance: speed at burnout more than 15,000 mph, highest point of trajectory approx 700 miles, range with max operational load LGM-30F more than 6,000 miles; LGM-30G more than 7,000 miles.

LGM-118A Peacekeeper

Initiated in response to the improved hardness of Soviet strategic forces, this program remains on schedule and within budgeted cost. Deployment of 50 Peacekeeper missiles in existing Minuteman III silos near F. E. Warren AFB, Wyo., began in June 1986. A proposed rail-garrison basing mode is currently being developed as an alternative for the deployment of another 50 missiles. A decision on whether to produce and deploy Peacekeeper Rail Garrison is expected in FY '90. Ninety missiles were funded in FY '84–89, with 12 more requested in FY '90. Initial operational capability for the first ten Peacekeepers was achieved in December 1986; full operational capability with 50 missiles was scheduled for December 1988.

The Peacekeeper is a four-stage ICBM that carries up to ten independently targetable reentry vehicles. It has many advantages over other missile weapon systems currently in the US inventory. Peacekeeper is more accurate, carries more warheads, and has greater range and target flexibility than the Minuteman ICBMs. In addition, its greater resistance to nuclear effects and its more capable guidance system provide Peacekeeper with a much improved ability to destroy very hard targets. The prompt retaliation made possible by these factors is intended to provide a decisive deterrent to any Soviet first strike.

Basing: Boeing Aerospace.
Assembly and Test: Martin Marietta, Denver Aerospace.
Power Plant: first three stages solid-propellant, fourth stage storable liquid; by Thiokol, Aerojet, Hercules, and Rocketdyne, respectively.
Guidance: inertial; integration by Rockwell, IMU by Northrop.
Warheads: 10 Avco Mk 21 reentry vehicles.
Dimensions: length 71 ft, diameter 7 ft 8 in.
Weight: approx 195,000 lb.

Small ICBM (SICBM)

Under the amended FY '88–89 DoD budget proposals forwarded by President Reagan in February 1988, the Small ICBM program was terminated. The budget included $250 million to keep the SICBM on life support in case President Bush might desire to revive it.

AGM-69A SRAM

This defense suppression and primary attack missile was deployed initially with the B-52Gs of SAC's 42d Bombardment Wing (Heavy) at Loring AFB, Me., in 1972. USAF contracts covering the production of 1,500 AGM-69As were authorized, and deliveries to equip 17 B-52 wings and two FB-111 wings at 18 SAC bases were completed in July 1975.

Armed with a nuclear warhead, the supersonic air-to-surface SRAM was designed to attack and neutralize enemy terminal defenses, such as surface-to-air missile sites. An inertial guidance system makes the missile impossible to jam. SAC B-1Bs can carry 24 AGM-69As internally; B-52G/Hs can carry eight AGM-69As on a rotary dispenser in the aft bomb bay, together with up to four nuclear bombs; and FB-111As can carry four AGM-69As on swiveling underwing pylons and two internally. When carried externally, a tailcone, 22.2 in long, is added to reduce drag.

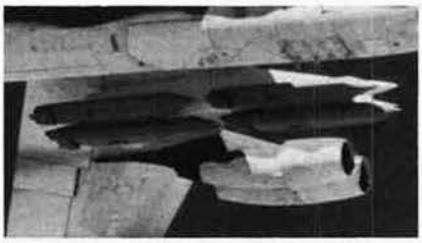
Contractor: Boeing Aerospace Company.
Power Plant: Lockheed Propulsion Company LPC-415 restartable solid-propellant two-pulse rocket engine.
Guidance: General Precision/Kearfott inertial system, permitting attack at high or low altitude and dogleg courses.
Warhead: nuclear, of similar yield to that of single Minuteman III warhead.
Dimensions: length 14 ft 0 in, body diameter 1 ft 5½ in.
Weight: launch weight approx 2,230 lb.
Performance: speed up to Mach 2.5, range 100 miles at high altitude, 35 miles at low altitude.

AGM-86B ALCM

The AGM-86B air-launched cruise missile is a small, unmanned, winged air vehicle capable of sustained subsonic flight following launch from a carrier aircraft. It has a turbofan engine and a nuclear warhead and is programmed for precision attack on surface targets. When launched in large numbers, each of the missiles would have to be countered, making defense against them both costly and complicated. Additionally, by diluting defenses, the ability of manned aircraft to penetrate to

AGM-69A SRAM

AGM-86B ALCM



AGM-129A (ACM)

major targets is improved. Small radar signature and low-level flight capability enhance the missile's effectiveness. Delivery of the last of 1,715 production models was accomplished in October 1986. USAF completed deployment of AGM-86s on 98 on-line B-52Gs in 1984, with 12 missiles fitted externally to each aircraft. B-52Hs are undergoing a similar conversion, scheduled for completion in FY '90. Ultimately, each B-52H is intended to be modified further to have a bomb-bay common strategic rotary launcher (CSRL) for eight more ALCMs, eight SRAMs, or a mix of both. ALCM-equipped units are at Griffiss AFB, N. Y., Wurtsmith AFB, Mich., Fairchild AFB, Wash., Eaker AFB, Ark., Carswell AFB, Tex., Barksdale AFB, La., and Minot AFB, N. D. Should the future decision be made to place ALCMs on the B-1B, provisions exist for the carriage of 12 cruise missiles on underfuselage stores stations, and eight carried internally on a CSRL.

Contractor: Boeing Aerospace Company.
Power Plant: Williams International Corporation/Teledyne CAE F107-WR-100 turbofan; 600 lb thrust.
Guidance: inertial plus Tercom, by Litton.
Warhead: W80-1 nuclear.
Dimensions: length 20 ft 9 in, body diameter 2 ft 0½ in, wing span 12 ft.
Weight: 3,200 lb.
Performance (approx): speed 500 mph, range more than 1,500 miles.

AGM-129A (ACM)

Convair Division of General Dynamics was selected in April 1983 to develop and manufacture an air-launched advanced cruise missile (ACM) to arm the B-52H and B-1B. In addition, McDonnell Douglas was awarded a contract in November 1987 for technology transfer leading to second-source capability for this advanced system. The ACM will have improved range, accuracy, survivability, and targeting flexibility compared with the AGM-86B, notably through embodiment of low-observability technology. It will be powered by a Williams International F112 turbofan.

AGM-131 SRAM II

Full-scale development (FSD) is under way of this nuclear-capable air-to-surface missile intended to augment, and eventually replace, the aging AGM-69A. SRAM II will arm B-1Bs and B-2s and will be capable of penetrating advanced defense systems from standoff ranges to strike hardened, heavily defended targets and mobile targets. It will use existing propulsion, guidance, and airframe technology to make possible significant performance improvements without unacceptable program risk. Major program activities include development of a new Hercules rocket motor to provide higher missile velocities and increased range; development by Litton of a guidance system that will ensure greater accuracy, even with extended range; and incorporation of a new warhead with modern safety features. Like the AGM-69A, SRAM II will be supersonic.

Following the system definition phase, which involved Boeing Aerospace, Martin Marietta, and McDonnell Douglas Astronautics, a request for full-scale development proposals was issued to industry. Source selection was completed in December 1986, and Boeing was announced the winner. Initial production of 400 missiles is due to begin this year, with 25 SRAM IIs requested in the FY '90–91 budget proposals. Planned procurement is for 1,633 missiles, with IOC scheduled for April 1993.

BGM-109G Gryphon GLCM

The GLCM is a small, mobile, ground-to-ground cruise missile developed to modernize NATO's intermediate-range nuclear forces (INF). Its characteristics include a small radar cross section, very low altitude flight profile, and all-weather capabilities; it is designed to complicate the enemy's targeting and defenses, thereby helping the survivability of other allied systems.

The first GLCM-operational base, in 1983, was at RAF Greenham Common, UK, followed by Comiso AB, Sicily, and Florennes AB, Belgium (both 1984), Wueschheim AB, West Germany (1986), and RAF Molesworth, UK (1987). A GLCM mobile flight comprises four transporter-erector launchers, each carrying four missiles, and two launch control centers. A total of 464 missiles was planned for deployment by 1988, but was halted at 19 flights with the signing of the INF Treaty. The first GLCMs were removed from Europe last September, and all GLCM missiles and erector launchers will be eliminated by May 31, 1991, as required by the INF Treaty.

Contractors: General Dynamics (Convair)/McDonnell Douglas Astronautics.
Power Plant: Williams International Corporation/Teledyne CAE F107-WR-400 turbofan; 600 lb thrust. Atlantic Research Corporation solid-propellant booster.
Guidance: Inertial plus Tercom, by Litton.
Warhead: W84 nuclear.
Dimensions: length 20 ft 6 in, diameter 1 ft 8½ in, wing span 8 ft 7 in.
Weight: with booster, 3,250 lb.
Performance: max speed high subsonic, range 1,500 miles.

AIM-7 Sparrow

Airborne Tactical and Defense Missiles

AIM-7 Sparrow

Sparrow is a radar-guided air-to-air missile with all-weather, all-altitude, and all-aspect capability. Approximately 34,000 AIM-7C, D, and E versions were produced. The **AIM-7E** was the original design primarily for use by the F-4 Phantom. The **AIM-7E-2** and **E-3** are improved versions that provide better maneuverability and "dogfight" capability. A later version is the advanced solid-state **AIM-7F**, with larger motor, Doppler guidance, improved ECM, and better capability over both medium

and "dogfight" ranges; this version currently equips USAF and USN F-4, F-14, F-15, and F/A-18 aircraft and will equip the F-16 (ADF) in the future. Approximately 5,400 AIM-7Fs were produced. A monopulse version of Sparrow designated **AIM-7M,** aimed at reducing cost and improving performance in the ECM and look-down clutter regions, entered production in FY '80 and began operational service during FY '83. Procurement continues, with funding for 558 missiles for USAF approved in the FY '88 budget, and further procurement sought in subsequent budget proposals. *(Data for AIM-7F.)*

Contractors: Raytheon Company/General Dynamics Pomona Division.
Power Plant: Hercules Mk 58 Mod 0 boost-sustain rocket motor.
Guidance: Raytheon semiactive Doppler radar homing system.
Warhead: high-explosive, blast fragmentation, weighing 86 lb.
Dimensions: length 11 ft 10 in, body diameter 8 in, wing span 3 ft 4 in.
Weight: launch weight 504 lb.
Performance (estimated): max speed more than Mach 3.5; range AIM-7E 14 miles, AIM-7F more than 25 miles.

AIM-9 Sidewinder

The AIM-9 Sidewinder is a close-range air-to-air missile using infrared guidance. Versions currently in the USAF inventory are:

AIM-9P: improved version of the AIM-9J, produced by Ford Aerospace by conversion of existing AIM-9Es and -9Js. Increased target-acquisition envelope, solid-state electronics, and increased lethality due to seeker improvements.

AIM-9P-3: improved version of AIM-9P, with increased lethality due to fuze improvements and a new rocket motor, providing reduced smoke and increased range.

AIM-9P-4: improved version of AIM-9P-3 developed by Ford Aerospace. A new guidance control unit provides an increased target acquisition envelope. The AIM-9P-4 is for foreign military sales.

AIM-9L: third-generation Sidewinder for USAF and USN, with all-aspect intercept capability. Improvements include new motor, double-delta nose fins for improved inner boundary performance and maneuverability, AM-FM conical scan for increased seeker sensitivity and improved tracking stability, annular blast fragmentation warhead and active optical fuze for increased lethality and low susceptibility to countermeasures. This version arms USAF F-15 and F-16 aircraft and features in USAF plans to provide self-defense capability for its A-7s, A-10s, F-4s, and F-111s.

AIM-9M: improved version of AIM-9L, with increased IRCCM capability, improved background discrimination, and reduced-smoke rocket motor. Full production began in FY '81 with an order for approximately 1,850 missiles. FY '88 and FY '89 budgets requested a total of 1,716 AIM-9Ms, with a final USAF procurement planned for FY '90.

AIM-9R: development of AIM-9M with improved control and guidance section for greater target acquisition range and better resistance to ECM. FSD started in 1986. *(Data for AIM-9M.)*

Contractor: Raytheon Company/Ford Aerospace and Communications Corporation.
Power Plant: Thiokol Hercules Mk 36 Mod 11 solid-propellant rocket motor.
Guidance: solid-state infrared homing guidance.
Warhead: high-explosive, weighing 20.8 lb.
Dimensions: length 9 ft 5 in, body diameter 5 in, fin span 2 ft 1 in.
Weight: launch weight 191 lb.
Performance: max speed above Mach 2; range more than 10 miles.

AGM-45A Shrike

Twelve versions of this supersonic air-to-surface missile were produced for USAF and USN, differing primarily in the frequency coverage of the front end detachable seeker sections. Designed to home automatically on enemy radar installations, the AGM-45 entered operational service in Vietnam during 1965. Thereafter, it played an important part in the US air offensive, becoming a standard penetration aid on US tactical aircraft. More than 13,000 were delivered to USAF between 1965 and 1978, and Shrikes continue to equip "Wild Weasel" F-4Gs and defense suppression F-4Es and F-16Cs. Upgrading under the Shrike gravity bias modification program will result in improved capabilities at low altitude.

Contractor: Naval Weapons Center.
Power Plant: Rocketdyne Mk 39 Mod 7 or Aerojet Mk 53 solid-propellant rocket motor.
Guidance: passive homing head by Texas Instruments.
Warhead: high-explosive fragmentation, weighing 145 lb.
Dimensions: length 10 ft 0 in, body diameter 8 in, span 3 ft 0 in.
Weight: launch weight 400 lb.
Performance (estimated): range more than 3 miles.

AIM-9L Sidewinder

AGM-65D Maverick

AGM-65 Maverick

The basic **AGM-65A** Maverick is a launch-and-leave TV-guided air-to-surface missile that enables the pilot of the launch aircraft to seek other targets or leave the target area once it has been launched. Production was initiated in 1971, following successful test launches over distances ranging from a few thousand feet to many miles and from high altitudes down to treetop level. Maverick missiles were first employed by USAF in Vietnam and are now carried by the A-7D, A-10, F-4D/E/G, F-5E/F, F-111F, and F-16, singly or in three-round underwing clusters, for use against pinpoint targets such as tanks and columns of vehicles. Orders for TV Maverick totaled 19,000.

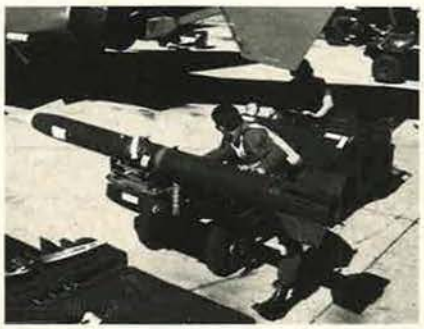
AGM-65B has a "scene magnification" TV seeker that enables the pilot to identify and lock on to smaller or more distant targets.

To overcome limitations of the TV Maverick, which can be used only in daylight clear-weather conditions, two new versions have been developed:

AGM-65D: with imaging infrared seeker (IIR). AFOTEC and TAC conducted operational flight testing with 25 live launches from A-7, A-10, F-4E, F-4G, and F-16 aircraft at Nellis AFB, Nev., in September 1986, resulting in 24 direct hits on a variety of vehicles. IIR Maverick became operational on A-10s at RAF Bentwaters, UK, in February 1986. A total of 14,700 has been ordered for USAF through FY '88. Raytheon is second source supplier.

AGM-65G: uses the IIR seeker with an alternate 298 lb blast fragmentation warhead for use against hardened targets. Software has been modified to include options for targeting ships and large land targets as well as mobile armor. This version also has a digital autopilot and a pneumatic, rather than hydraulic, actuation system. First successful launch took place in November 1987 and this version is now in production. USAF plans, initially, to acquire 1,800 "G" models. *(Data for AGM-65A.)*

Contractor: GM-Hughes, Missile Systems Group.
Power Plant: Thiokol TX-481 solid-propellant rocket motor.
Guidance: self-homing electro-optical guidance system.
Warhead: high-explosive, shaped charge.
Dimensions: length 8 ft 2 in, body diameter 1 ft 0 in, wing span 2 ft 4½ in.
Weight: launch weight 462 lb.
Performance: range of 0.6 to 14 miles.



AGM-45A Shrike

AGM-88A HARM

The lethality of USAF's F-4G "Wild Weasel" is greatly enhanced by the availability of HARM (High-speed Anti-Radiation Missile), which achieved IOC in September 1984. The emphasis on high speed reflects experience gained in Vietnam, where Soviet-built surface-to-air missile radar systems sometimes detected the approach of first-generation Shrikes and ceased operation before the missiles could lock on them. HARM can cover a wide range of frequency spectra through the use of programmable digital processors in both the aircraft's avionics equipment and the missile. An integration program is ongoing to equip F-16s in the defense suppression role with HARM. The missile is also suitable for adaptation to the EF-111A, B-52, and F-15. Testing of a software upgrade will be completed this year, aimed at improving performance against new radars. EEPROMs (Erasable Electronically Programmable Read Only Memory) are being retrofitted on USAFE, PACAF, and TAC HARMs, permitting changes to missile memory in the field. Development of a lower-cost seeker (LCS), jointly funded by USN and USAF, is in hand, as is a Block IV upgrade to make the missile more effective against tougher targets. By the end of 1988 a total of 3,063 HARMs had been delivered. USAF plans to acquire 9,273 by the time production ends in 1994.

Contractor: Texas Instruments, Inc.
Power Plant: Thiokol smokeless dual-thrust solid-propellant rocket motor. Hercules second source.
Guidance: passive homing guidance system, using seeker head that homes on enemy radar emissions.
Warhead: high-explosive.
Dimensions: length 13 ft 8½ in, body diameter 10 in, wing span 3 ft 8½ in.
Weight: 807 lb.
Performance: cruising speed supersonic, altitude limits S/L to 40,000 ft, range more than 10 miles.

AGM-136A Tacit Rainbow

Designed to complement the AGM-88A HARM, the AGM-136A Tacit Rainbow is a low-cost, programmable, loitering, antiradiation weapon system that can be air-launched to seek out autonomously and destroy enemy radars. The missile features a single-piece, spring-loaded wing that is stored under the fuselage before launch and that rotates and locks into place on release. The horizontal stabilizers and a dorsal tail fin come out after launch. Carrier aircraft will be the B-52G for USAF and the A-6E for the USN. FSD is scheduled for completion during FY '90, with subsequent production under USAF

AGM-88A HARM

contract for both the Air Force and the Navy to be centered in a new plant at Perry, Ga. Major supporting contractors include Boeing Military Airplanes, Delco, Singer Kearfott, Texas Instruments, and Williams International.
Prime Contractor: Northrop Ventura.
Power Plant: Williams International turbofan.
Guidance: passive radar homing.
Warhead: high-explosive.
Dimensions: length 8 ft 4 in, body diameter 2 ft 3 in, wing span 5 ft 1½ in.
Weight: 1,268 lb.
Performance: range 56 miles.

GBU-15 and AGM-130

The **GBU-15** is an air-launched cruciform-wing glide bomb fitted with a guidance system designed to give it pinpoint accuracy from low or medium altitudes over short standoff ranges. Development began in 1974, based on experience gained in Vietnam with the earlier Pave Strike GBU-8 HOBO modular weapon program. The GBU-15 is intended for tactical use to suppress enemy defenses and to destroy heavily defended targets. The target-detecting device is carried on the front of the warhead; the control module, with autopilot and data link module, attaches to the rear.

The weapon offers two modes of attack. In direct attack, the weapon is locked on to the target before launch and flies a near line-of-sight profile to impact. In the indirect mode, the seeker can be locked on to the target after launch, or the operator can fly the weapon manually to impact, using guidance updates provided through the data link. This profile uses a midcourse glide phase and extends standoff range. The GBU-15 is deployed with F-4E and F-111 aircraft and has been test launched from the F-15E and F-16D. The **GBU-15(V)1/B** TV-guided variant qualified for operational service in 1983; the **GBU-15(V)2/B** imaging infrared (IIR) version entered service in 1987. GBU-15 procurement was completed in FY '87.

Development of the **AGM-130** rocket-powered version of the GBU-15 was terminated under the amended FY '88–89 budget requests. However, testing has continued through completion of the originally contracted program and is providing very useful technology demonstration.
Contractor: Rockwell International Corporation.
Guidance: TV or imaging infrared seeker.
Warhead: Mk 84 bomb (2,000 lb unitary).
Dimensions: length 12 ft 10½ in, body diameter 1 ft 6 in, wing span 4 ft 11 in.
Weight: 2,450 lb.
Performance: cruising speed subsonic.

ASM-135A ASAT

Further development of this small, high-technology, air-launched antisatellite (ASAT) weapon was terminated under the amended FY '88–89 budget proposals, because of Congress's unwillingness to permit testing to complete the program. Details of ASAT can be found in the 1987 "Gallery of USAF Weapons."

AIM-120A (AMRAAM)

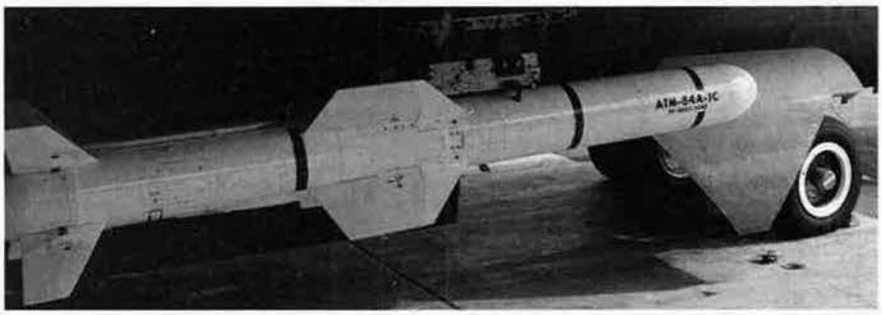
Intended as a replacement for the AIM-7 Sparrow, the advanced medium-range air-to-air missile (AMRAAM) is currently described as the "number-one tactical priority." It will provide an all-weather, all-environment capability for USAF's F-15 and F-16 and the Navy's F-14 and F/A-18 fighters. Development has been under way since December 1981.

Designated AIM-120A, AMRAAM has inertial midcourse guidance and active radar terminal homing that provides launch-and-maneuver capability. There are significant improvements in operational effectiveness over the AIM-7 Sparrow, including increased average velocity, reduced miss distance, improved fuzing, increased warhead lethality, multiple target engagement capability, improved clutter rejection in low-altitude environments, improved ECCM capability, increased maximum launch range, reduced-smoke motor, and improved maintenance and handling.

A leader/follower program has been under way (Hughes/Raytheon), with the preproduction effort (producibility and qualification) in FY '86 and low-rate initial production in FY '87 (160 missiles). Hughes and Raytheon have already been awarded Lots 1 and 2 and will compete for subsequent Lots. The first production AIM-120A was delivered by Hughes last fall, and IOC is anticipated next year. USAF plans to acquire 17,000 missiles; 1,870 were requested in FY '88 and '89, with a further 1,450 in FY '90 and 2,200 in FY '91. Additionally, funding in FY '90 is requested for P3I (preplanned product improvement), which would seek to develop AMRAAM improvements, including rapid reprogramming, adjustable countermeasures, advanced counter-countermeasures, and options for smart ordnance packages and dual-mode fuzing.
Contractors: Hughes Aircraft Company/Raytheon Company.
Guidance: inertial midcourse, with active radar terminal homing.
Dimensions: length 12 ft, body diameter 7 in, span of tail control fins 2 ft 1 in.
Weight: 340 lb.
Performance: cruising speed approx Mach 4, range approx 31 miles.

GBU-15

AIM-120A (AMRAAM)



AGM-84A Harpoon

AGM-84A Harpoon

USAF initiated a cooperative memorandum of understanding with the USN to equip two 15-aircraft B-52G squadrons with the Harpoon all-weather antiship missile in support of maritime antisurface warfare operations. Compatibility testing began in spring 1983, and full operational capability was achieved that October. Modified aircraft are located at Loring AFB, Me., for Atlantic operations and at Andersen AFB, Guam, for Pacific operations. Each B-52G can carry eight to 12 missiles.
Contractor: McDonnell Douglas Astronautics Company.
Power Plant: Teledyne CAE J402-CA-400 turbojet; 660 lb thrust.
Guidance: sea-skimming cruise monitored by radar altimeter, active radar terminal homing.
Warhead: penetration high-explosive blast type, weighing 488 lb.
Dimensions: length 12 ft 7½ in, body diameter 1 ft 1½ in, wing span 3 ft.
Weight: 1,145 lb.
Performance: speed high subsonic, range more than 57 miles.

Have Nap

Under the Have Nap program, USAF has acquired a quantity of Israeli-built Popeye medium-range TV-guided standoff missiles. Value of the sixteen-month contract, awarded in June 1988 to Rafael of Haifa, Israel, is $39 million plus options.

Purpose of Have Nap is to provide long-range bombers with a conventional precision strike capability, in support of worldwide theater commanders. Primary carrier aircraft will be the conventionally dedicated B-52G if the decision is taken to put Have Nap into production. For that phase of the program Rafael would be teamed with Martin Marietta.
Contractor: Rafael Armament Development Authority.
Power Plant: solid-propellant rocket motor.
Guidance: inertial, with TV homing.
Warhead: high-explosive, weighing 750 lb.
Dimensions: length 18 ft 8½ in, body diameter 1 ft 9½ in, wing span 5 ft 5 in.
Weight: 3,000 lb.
Performance: range 50 miles.

Rapier

Rapier is unusual in that US land-based antiaircraft missiles are normally operated by the Army. Under a decision confirmed by an initial contract for 32 fire units in February 1981, British-built Rapier missile systems are deployed at seven USAF bases in the UK to protect Air Force installations. The last unit became operational in July 1986. Manned by RAF Regiment personnel, the USAF version of Rapier is intended primarily for defense against fast (Mach 1+) maneuvering, low-flying targets by day and night. The four-round fire unit, Blindfire radar, and a trailer of reload missiles are towed by Land Rovers loaded with support equipment.

Under a similar agreement, the government of Turkey agreed to locate Rapiers procured by DoD to defend two US air bases in that country.
Contractor: British Aerospace PLC, Dynamics Division.
Power Plant: IMI two-stage solid-propellant rocket motor.
Guidance: Racal-Decca surveillance radar and command to line-of-sight guidance. Optional Marconi DN181 Blindfire radar or optical target tracking, according to conditions.
Warhead: semi armor-piercing, with impact fuze.
Dimensions: length 7 ft 4 in, body diameter 5 in, wing span 1 ft 3 in.
Weight: approx 94 lb.
Performance: max speed more than Mach 2, range 4 miles.

Launch Vehicles

Atlas II

In operation since 1957, Atlas and Atlas/Centaur vehicles have achieved a percentage success rate well into the 90s in around 500 launches of military and commercial satellites, as well as manned spacecraft. The supply of retired and modified Atlas ICBMs has been exhausted, but in May 1988 USAF selected General Dynamics to build an upgraded Atlas/Centaur vehicle, known as Atlas II, to meet its continuing medium launch vehicle (MLV II) requirement. The familiar "stage-and-a-half" configuration of the original ICBM is retained for the basic Atlas. Changes include lower-cost advanced avionics, an improved flight computer, booster engines with greater thrust, and longer propellant tanks. The engine and tank changes will be made to both the Atlas and Centaur stages. Eleven Atlas II vehicles have been procured to date, with the first flight scheduled for 1991. Primary payload will be the Defense Satellite Communications System (DSCS).
Prime Contractor: General Dynamics Corporation, Convair Division.
Power Plant: uprated Rocketdyne MA-5 propulsion system in Atlas stage, comprising central sustainer motor and two boosters; total thrust 414,000 lb.
Dimensions (Atlas stage): length 81 ft 7 in, max body diameter 10 ft 0 in.
Launch Weight: 412,000 lb.
Performance: capable of putting 11,200 lb into a low earth orbit and 6,100 lb into a geosynchronous transfer orbit.

Centaur

Centaur was the first US high-energy upper stage and first to utilize liquid hydrogen as a propellant. Its multiburn and extended coast capability were first used operationally during the 1977 Mariner Jupiter/Saturn missions. The **D-1A** version used with the Atlas demonstrated widely ranging applications and capabilities. The nose section of Atlas was modified to a constant 10 ft

diameter to accommodate the Centaur, which, in turn, provided most of the electronic command and control systems for the launch vehicle. A 10 ft diameter fairing protected payloads for Centaur D-1A.

The version of Centaur to be used on the new Atlas II will have modifications to its tanks and engines.

The modified **Centaur G-prime** upper stage will be used with the Titan IV, creating the greatest weight-to-altitude capability of any US launch vehicle, by placing a 10,200 lb payload into geosynchronous orbit. *(Data for Centaur D-1A and G-prime.)*

Prime Contractor: General Dynamics Corporation, Convair Division.

Power Plant: two Pratt & Whitney RL 10A-3 liquid oxygen/liquid hydrogen rocket engines; each 16,500 lb thrust.

Guidance: inertial guidance system.

Dimensions (Centaur D-1A only): length 30 ft 0 in, diameter 10 ft 0 in.

Launch Weight: (D-1A, approx): 35,000 lb; (G-prime-mod, approx): 53,000 lb.

Scout

Scout was designed to enable NASA and DoD to conduct space, orbital, and reentry research at comparatively low cost, using off-the-shelf major components where available. The basic current version, with an improved fourth stage, was launched successfully for the first time in August 1965. In addition to increasing the payload, this version can be maneuvered in yaw and can send a 100 lb payload more than 16,000 miles into space. Using the Algol IIIA first-stage motor, Scouts can put 377 lb payloads into a 310-mile polar orbit and have been used to launch many unmanned spacecraft, including satellites, for DoD, NASA, and international groups.

Prime Contractor: LTV Missiles & Electronics Group (a unit of LTV Corporation).

Power Plant: first stage: CSD Algol IIIA, 109,000 lb thrust; second stage: Thiokol Castor IIA solid-propellant motor, 64,000 lb thrust; third stage: Thiokol Antares IIIA solid-propellant motor, 18,700 lb thrust; fourth stage: Thiokol Altair IIIA solid-propellant motor, 5,800 lb thrust.

Guidance: simplified Honeywell gyro guidance system.

Dimensions: height overall 75 ft 5 in, max body diameter 3 ft 9 in.

Launch Weight: 47,619 lb.

Titan II

USAF has refurbished and reactivated Titan II ICBMs for use as space launch vehicles now that there are no more Atlas Es. Able to place payloads of more than 4,200 lb into polar orbit, the Titan IIs are suitable for launch-on-demand missions. The first launch of a Titan II space vehicle occurred last September. The Titan II will support a variety of DoD users, including DMSP, NROSS, and the space test program. As of early 1989, 14 of the 56 available Titan II missiles are scheduled for conversion to space launch vehicles.

Prime Contractor: Martin Marietta Denver Aerospace.

Power Plant: first and second stages: Aerojet liquid hypergolic propellants: first stage 474,000 lb thrust; second stage 100,000 lb thrust.

Guidance: Delco inertial guidance system.

Dimensions: first and second stages: height 110 ft 9½ in, diameter 10 ft; payload fairing heights 20, 25, and 30 ft, diameter 10 ft.

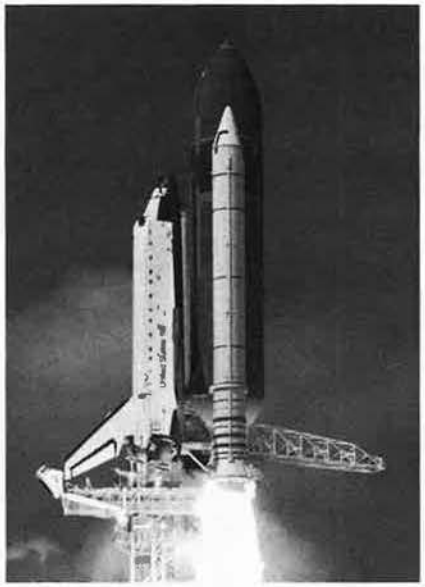
Launch Weight: 408,000 lb.

Performance: 4,200 lb to low earth polar orbit.

Titan 34D and Titan IV

The basic **Titan 34D** has an uprated version of the two-stage Titan II ICBM as its core section, plus two five-and-a-half segment solid strap-on boosters, and either the Boeing inertial upper stage (IUS) developed for the shuttle or Transtage, an upper stage capable of functioning both in the boost phase of flight and as a restartable space propulsion vehicle. It can place a 4,000 lb payload into geosynchronous orbit or 27,000 lb into low earth polar orbit. Sixteen Titan 34Ds were ordered by USAF. The first of them was launched from Cape Canaveral in October 1982. However, the launch program was seriously interrupted by the successive failure of two Titan 34Ds in August 1985 and April 1986. AFSC Space Division's subsequent reassessment of the 34D was completed in the summer of 1987, and the rocket was launched successfully in October and again in November the same year. The last Titan 34Ds were scheduled to be launched during 1989.

In February 1985, the **Titan IV** was selected to augment the space shuttle and to allow greater flexibility in launching critical military payloads. It has stretched first and second stages, seven-segment solid boosters, and either the Centaur G-prime upper stage, enabling it to place a 10,200 lb payload into geosynchronous orbit, 31,100 lb into low polar orbit, or 39,100 lb into low equatorial orbit, or the IUS, which can place 5,300 lb into geosynchronous orbit. USAF originally contracted for 23 Titan IVs, and the capability to launch a satellite into equatorial orbit from Cape Canaveral, Fla., has been available since the beginning of this year. Launches of satellites into transpolar orbits from Vandenberg AFB, Calif., are scheduled to begin in early 1990, and the first Titan IV/Centaur launch capability of a payload into geosynchronous orbit from Cape Canaveral is scheduled for late 1990. The Air Force is now planning to procure an additional 18 vehicles (with options for six more) to support launches through 1995.



Space Shuttle

Titan 34D

Prime Contractor: Martin Marietta Denver Aerospace.

Power Plant: Titan 34D first and second stages: Aerojet liquid-propellant engines: first stage 526,000 lb thrust; second stage 102,000 lb thrust; Transtage: Aerojet twin-chamber liquid-propellant engine; 16,000 lb thrust; two CSD five-and-a-half segment solid-propellant booster rocket motors; each more than 1,150,000 lb thrust. (Titan IV: first stage 546,000 lb thrust; second stage 104,000 lb thrust; two SRBs total 3,200,000 lb thrust.)

Dimensions: Titan 34D first and second stages of core: height 101 ft, diameter 10 ft; Transtage: height 14 ft 8 in, diameter 10 ft.

Launch Weight (approx): (Titan 34D) 1,400,000 lb; (Titan IV) 1,900,000 lb.

Performance: (Titan 34D/Transtage): 4,000 lb to geosynchronous orbit; (Titan IV/Centaur): 10,200 lb to geosynchronous orbit.

Space Transportation System

The Space Transportation System (STS) regained its place in space with the successful flight of *Discovery* last September. This flight marked the first shuttle launch since the loss of the orbiter *Challenger* and its crew in January 1986. The orbiter *Atlantis* followed in December, launching a military payload, and *Discovery* was launched again in March 1989.

Developed for use by both DoD and NASA, the space shuttle was the first reusable space vehicle. It consists of an orbiter, similar in configuration to a delta-wing airplane but powered by liquid-propellant rocket motors; a large jettisonable tank carrying the fuel for these motors, which is attached to the orbiter at liftoff; and two solid-propellant rocket boosters, mounted on each side of the fuel tank for liftoff.

The shuttle is launched vertically, with all engines firing in both the orbiter and the boosters. At an altitude of approximately 28 miles, the booster stages separate and descend by parachute into the ocean for recovery and eventual reuse. The orbiter then continues under its own power, jettisoning the external fuel tank just before attaining orbit. The orbiter is provided with a series of smaller rocket engines for maneuvering and attitude control, and these ensure insertion of the vehicle into the final desired orbit. Its main tasks are to place satellites into orbit, retrieve satellites from orbit, and repair and service satellites in orbit. On completion of a mission, the orbiter flies back into the atmosphere and, once through the reentry phase, lands like an airplane, but without power.

Four operational orbiters, named *Columbia, Challenger, Discovery,* and *Atlantis,* were built. A new orbiter to replace *Challenger* is under construction and scheduled for delivery in spring 1991. The first of four test flights (STS-1) was made by *Columbia* from Kennedy Space Center, Fla., in April 1981. The first operational mission deployed two satellites into space in November 1982. First payload deployment for DoD, using an IUS booster, took place in January 1985. However, following the loss of *Challenger,* military payloads will be carried on fewer than one-third of the shuttle flights now scheduled over the next few years. Shuttle facilities at the Vandenberg AFB, Calif., launch and landing site have been placed in mothball status.

Prime Contractors: Rockwell International (orbiter), Martin Marietta (propellant tank), Thiokol (boosters), Lockheed Space Operations (shuttle processing).

Power Plant: three Rocketdyne main engines, each 375,000 lb thrust at liftoff. Two Thiokol solid-propellant rocket boosters, each 2,700,000 lb thrust at liftoff.

Guidance: automatic and manual control.

Dimensions: orbiter: length 122 ft, wing span 78 ft 0.7 in, height 56 ft 7 in.

Launch Weights: shuttle complete approx 4,500,000 lb, orbiter (empty) 165,000 lb, external tank (full) 1,655,600 lb, boosters (2) each 1,292,000 lb.

Inertial Upper Stage (IUS)

Used for the first time in October 1982, the IUS is intended to serve as an upper stage for both the Titan 34D/IV and the space shuttle. Consisting of an aft skirt, an aft-stage solid rocket motor, an interstage, a forward-stage solid rocket motor, and an equipment support structure, it has the capability of boosting 4,000 lb into geosynchronous orbit when used with Titan 34 or 5,300 lb on Titan IV.

Prime Contractor: Boeing Aerospace.

Power Plant: aft-stage solid rocket motor 21,400 lb thrust, forward-stage solid rocket motor 18,500 lb thrust.

Guidance: inertial, plus star tracker.

Dimensions: length 17 ft, diameter 9 ft 2¼ in.

Launch Weight: 32,500 lb.

PAM-D II

The original PAM (Payload Assist Module) was developed as a commercial venture in 1976 to improve the load-carrying capability of the Delta and Atlas launch vehicles and for use on the space shuttle. An improved motor in PAM-D II enables it to boost a 4,200 lb satellite into geosynchronous orbit. It was selected by USAF to put all 28 Navstar GPS satellites into 10,900 nautical mile, twelve-hour orbits from the shuttle, under a multi-year purchase agreement to procure 28 of the upper stages in 1985–90. It is still hoped to launch 22 of the satellites by October 1991, but 12 of them will now be put into orbit by Delta II MLVs and only ten by shuttle. A spring-loaded mechanism will eject each spinning PAM-D II and satellite from the shuttle cargo bay. The spinning motion will stabilize the package from initial deployment to positioning in orbit.

Contractor: McDonnell Douglas Astronautics Company.

Delta II

In January 1987, McDonnell Douglas was selected by USAF to build 20 of a modified version of its Delta rocket to launch the Navstar Global Positioning System (GPS) satellites. The Delta II is slightly larger than the earlier Delta in order to satisfy USAF's medium-payload requirement. The first launch, on February 14 of this year, was successful. All 20 rockets are to be launched by 1991, the contract containing harsh financial penalties should any fail.

Delta II is a three-stage booster surrounded by nine solid-propellant, graphite epoxy motors (GEMs). The GEMs are currently under development and will not be available for the first nine GPS flights. These flights will, therefore, employ a modified version of the current Delta's Castor IV engine, the Castor IVA. Delta II will differ from the earlier version in having a twelve-foot stretch in the first-stage tanks and, from flight No. 10, an increased expansion ratio on the first-stage engine.

Additional Delta IIs are planned for procurement for GPS replenishment after the required constellation is achieved.

Prime Contractor: McDonnell Douglas Astronautics Corporation.

Power Plant: first stage: Rocketdyne RS-27A liquid-propellant engine, 237,000 lb thrust; second stage: Aerojet IT1P liquid-propellant engine, 9,400 lb thrust; third stage: Morton Thiokol SGS II derivative, 15,400 lb thrust; strap-on GEM solid rocket motors, 143,235 lb thrust.

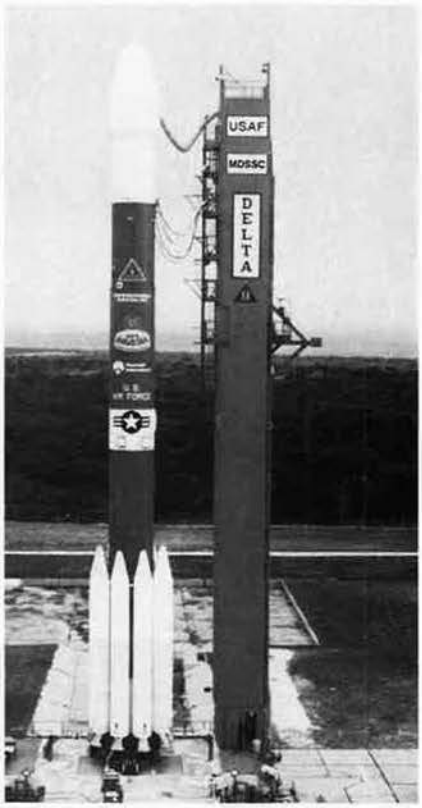
Dimensions: length 130 ft, diameter 8 ft; bulbous payload fairing, max diameter, 9 ft 6 in.

Liftoff Weight: 509,000 lb.

Performance: 11,110 lb to 100 nm.

Advanced Launch System (ALS)

On August 16 last year, USAF awarded contracts to Boeing Aerospace, General Dynamics Space Systems Division, and the team of Martin Marietta and McDonnell Douglas Astronautics for system design and technology demonstrations through preliminary design review of a heavy-lift Advanced Launch System (ALS). The contracts are for a minimum of 24 months and will result in the selection of a winning design. Development of the ALS is aimed at significantly reducing launch costs for civil and defense users, whilst assuring access to space for the late 1990s and beyond. The new system must be able to place payloads weighing up to 160,000 lb into low earth orbit at considerably reduced cost per pound of payload. FY '89 funding is provided by SDI, with Air Force funding to begin in FY '90. NASA is a major participant in this effort.



Delta II

Remotely Piloted Vehicles (RPVs)

MQM-107B/D Streaker

A longer, reengined version of the earlier MQM-107A, originally ordered for the US Army in 1975, the **MQM-107B** is a recoverable, variable-speed target drone. Improvements tested and proven on the "A" version are incorporated on the "B" version. An initial order for ten each for USAF and the US Army was supplemented in April 1983 with major production orders for both services. Deliveries were made between August 1984 and May 1985, but it is planned to continue procurement of the MQM-107B as USAF's standard subscale target drone. Also in use with USAF, the **MQM-107D** is similar to the "B" version but is powered by a Teledyne CAE 373-8 engine (960 lb thrust). MQM-107B/Ds assigned to Tyndall AFB, Fla., and MQM-107Ds at Wallace AS in the Philippines are used to test and evaluate air-to-air missiles. *(Data for MQM-107B.)*

MQM-107B

AQM-34M

QF-100

Contractor: Beech Aircraft Corporation.

Power Plant: one Microturbo TRI 60-2 Model 074 turbojet; 831 lb thrust.

Guidance and Control: analog or digital, for both ground control and preprogrammed flight. High-*g* autopilot provisions.

Dimensions: length 18 ft 1 in, body diameter 1 ft 3 in, span 9 ft 10 in.

Weight: launch weight (incl booster) 1,090 lb.

Performance: operating speed 230–594 mph, operating height 50–40,000 ft, endurance 2 hr 18 min.

BQM-34 Firebee

Since initial development of the **BQM-34A** in the late 1950s, more than 6,000 of these jet target vehicles have been delivered to support weapon system and target research, development, test, evaluation, quality assurance, training, and annual service practices by all three of the US services and by foreign governments. The BQM-34s deployed at Wallace AS in the Philippines and Tyndall AFB, Fla., are used in the testing and evaluation of air-to-air missiles.

The BQM-34A was to be replaced by the MQM-107D. However, in September 1987, USAF placed an order for 50 new Firebee drones. These are equipped with an uprated General Electric J85-17C engine, which provides a thrust to weight ratio of 1:1 and features higher climb rates and 6*g* maneuvering capability. A new microprocessor flight control system (MFCS) provides a prelaunch and in-flight self-test capability. The new targets are to be used for weapon system evaluation at Tyndall AFB, starting this year. *(Data for BQM-34A.)*

Contractor: Teledyne Ryan Aeronautical.

Power Plant: one Teledyne CAE J69-T-29 turbojet; 1,700 lb thrust; later models have one General Electric J85-GE-7 turbojet; 2,450 lb thrust.

Guidance and Control: remote control methods include choice of radar, radio, active seeker, and automatic navigator developed by Teledyne Ryan; Vega DTCS (drone tracking and control system); microwave command and guidance system also available.

Dimensions: length 22 ft 10.8 in, body diameter 3 ft 1.2 in. span 12 ft 10.8 in.

Weight: launch weight 2,500 lb.

Performance: max level speed at 6,500 ft 690 mph, operating height range 20 ft to more than 60,000 ft, max range 796 miles.

AQM-34M Firebee

Eighteen AQM-34 Firebee drones have been reactivated for tests of the over-the-horizon backscatter (OTH-B) and north warning radar systems. The first was successfully tested in September 1987. The drones, which had been stored at the Warner Robins (Ga.) Air Logistics Center for ten years, are being used by the 6514th Test Squadron at Hill AFB, Utah.

Contractor: Teledyne Ryan Aeronautical.

Power Plant: one J69-T-41A turbojet; 1,920 lb thrust.

Guidance and Control: Preprogrammed digital computer, with Doppler guidance system.

Dimensions: length 30 ft, body diameter 3 ft 1.2 in, wing span 14 ft 6 in.

Weight: max launch weight 3,113 lb.

QF-100

A full-scale aerial target (FSAT) program is ongoing which converts retired F-100 fighter-bombers to QF-100 RPV configuration. This program provides FSATs for air-to-air and ground-to-air missile evaluation at Eglin Gulf Test Range in Florida and White Sands Missile Range in New Mexico.

Contractor: initial deliveries (from 1981) Sperry Corporation; follow-on (from 1984) FSI.

Power Plant: one Pratt & Whitney J57-P-21A turbojet; 16,950 lb thrust.

Guidance and Control: dual Vega command guidance and telemetry systems.

Dimensions: length 54 ft 3 in, height 16 ft 2⅔ in, wing span 38 ft 9⅓ in.

Weight: mission operational weight 31,000 lb.

Performance: max speed at altitude Mach 1.3, operating height range 200–50,000 ft, nominal range 138 miles.

QF-106

The QF-106 will replace the QF-100 as USAF's FSAT in late FY '90. Advantages of the QF-106 over the QF-100 include higher supersonic speeds while under remote control and increased maneuverability.

Contractor: Honeywell Inc.

Power Plant: one Pratt & Whitney J75-P-17 turbojet; 24,500 lb thrust with afterburning.

Guidance and Control: automatic flight control system with digital backup.

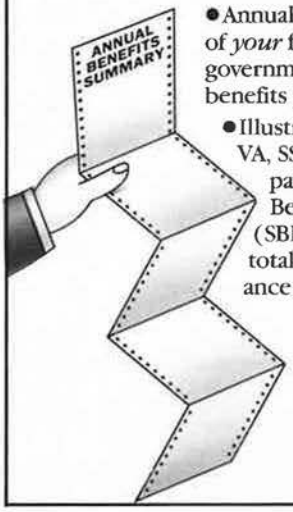
Dimensions: length 70 ft 8 in, height 20 ft 3 in, wing span 38 ft 5 in.

Weight: mission operational weight 40,500 lb.

Performance: max speed Mach 2, service ceiling 50–55,000 ft, range (approx) 400 miles. ■

Here Are Just a *Few* of Our Services

1. Individually tailored summary of benefits



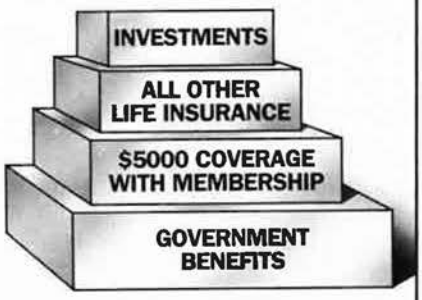
- Annual summary of *your* family's government benefits package
- Illustration of VA, SS retired pay, Survivor Benefit Plan (SBP) and your total life insurance portfolio

2. Reliable counsel on insurance and government benefit programs

- Reliable, unbiased advice on life insurance; information on health insurance
- Complete authoritative information on VA, Social Security, SGLI, and SBP
- Pre-retirement advice

3. Baseline life insurance included with membership

- $5,000 coverage comes with membership
- Provides funds for final expenses
- Can grow significantly



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Altus AFB, Okla. 73523-5000; within Altus city limits. Phone (405) 482-8100; AUTOVON 866-1110. MAC base. 443d Military Airlift Wing (Training); 340th Air Refueling Wing (SAC); 2002d Communications Sqdn. (AFCC); Field Training Det. 403; 71st Flying Training Wing, OLK ACE Det. (ATC), T-37 aircraft operations; Det. 4, 17th Weather Sqdn.; Det. 3, 1600th Management Engineering Sqdn.; Det. 4, 1365th Audiovisual Sqdn. Base activated Jan. 1943; inactivated May 1945; reactivated Jan. 1953. Area 3,582 acres, plus 818 leased. Altitude 1,376 ft. Military 3,542; civilians 1,329; approximately 400–500 TDY students (officer and enlisted) in training per month. Payroll $86.3 million. Housing: 133 officer; 667 NCO; 365 VAQ, 158 VOQ, 11 transient family units. 25-bed hospital.

Andersen AFB, Guam, APO San Francisco 96334-5000; 2 mi. N of Yigo. Phone: AUTOVON 322-1110. SAC base. 43d Bomb Wing, heavy bomber and tanker operations with B-52 and KC-135 aircraft; 43d Combat Support Gp.; 27th Communications Sqdn. (AFCC); 605th Military Airlift Support Sqdn. (MAC). Base also supports Joint Typhoon Warning Center, Northwest Field, and Andersen South housing area. 43d BMW is SAC's only B-52 unit outside the CONUS. Mission is conventional bombing, sea surveillance, and antiship operations. Andersen serves as a vital refueling point for aircraft operating in the Pacific and is home for the Pacific Tanker Task Force. Base activated late 1944; named for Gen. James Roy Andersen, lost at sea between Kwajalein and Hawaii Feb. 26, 1946. General Andersen was the Chief of Staff, Headquarters Army Air Forces, Pacific Ocean Areas. Area: 20,504 acres. Altitude: 612 ft. Military 3,000; civilians 467. Payroll $10.8 million. Housing: 262 officer; 1,489 civilian. Clinic.

Andrews AFB, Md. 20331-5000; 11 mi. SE of Washington, D. C. Phone (301) 981-9111; AUTOVON 858-1110. MAC base. Hq. Air Force Systems Command (AFSC) provides aerospace systems, equipment, and initial spare parts for the Air Force's operational and support commands. 1776th Air Base Wing; 89th Military Airlift Wing; 113th Tactical Fighter Wing (ANG); 459th Military Airlift Wing (AFRES); 2045th Communications Gp. (AFCC); 1361st Audiovisual Sqdn.; Naval Air Facility; Marine Aircraft Gp. 41, Det. A. Base activated May 1943; named for Lt. Gen. Frank M. Andrews, military air pioneer and WW II commander of the European theater, killed in aircraft accident May 3, 1943, in Iceland. Area 4,982 acres (including easements). Altitude 281 ft. Military 10,112; civilians 4,624. Payroll $329.5 million. Housing: 387 officer; 1,695 NCO; 210 mobile home spaces; 482 transient (incl. 68 temporary living quarters for incoming personnel, 79 DV suites, 223 VOQ, 112 TAQ). 320-bed hospital.

Arnold AFB, Tenn. 37389; approx. 7 mi. SE of Manchester. Phone (615) 454-3000; AUTOVON 340-5011. AFSC base. Site of Arnold Engineering Development Center, free world's largest complex of wind tunnels, jet and rocket engine test cells, space simulation chambers, and hyperballistic ranges. AEDC supports the acquisition of new aerospace systems by conducting research, development, and evaluation testing for USAF, other services, and government agencies. Base activated Jan. 1, 1950; named for Gen. H. H. "Hap" Arnold, wartime Chief of the AAF. Area 40,118 acres. Altitude 950–1,150 ft. Military 186; civilians 220; contractor employees 3,600. Payroll $142.2 million. Housing: 24 officer; 16 NCO; 45 transient. Medical aid station.

Aviano AB, Italy, APO New York 09292-5000; adjacent to Aviano, 50 mi. N of Venice, Italy. Phone (commercial, from CONUS) 011-39-434-651141; AUTOVON 632-1110. USAFE base. 40th Tactical Gp. manages this USAFE main operating base in support of USAFE and NATO. Originally an Italian flying school, which opened in 1939; 40th Tactical Gp. began operation in Apr. 1966. Area 1,140 acres. Altitude 319 ft. Military 2,500; civilians 500. Payroll $74.6 million. No on-base or government-leased housing. 665 billeting spaces. Clinic.

Barksdale AFB, La. 71110-5000; in Bossier City. Phone (318) 456-2252; AUTOVON 781-1110. SAC base. Hq. 8th Air Force; 2d Bomb Wing, B-52G, KC-135, and KC-10 aircraft operations; 1st Combat Evaluation Gp.; 46th Communications Gp. (AFCC); Det. 1, 307th Civil Engineering Sqdn. RED HORSE (AFRES); Det. 1, 14th Flying Training Wing (ATC), T-37 aircraft operations; Det. 5, 3904th Management Engineering Sqdn.; 26th Weather Sqdn. (MAC); Det. 3, 1401st Military Airlift Sqdn. (MAC), CT-21 aircraft operations; 49th Test Sqdn.; 3097th Aviation Depot Sqdn. (AFLC); Det. 2, 4200th Test Sqdn.; 3903d School Sqdn. (SAC NCO Academy); 745th Air Force Band Sqdn.; 78th Air Refueling Sqdn. (AFRES), KC-10 aircraft operations; 917th Tactical Fighter Wing (AFRES), A-10 operations. Also home of the 8th Air Force Museum. The 917th TFW trains all ANG and AFRES pilots in the 46th Tactical Fighter Training Sqdn. Base activated Feb. 2, 1933; named for Lt. Eugene H. Barksdale, WW I airman killed Aug. 1926 in crash near Wright Field, Ohio. Area 22,000 acres (20,000 acres reserved for recreation). Altitude 166 ft. Military 7,000; civilians 1,207. Payroll $145.3 million. Housing: 205 officer; 828 NCO; 29 transient. 70-bed hospital.

Beale AFB, Calif. 95903-5000; 13 mi. E of Marysville. Phone (916) 634-3000; AUTOVON 368-1110. SAC base. 14th Air Div.; 9th Strategic Recon Wing; 7th Missile Warning Sqdn. (AFSPACECOM); 1883d Communications Sqdn. (AFCC). Aircraft include the SR-71, U-2, and TR-1 reconnaissance aircraft, KC-135 aerial tankers, and T-38 trainers. Originally US Army's Camp Beale. Became Air Force installation Apr. 1948; became AFB Nov. 1951. Named for Brig. Gen. E. F. Beale, Indian agent in California prior to Civil War. Area 22,944 acres. Altitude 113 ft. Military 4,141; civilians 500. Payroll $146.6 million. Housing: 211 officer; 1,501 NCO; 127 transient. 25-bed hospital.

Bergstrom AFB, Tex. 78743-5002; 7 mi. SE of downtown Austin. Phone (512) 369-4100; AUTOVON 685-4100. TAC base. 67th Tactical Reconnaissance Wing, RF-4C reconnaissance operations; Hq. 12th Air Force; Hq. 10th Air Force (AFRES); 924th Tactical Fighter Gp. (AFRES), F-4D fighter operations; TAC NCO Academy West; 602d Tactical Air Control Gp.; Det. 67, 4400th Management Engineering Sqdn.; Det. 12, Tactical Communications Div. Base activated Sept. 22, 1942; named for Capt. John A. E. Bergstrom, first Austin serviceman killed in WW II, who died Dec. 8, 1941, at Clark Field, Philippines. Area 3,999 acres. Altitude 541 ft. Military 4,951; civilians 1,054. Payroll $147.2 million. Housing: 75 officer; 644 enlisted; 182 transient (81 VOQ, 60 VAQ, 41 TLF). 30-bed hospital.

Bitburg AB, W. Germany, APO New York 09132-5000; 15 mi. N of Trier, W. Germany. Phone (commercial, from CONUS) 011-49-6561-61-1110; AUTOVON 453-1110. USAFE base. 36th TFW with three fighter sqdns. flying F-15C/D Eagle aircraft. Base activated in 1952. Area 1,236 acres. Altitude 1,228 ft. Military 3,621; civilians 853. Payroll $102 million. Housing: 75 officer; 1,128 NCO; 62 transient. 40-bed hospital.

Bolling AFB, D. C. 20332-5000; 3 mi. S of US Capitol. Phone (202) 545-6700; AUTOVON 227-0101. Air Force District of Washington. 1100th Air Base Gp.; US Air Force Honor Guard; US Air Force Band; Air Force Office of Scientific Research (AFSC); Air Force Chief of Chaplains; Air Force Surgeon General; Air Force Office of History; Hq. Air Force Office of Special Investigations. Activated Oct. 1917; named for Col. Raynal C. Bolling, first high-ranking Air Service officer killed in WW I. Area 604 acres. Military 2,800; civilians 1,000. Payroll $112 million. Housing: 405 officer; 990 NCO; 257 transient. Clinic.

Brooks AFB, Tex. 78235; in SE San Antonio. Phone (512) 536-1110; AUTOVON 240-1110. AFSC base. Human Systems Div.; USAF School of Aerospace Medicine; Air Force Occupational and Environmental Lab (AFSC); Air Force Drug Testing Lab (AFSC); Air Force Human Resources Lab (AFSC); 6570th Air Base Gp. Tenant units include 6575th School Sqdn. (Systems Acquisition School); Air Force Office of Medical Support; Hq. AFSC Det. 20, Directorate of Professional Development; 2199th Communications Sqdn. (AFCC); Det. 16, 6592d Management Engineering Sqdn.; 6906th Electronic Security Sqdn. (ESC). Base activated Dec. 8, 1917; named for Cadet Sidney J. Brooks, Jr., killed Nov. 13, 1917, on his commissioning flight. Area 1,210 acres. Altitude 600 ft. Military 1,620; civilians 1,367. Payroll $87 million. Housing: 70 officer; 100 NCO; 8 transient. Clinic.

Cannon AFB, N. M. 88103-5000; 7 mi. W of Clovis. Phone (505) 784-3311; AUTOVON 681-1110. TAC base. 27th Tactical Fighter Wing, F-111D fighter operations. Base activated Aug. 1942; named for Gen. John K. Cannon, WW II commander of all Allied air forces in the Mediterranean theater. Area 25,663 acres. Altitude 4,295 ft. Military 3,650; civilians 782. Payroll $116 million. Housing: 149 officer; 862 enlisted. 40-bed hospital.

Carswell AFB, Tex. 76127-5000; 7 mi. WNW of downtown Fort Worth. Phone (817) 782-5000; AUTOVON 739-1110. SAC base. 19th Air Div.; 7th Bomb Wing (SAC); 301st Tactical Fighter Wing (AFRES); 436th Strategic Training Sqdn. (SAC); 2048th Communications Sqdn. (AFCC); AF Central Notice to Airman (NOTAM) Facility (AFSC); Det. 1, 1365th Audiovisual Sqdn. (MAC); Det. 7, AF Global Weather Central (MAC); Det. 415, 3751st Field Training Sqdn. (MAC); aircraft include B-52s, KC-135s, and AFRES F-4s. T-37 Accelerated Copilot Enrichment Program. Base activated Aug. 1942; named Jan. 30, 1948, for Maj. Horace S. Carswell, Jr., native of Fort Worth, WW II B-24 pilot, and posthumous Medal of Honor recipient. Carswell is the only military facility to have its namesake interred on the premises. Area 3,274 acres. Altitude 650 ft. Military 6,946; civilians 1,280. Payroll $322 million. Housing: 107 officer; 700 NCO; 106 VOQ, 18 TLF, 80 VAQ. 100-bed regional hospital. A $34.7 million reconstruction program upgrading the hospital was completed in 1988.

Castle AFB, Calif. 95342-5000; 8 mi. NW of Merced. Phone (209) 726-2011; AUTOVON 347-1110. SAC base. 93d Bomb Wing. Conducts training of all SAC B-52 and KC-135 aircrews. Also houses Det. 1, 318th Fighter Interceptor Sqdn. (TAC). Site of Castle Air Museum. Base

activated Sept. 1941; named for Brig. Gen. Frederick W. Castle, WW II B-17 pilot and Medal of Honor recipient. Area 2,700 acres. Altitude 188 ft. Military 5,833; civilians 853. Payroll $191.4 million. Housing: 92 officer; 842 NCO; 432 transient (incl. 88 VAQ, 272 VOQ, 12 family quarters, 24 distinguished visitor quarters). 25-bed hospital.

Chanute AFB, Ill. 61868-5000; 14 mi. N of Champaign at Rantoul. Phone (217) 495-1110; AUTOVON 862-1110. ATC base. Chanute Technical Training Center provides training in missile and aircraft mechanics, aerospace ground equipment, life support, metallurgy and nondestructive inspection, weather forecasting, weather equipment, and fire protection and rescue. Display center and historical aircraft park make up a base museum. Base activated May 1, 1917; named for Octave Chanute, aeronautical engineer and glider pioneer who died in 1910. Area 2,125 acres. Altitude 735 ft. Military 5,950; civilians 991. Payroll $122.8 million. Housing: 154 officer; 1,319 enlisted; 296 VOQ, 996 VAQ, 34 TLF. 35-bed hospital.

Charleston AFB, S. C. 29404-5000; located in North Charleston 10 mi. from downtown Charleston. Phone (803) 554-0230; AUTOVON 583-0111. MAC base. Joint-use airfield. 437th Military Airlift Wing; 315th MAW (AFRES Assoc.); 1968th Communications Sqdn.; Det. 1, 107th Fighter Interceptor Gp. (TAC); Det. 7, 1361st Audiovisual Sqdn. Base activated Dec. 1941; inactivated Feb. 1946; reactivated 1952. Area 6,314 acres (incl. an auxiliary airfield). Altitude 45 ft. Military 7,790 (incl. AFRES); civilians 1,378. Payroll $149.2 million. Housing: 127 officer; 850 NCO; 1,798 dormitory spaces; 75 trailer spaces; 535 transient (7 DV suites, 128 VOQ, 400 VAQ). Medical clinic.

Cheyenne Mountain AFB, Colo. 80914-5515; 6 mi. S of Colorado Springs. Phone (719) 554-7321; AUTOVON 692-7011. AFSPACECOM base. Host unit is 3d Space Support Wing (AFSPACECOM). Cheyenne Mountain Support Group, North American Aerospace Defense Command (NORAD) Command Post, and US Space Command operations centers. Base activated 1966. Area 451 total acres. Altitude 7,200 ft. More than 1,400 people. No housing or transient quarters. Medical aid station.

Clark AB, Republic of the Philippines, APO San Francisco 96274-5000; 65 mi. N of Manila. Phone (commercial, from CONUS) 011-6345-35-33995; AUTOVON 393-3995. PACAF base. Hq. 13th Air Force; 3d Tactical Fighter Wing, F-4E and F-4G fighter operations; 374th Tactical Airlift Wing (MAC); 13th Air Force Medical Center; 1961st Communications Gp. (AFCC); 8th Mobile Aerial Port Sqdn.; 9th Aeromedical Evacuation Sqdn.; 20th Aeromedical Airlift Sqdn.; 31st Aerospace Rescue & Recovery Sqdn. (MAC); 6922d Electronic Security Sqdn. (ESC). Base activated as Fort Stotsenburg in 1903, renamed in 1919 for Maj. Harold M. Clark, an early aviator killed in a seaplane crash at Miraflores Locks, Panama Canal Zone. Area 9,285 acres. Altitude 478 ft. Military 9,720; US citizens 1,006; local nationals 3,736. Payroll $193 million. Housing: 478 officer; 1,647 NCO; 72 civilian houses and 51 unaccompanied/bachelor dormitories; 664 transient, 128 temporary lodging facility units. 145-bed hospital.

Columbus AFB, Miss. 39701-5000; 10 mi. NNW of Columbus. Phone (601) 434-7322; AUTOVON 742-1110. ATC base. 14th Flying Training Wing, undergraduate pilot training. Base activated 1941 for pilot training. Area 6,013 acres. Altitude 214 ft. Military 2,000; civilians 1,040 (incl. 625 contract civilians). Payroll $75 million (FY '87). Housing: 234 officer; 586 NCO; 61 transient. 20-bed hospital.

Comiso AB, Italy, APO New York 09694-5000; on the island of Sicily 3 mi. from Comiso. Phone (commercial, from CONUS) 011-39-932-731-111; AUTOVON 628-8110. USAFE base. 487th Tactical Missile Wing, which operates the BGM-109 ground-launched cruise missile. Part of Italy's Magliocco air base, activated in 1936; 487th TMW activated June 30, 1983. Area 379 acres. Altitude 714 ft. Military 1,913; civilians 402. Payroll $52 million. Housing: 530 base housing units; 32 TLF; 22 VAQ/VOQ rooms; 3 DV suites; 956 dormitory rooms. Clinic.

Davis-Monthan AFB, Ariz. 85707-5000; within the city limits of Tucson. Phone (602) 750-3900; AUTOVON 361-1110. TAC base. 836th Air Div.; 355th Tactical Training Wing, A-10 combat crew training; 602d Tactical Air Control Wing, headquarters for OA-10, OV-10, and ground FAC tactical air control operations; 868th Tactical Missile Training Gp., ground-launched cruise missile training operations; 41st Electronic Combat Sqdn. (EC-130H); Det. 1, 120th Fighter Interceptor Gp. (Mont-ANG); and the 71st Special Operations Sqdn. (AFRES), flying HH-3 and CH-3 Jolly Green Giant helicopters. Also site of AFLC's Aerospace Maintenance and Regeneration Center. Base activated 1927; named for two local early aviators—1st Lt. Samuel H. Davis, killed Dec. 28, 1921, and 2d Lt. Oscar Monthan, killed Mar. 27, 1924. Area 11,000 acres. Altitude 2,620 ft. Military 5,725; civilians 1,499. Payroll $160.8 million. Housing: 133 officer; 1,102 enlisted; 8 guest; 680 transient. 65-bed hospital.

Dover AFB, Del. 19902-5000; 3 mi. SE of Dover. Phone (302) 678-7011; AUTOVON 455-1110. MAC base. 436th Military Airlift Wing; 512th MAW (AFRES Assoc.). Dover operates the largest aerial port facility on the East Coast. Base activated Dec. 1941; inactivated 1946; reactivated Feb. 1951. Area 3,734 acres. Altitude 28 ft. Military 4,647; civilians 1,096. Payroll $330 million. Housing: 107 officer; 1,449 enlisted; 670 transient (512 VAQ, 158 VOQ). 14 TLF. 30-bed hospital.

Dyess AFB, Tex. 79607-5000; WSW border of Abilene. Phone (915) 696-0212; AUTOVON 461-1110. SAC base. 96th Bomb Wing; Det. 1, 4201st Test Sqdn. (SAC); 463d Tactical Airlift Wing; Det. 4, 1722d Combat Control Sqdn. (MAC); 1993d Communications Sqdn. (AFCC); Field Training Det. 417; 12th Flying Training Wing ACE Det. OLC; B-1B Site Activation Task Force (AFSC); B-1B, KC-135, C-130, T-38 operations. First base to activate an operational B-1B wing and conduct B-1 combat crew training for the Air Force. First B-1B arrived June 1985; wing met initial operational capability Oct. 1986. Base activated Apr. 1942; deactivated Dec. 1945; reactivated as Abilene AB Sept. 1955. In Mar. 1956, renamed for Lt. Col. William E. Dyess, WW II fighter pilot known best for his escape from a Japanese prison camp, killed in P-38 crash at Burbank, Calif., Dec. 1943. Area 6,405 acres. Altitude 1,789 ft. Military 5,523; civilians 455. Payroll $159 million. Housing: 120 officer; 873 NCO; 270 VAQ/VOQ, 40 TLF. 35-bed hospital.

Eaker AFB, Ark. 72315-5000; 4 mi. NW of Blytheville. Phone (501) 762-7000; AUTOVON 721-1110. SAC base. 97th Bomb Wing; aircraft include B-52s and KC-135s. Base activated June 1942; inactivated Feb. 1947; reactivated Aug. 1955. Known as Blytheville AFB until 1988, when name was changed to honor the late Gen. Ira C. Eaker, airpower pioneer and leader of 8th Air Force in World War II. Area 3,286 acres. Altitude 254 ft. Military 3,290; civilians 408. Payroll $69.9 million. Housing: 196 officer; 732 NCO; 69 transient. 20-bed hospital.

Edwards AFB, Calif. 93523; 20 mi. E of Rosamond. Phone (805) 277-1110; AUTOVON 527-1110. AFSC base. Site of Air Force Flight Test Center (AFFTC), which conducts developmental and follow-on testing and evaluation of manned and unmanned aircraft and related avionics flight-control and weapon systems. AFFTC also operates the USAF Test Pilot School, which trains test pilots, flight-test engineers, and flight-test navigators. Also site of USAF Astronautics Laboratory, US Army Aviation Engineering Flight Activity, the NASA Ames Dryden Flight Research Facility, and the Jet Propulsion Laboratory's test facility. Edwards is the primary landing site for space shuttle missions. Base activities began in Sept. 1933. Originally Muroc Army Air Field; renamed for Capt. Glen W. Edwards, killed June 5, 1948, in crash of a YB-49 "Flying Wing." Area 301,000 acres. Altitude 2,302 ft. Military 4,443 (including tenant units); government and contractor civilians 8,160. Payroll $566.6 million (incl. tenant units and contractors). Housing: 536 officer (incl. BOQ); 3,236 enlisted (incl. 1,466 dormitory spaces and 191 bachelor NCO quarters); 211 transient (64 VAQ, 96 VOQ, 51 TLF); 188 mobile home park units. 25-bed hospital.

Eglin AFB, Fla. 32542; 2 mi. SW of the twin cities of Niceville and Valparaiso; 7 mi. NE of Fort Walton Beach. Phone (904) 881-6668; AUTOVON 872-1110. AFSC base. Eglin is the free world's largest air force base in terms of land area, covering an area roughly two-thirds the size of Rhode Island. Air Force Munitions Systems Division (host); Air Force Armament Lab (AFSC); 33d Tactical Fighter Wing; 39th Special Operations Wing; Tactical Air Warfare Center; 1972d Communications Gp.; 919th Special Operations Gp. (AFRES); 20th Surveillance Sqdn.; 55th Special Operations Sqdn.; 728th Tactical Control Sqdn.; US Army Florida Ranger Camp; a US Navy Explosive Ordnance Disposal School; Air Force Armament Museum. Base activated 1935; named for Lt. Col. Frederick I. Eglin, WW I flyer killed in aircraft accident Jan. 1, 1937. Area 464,980 acres. Altitude 85 ft. Work force (excl. Hurlburt Field): military 9,916; civilians 4,791; contractor 950. Payroll $381.8 million (excl. Hurlburt Field). Housing: 276 officer; 2,083 enlisted; 227 trailer spaces (officer and enlisted); 88 transient. 155-bed USAF regional hospital. AFSC clinic at Hurlburt Field.

Eielson AFB, Alaska 99702-5000; 26 mi. SE of Fairbanks. Phone (907) 377-1178; AUTOVON (317) 377-1110. AAC base. 343d Tactical Fighter Wing (host); 343d Combat Support Gp.; 18th Tactical Fighter Sqdn.; 25th Tactical Air Support Sqdn. Major tenants include 6th Strategic Reconnaissance Wing (SAC); 1995th Communications Sqdn. (AFCC); Arctic Survival School (ATC); 168th AREFS (ANG). Base activated Oct. 1944; named for Carl Ben Eielson, Arctic aviation pioneer who died Nov. 1929. Area 23,500 acres (approx.). Altitude 534 ft. Military 3,467; civilians 315. Payroll $125.3 million. Housing: 164 officer; 1,296 NCO; 90 transient. Clinic.

Ellsworth AFB, S. D. 57706-5000; 11 mi. ENE of Rapid City. Phone (605) 385-1000; AUTOVON 675-1000. 12th Air Div. (host); 44th Strategic Missile Wing, Minuteman II operations; 28th Bombardment Wing, two B-1 sqdns., one each KC-135R, EC-135; 25th Strategic Training Sqdn.; Det. 2, 37th Aerospace Rescue & Recovery Sqdn., Huey HH-1H; OLA, 84th Flying Training Wing (ATC); Det. 17, 9th Weather Sqdn.; 2148th Communications Sqdn. (AFCC). Home of the South Dakota Air and Space Museum. Base activated July 1942 as Rapid City Army Air Base; renamed June 13, 1953, for Brig. Gen. Richard E. Ellsworth, killed Mar. 18, 1953, in crash of RB-36 in Newfoundland. Area 4,906 acres. Altitude 3,200 ft. Military 7,000; civilians 750. Payroll $150.1 million. Housing: 327 officer; 1,473 NCO; 200 transient. 40-bed hospital.

Elmendorf AFB, Alaska 99506-5000; bordering Anchorage. Phone (907) 552-1110; AUTOVON (317) 552-1110. Hq. Alaskan Air Command; Hq. Alaskan NORAD Region; 21st Tactical Fighter Wing (host); 21st Combat Support Gp.; 11th Tactical Control Wing; 1931st Communications Wing; NORAD Region Operations Control Center; Rescue Coordination Center; 43d Tactical Fighter Sqdn.; 54th Tactical Fighter Sqdn.; 962d AWACS (TAC); 6981st Electronic Security Sqdn. (ESC); 616th Military Airlift Gp. (MAC); 17th Tactical Airlift Sqdn. (MAC); 71st Aerospace Rescue & Recovery Sqdn. (MAC); 11th Weather Sqdn. (MAC); plus varied US Army, Navy, and Marine activities. Base activated July 1940; named for Capt. Hugh Elmendorf, killed Jan. 13, 1933, at Wright Field, Ohio, while flight-testing a new pursuit plane. Area 13,130 acres. Altitude 118 ft. Military 6,400; civilians 2,400. Payroll $148 million. Housing: 230 officer; 1,300 NCO; transient incl. 52 family units (no pets), 90 VOQ, 300 VAQ. 95-bed hospital.

England AFB, La. 71311-5004; 5 mi. W of Alexandria. Phone (318) 448-2100; AUTOVON 683-1110. TAC base. 23d Tactical Fighter Wing, A-10 fighter operations. Base activated Oct. 1942; named for Lt. Col. John B. England, WW II P-51 pilot and ace credited with 17.5 victories, killed Nov. 17, 1954, in F-86 crash in France. Area 2,282 acres. Altitude 89 ft. Military 3,057; civilians 667. Payroll $76 million. Housing: 92 officer; 506 NCO; transient incl. 18 VAQ double rooms with 2 rooms for SNCOs and a chief's suite, 34 VOQ single rooms, 5 VIP suites, family rooms limited, reservations required. 15-bed hospital.

Fairchild AFB, Wash. 99011-5000; 12 mi. WSW of Spokane. Phone (509) 247-5704; AUTOVON 352-1110. SAC base. 57th Air Division; 92d Bomb Wing (SAC); 3636th Combat Crew Training Wing (ATC); 141st Air Refueling Wing (ANG); Det. 24, 40th Aerospace Rescue & Recovery Sqdn. (MAC); Det. 1, 1000th Satellite Operations Gp. (AFSPACECOM); 2039th Communications Sqdn. (AFCC). Base activated Jan. 1942; named for Gen. Muir S. Fairchild, USAF Vice Chief of Staff at his death in 1950. Area 6,127 acres. Altitude 2,462 ft. Military 4,368; civilians 610. Payroll $82.9 million for active-duty military and civilian. $19 million for ANG. Housing: 462 officer; 1,118 NCO; transient incl. 29 VOQ, 62 VAQ, and 8 temporary lodging facilities. 45-bed hospital.

Falcon AFB, Colo. 80912-5000; 9 mi. E of Colorado Springs. Phone (719) 550-4113; AUTOVON 560-1110. AFSPACECOM base. 2d Space Wing. Host unit is 3d Space Support Wing (AFSPACECOM). Strategic Defense Initiative National Test Facility. Base activated Sept. 26, 1985. Area 1,499 acres. Altitude 6,267 ft. Military active-duty 1,200; civilians 170; contractors 1,434. No housing or transient quarters. Medical aid station.

Francis E. Warren AFB, Wyo. 82005-5000; adjacent to Cheyenne. Phone (307) 775-1110; AUTOVON 481-1110. SAC base. 90th Strategic Missile Wing; 90th Combat Support Gp.; 37th Aerospace Rescue & Recovery Sqdn. (MAC); SATAF (AFSC); Det. 60, OO-ALC (AFLC). Base activated as Fort D. A. Russell July 4, 1867; under Army jurisdiction until 1947, when reassigned to USAF. Base renamed in 1930 for Francis Emory Warren, Wyoming senator and first state governor. Area 5,866 acres, plus 50 Peacekeeper and 150 Minuteman III missile sites distributed over 12,600 sq. mi. in Wyoming, Colorado, and Nebraska. F. E. Warren AFB was designated by President Reagan as the main operating base for the proposed deployment of the Peacekeeper rail-garrison system. Altitude 6,142 ft. Military 3,790; civilians 761. Payroll $102.4 million. Housing: 203 officer; 628 NCO; 36 transient. 25-bed hospital.

George AFB, Calif. 92394-5000; 6 mi. NW of Victorville. Phone (619) 269-1110; AUTOVON 353-1110. TAC base. 831st Air Div.; 37th Tactical Fighter Wing, home of TAC's Wild Weasel F-4G squadrons; 35th Tactical Training Wing, F-4 transitional and upgrade training; German Air Force training in F-4; Air Warrior, close air support of the

National Training Center (Army); OLAD (Operating Location Alert Detachment), 144th Fighter Interceptor Wing (TAC); 27th Tactical Air Support Sqdn., OV-10; 2067th Communications Sqdn. (AFCC). Base activated 1941; named for Brig. Gen. Harold H. George, WW I fighter ace killed Apr. 29, 1942, in aircraft accident in Australia. Area 5,347 acres. Altitude 2,875 ft. Military 5,246; civilians 548. Payroll $121.49 million. Housing: 145 officer; 1,496 enlisted; 40 transient. 25-bed hospital.

Goodfellow AFB, Tex. 76908-5000; 2 mi. SE of San Angelo. Phone (915) 657-3231; AUTOVON 477-3231. ATC base. Goodfellow Technical Training Center provides technical training for all Air Force people entering the intelligence career fields and also provides cryptologic training for members of the other military services, civilian intelligence agencies, and foreign military personnel. Major units include 3480th Technical Training Wing (ATC); 3480th Technical Training Gp. (ATC); 3480th Student Gp. (ATC); 3490th Technical Training Gp. (ATC); 3495th Technical Training Gp. (ATC); 8th Missile Warning Sqdn. (at nearby Eldorado AFS, the location of the Southwest Pave Paws radar site) (AFSPACECOM); Det. 6, USAF Occupational Measurement Center (USAFOMC); 2081st Communications Sqdn. (AFCC); NCO Professional Military Education Center (ESC); 3d Battalion, 112th Military Intelligence Brigade (US Army); Naval Technical Training Center Detachment; Marine Corps Administrative Detachment. Base activated Jan. 1941; named for Lt. John J. Goodfellow, Jr., WW I fighter pilot killed in combat Sept. 14, 1918. Area 1,127 acres. Altitude 1,877 ft. Military 3,293; civilians 554. Payroll $69.8 million. Housing: 3 officer; 59 NCO; 604 transient (570 VAQ, 34 VOQ), 20 TLF. Clinic.

Grand Forks AFB, N. D. 58205-5000; 16 mi. W of Grand Forks. Phone (701) 747-3000; AUTOVON 362-1110. SAC base. 42d Air Div.; 319th Bomb Wing (KC-135R and B-1B); 321st Strategic Missile Wing (Minuteman III). Base activated 1956; named after the city of Grand Forks, whose citizens bought the property for the Air Force. Area 6,912 acres. Missile complex covers an additional 7,500 sq. mi. Altitude 911 ft. Military 5,352; civilians 556. Payroll $116.6 million. Housing: 476 officer; 1,801 NCO; 136 transient. 35-bed hospital.

Griffiss AFB, N. Y. 13441-5000; 1 mi. NE of Rome. Phone (315) 330-1110; AUTOVON 587-1110. SAC base. 416th Bomb Wing. Other major units are Rome Air Development Center (AFSC); 485th Engineering Installation Gp. (AFCC); Hq. 24th Air Div. (TAC); Northeast Air Defense Sector (TAC); 933d Civil Engineering Sqdn. (AFRES); 10th Aviation Brigade (US Army). Base activated Feb. 1, 1942; named for Lt. Col. Townsend E. Griffiss, killed in aircraft accident Feb. 15, 1942 (the first US airman to lose his life in Europe during WW II while in the line of duty). Area 3,896 acres. Altitude 504 ft. Military 4,817; civilians 2,801. Payroll $181.3 million. Housing: 169 officer; 566 NCO; 50 trailers; 109 transient. 20-bed hospital.

Grissom AFB, Ind. 46971-5000; 7 mi. S of Peru. Phone (317) 689-5211; AUTOVON 928-1110. SAC base. 305th Air Refueling Wing; 930th Tactical Fighter Gp. (AFRES); 434th Air Refueling Wing (AFRES). Activated Jan. 1943 for Navy flight training; reactivated June 1954 as Bunker Hill AFB; renamed May 1968 for Lt. Col. Virgil I. "Gus" Grissom, killed Jan. 27, 1967, at Cape Kennedy, Fla., with other Astronauts Edward White and Roger Chaffee in Apollo capsule fire. Area 3,000 acres. Altitude 800 ft. Military 2,740; civilians 993. Payroll $56.3 million (SAC only). Housing: 144 officer; 972 NCO; 133 transient. Clinic, outpatient care only.

Gunter AFB, Ala. 36114; 4 mi. NE of Montgomery. Phone (205) 279-1110; AUTOVON 446-1110. AU base. Hq. Standard Systems Center (AFCC); Air Force Logistics Management Center; USAF Extension Course Institute; USAF Senior NCO Academy. Base activated Aug. 27, 1940; named for William A. Gunter, longtime mayor of Montgomery and airpower advocate, died 1940. Area 368 acres. Altitude 220 ft. Military 1,619; civilians 968. Payroll included in Maxwell entry. Housing: 118 officer; 206 NCO; 378 transient (107 VOQ, 268 VAC, 3 TLF).

Hahn AB, W. Germany, APO New York 09122-5000; 2 mi. from Sohren, approx. 70 mi. W of Frankfurt. Phone (commercial, from CONUS) 011-49-6543-51-1110; AUTOVON 450-1110. USAFE base. 50th Tactical Fighter Wing with three squadrons of F-16C/D aircraft. Base activated in 1951; USAF began operations in 1953. Area 1,200 acres. Altitude 1,560 ft. Military 5,650; civilians 1,815. Payroll $149.8 million. Housing: 672 apts.; 303 US Govt. leased housing. Billeting: 53 officer; 1,422 enlisted. 20-bed hospital.

Hanscom AFB, Mass. 01731; 17 mi. NW of Boston. Phone (617) 377-4441; AUTOVON 478-5980. AFSC base. Hq. Electronic Systems Div. (AFSC) manages development and acquisition of command control communications and intelligence (C^3I) systems. Also site of Air Force Geophysics Lab, center for research and exploratory development in the terrestrial, atmospheric, and space environments. Base has no flying mission; transient USAF aircraft use runways of Laurence G. Hanscom Field, state-operated airfield adjoining the base. Base named for Laurence G. Hanscom, a pre-WW II advocate of private aviation, killed in a lightplane accident in 1941. Area 846 acres. Altitude 133 ft. Military 2,950; civilians 2,580. Payroll $170 million. Housing: 370 officer; 489 NCO; 30-unit TLF, 754 BOQ/VOQ. Clinic.

Hellenikon AB, Greece, APO New York 09223-5000; 10 mi. S of Athens. Phone (commercial, from CONUS) 011-301-989-5513; AUTOVON 662-1110. USAFE base. 7206th Air Base Gp. Provides operations and maintenance support, administrative control, and base operating support to USAFE and other US forces. Base began operation in 1947 as a military mission. Named after nearest town. Area 172 acres. Altitude 90 ft. Military 1,400; civilians 750. Payroll $50.8 million. No housing; 108 dormitory rooms and 264 consolidated billeting. Hospital.

Hickam AFB, Hawaii 96853-5000; 10 mi. W of Honolulu. Phone (808) 471-7110 (Oahu military operator); AUTOVON 471-7110. PACAF base. Hq. Pacific Air Forces. Host unit 15th Air Base Wing, supporting Air Force units and installations in Hawaii and throughout the Pacific; subordinate unit 9th Airborne Command and Control Sqdn. Major associate units include Hq. 3d Air Div. (SAC); 834th Airlift Div. (MAC); Hq. Pacific Communications Div. (AFCC); 1st Weather Wing (MAC); 154th Composite Gp. (ANG); 619th Military Airlift Support Sqdn. (MAC); Det. 1, 89th Military Airlift Wing (MAC). Base activated Sept. 1938; named for Lt. Col. Horace M. Hickam, air pioneer killed in crash Nov. 5, 1934, at Fort Crockett, Tex. Area 2,694 acres. Altitude sea level. Military 3,612; civilians 1,961. Payroll $347 million (includes Hickam and Wheeler AFBs and Bellows AFS). Housing: 535 officer; 1,920 enlisted. Clinic (15th Medical Gp.).

Hill AFB, Utah 84056-5990; 5 mi. S of Ogden. Phone (801) 777-7221; AUTOVON 458-1110. AFLC base. Hq. Ogden Air Logistics Center. Furnishes logistics support for Minuteman, Peacekeeper, and Small ICBM missiles; Maverick air-to-ground missiles; laser and electro-optical guided bombs; F-4 and F-16 systems manager; air munitions; aircraft landing gear including wheels, brakes and struts, tires and tubes; photographic and aerospace training equipment. Other units include 388th Tactical Fighter Wing (TAC); 419th Tactical Fighter Wing (AFRES); 729th Tactical Control Sqdn.(TAC); 6545th Test Gp. (AFSC), which oversees management of Utah Test and Training Range and RPV test programs. Base activated Nov. 1940; named for Maj. Ployer P. Hill, killed Oct. 30, 1935, test-flying the first B-17. Area 6,666 acres; manages 961,012 acres. Altitude 4,788 ft. Military 5,100; civilians 15,300. Payroll $586 million. Housing: 263 officer; 882 NCO; 45 transient. 35-bed hospital.

Holloman AFB, N. M. 88330-5000; 8 mi. SW of Alamogordo. Phone (505) 479-6511; AUTOVON 867-1110. TAC base. 833d Air Div.; 49th Tactical Fighter Wing, F-15 operations; 479th Tactical Training Wing, lead-in fighter training; 4449th Mobility Support Sqdn., Harvest Bare; 83d Tactical Control Sqdn.; 6585th Test Gp. (AFSC) conducts test and evaluation of aircraft and missile systems. Twenty other tenant units located at Holloman, including 1877th Communications Sqdn., 4th Satellite Communications Sqdn. (AFSPACECOM), 1984th Communications Sqdn., Air Force Geophysical Laboratory detachment, and a US Army unit. Base activated 1942; named for Col. George Holloman, guided-missile pioneer, killed in B-17 crash on Formosa Mar. 19, 1946. Area 50,697 acres. Altitude 4,093 ft. Military 5,447; civilians 1,736. Payroll $210 million. Housing: 191 officer; 1,360 NCO; 255 transient. 30-bed hospital.

Homestead AFB, Fla. 33039-5000; 5 mi. NNE of Homestead. Phone (305) 257-8011; AUTOVON 791-0111. TAC base. 31st Tactical Fighter Wing, F-16 fighter operations; site of ATC sea-survival school; 726th Tactical Control Sqdn. (TAC); Naval Security Group Activity; 482d Tactical Fighter Wing (AFRES); 301st Aerospace Rescue & Recovery Sqdn. (AFRES); OLAA (Operating Location AA), 125th Fighter Interceptor Gp. (TAC). Base activated Apr. 1955. Area 3,345 acres. Altitude 7 ft. Military 5,139; civilians 1,035. Payroll $320 million. Housing: 321 officer; 1,294 NCO; 359 transient. 80-bed hospital.

Howard AFB, Panama, APO Miami 34001-5000. The 830th Air Div. represents the US Air Force in operations throughout Latin America. With headquarters at Howard AFB, Republic of Panama, the 830th AD is a unit of Tactical Air Command and reports to 12th Air Force, Bergstrom AFB, Tex. Howard was originally established in 1928 as a military post, known as Bruja Point Military Reservation, and was later named for Maj. Charles Harold Howard. Major units of the air division located at Howard are the 24th Tactical Air Support Sqdn. and the 24th Composite Wing. The air division and tenant units have approx. 3,500 assigned, of which 2,360 are military.

Hurlburt Field, Fla. 32544-5000; 5 mi. W of Fort Walton Beach. Phone (904) 881-6668; AUTOVON 579-1110; for information AUTOVON 872-1110 (Eglin AFB). Hurlburt Field is a MAC base, though located on the Eglin AFB (AFSC) reservation. Home of Hq. 23d Air Force, which is the focal point for all USAF special operations matters. The 23d Air Force serves a dual role as a numbered air force for MAC and as the Air Force Special Operations Command, a service component of the US Special Operations Command. The base host wing is the 1st Special Operations Wing, equipped with MC-130E (Combat Talon), AC-130H (Spectre gunship), and MH-53J (Pave Low III) aircraft. Tenant units include the USAF Special Operations School; 1720th Special Tactics Gp.; 1723d Combat Control Sqdn.; Special Operations Weather Team; 6th Weather Sqdn. and 7th Weather Wing; Special Missions Operational Test and Evaluation Center; 4442d Tactical Control Gp., which includes the US Air Force Air Ground Operations School and the 727th Tactical Control Sqdn.; 823d Civil Engineering RED HORSE Sqdn.; Det. 8, 1361st Audiovisual Sqdn. Base activated 1943; named for Lt. Donald W. Hurlburt, WW II pilot killed Oct. 1, 1943, in a crash on Eglin reservation. Altitude 38 ft. Military 4,600; civilians 725. Payroll $114 million. Housing: 36 officer; 344 NCO; 210 transient rooms with 258 beds. Medical clinic only at Hurlburt, but 155-bed hospital at Eglin Regional Hospital located 12 mi. away.

Incirlik AB, Turkey, APO New York 09289-5000; 10 mi. E of Adana. Phone (commercial, from CONUS) 011-90-71-221774 through 221780; AUTOVON 676-1110. USAFE base. 39th Tactical Gp. Also home for 628th Military Airlift Support Sqdn. Base activated in May 1954; present unit began operations in Mar. 1966. Incirlik, in Turkish, means fig orchard, which is what the land was used for before the base was built. Area 3,400 acres. Altitude 240 ft. Military 2,400; civilians 2,000. Payroll $49 million. Housing: 950 units; 49 TLF; 184 VAQ; 216 VOQ; 6,014 dorm rooms. Regional hospital.

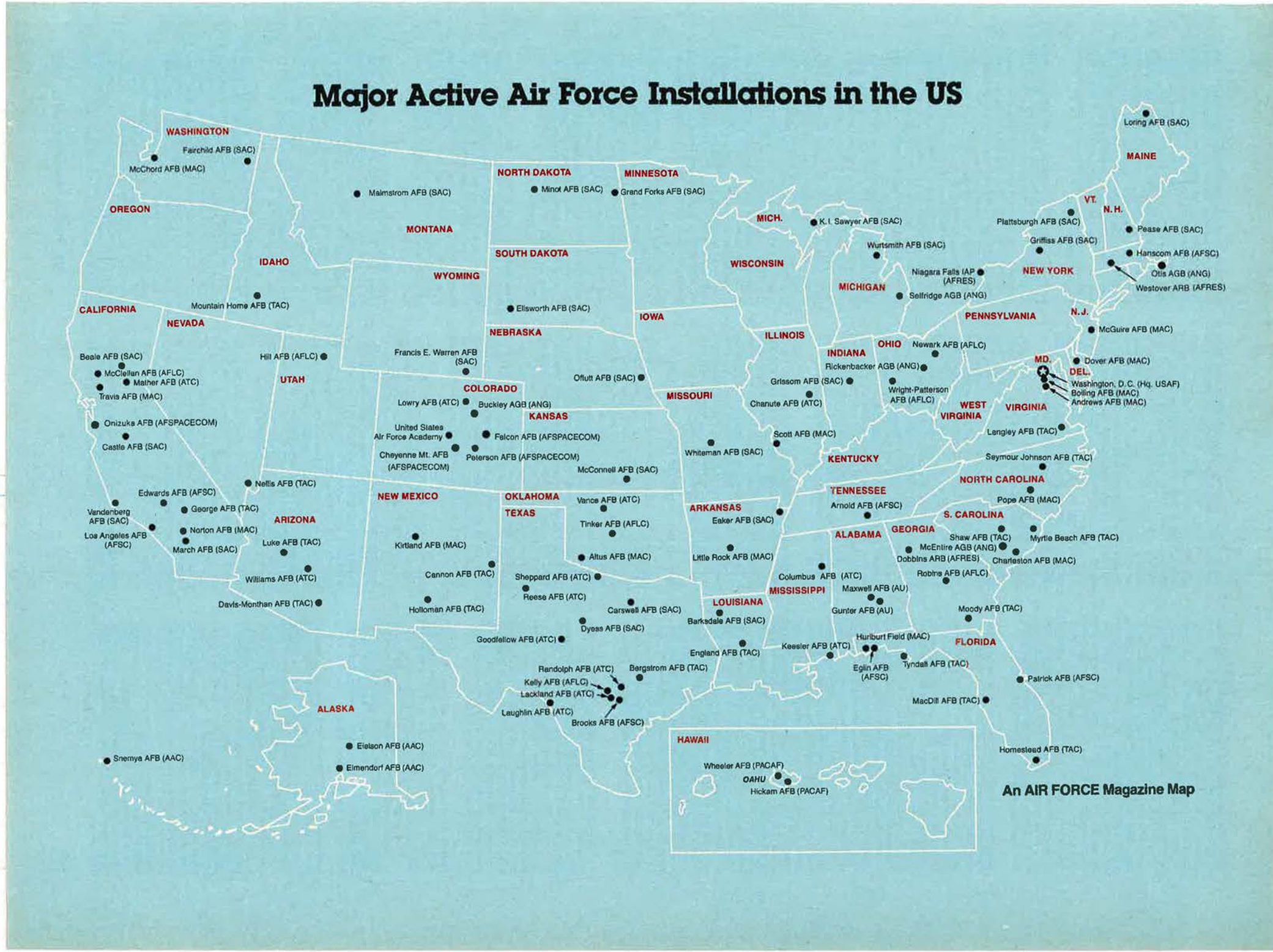
Iraklion AB, Crete, Greece, APO New York 09291-5000; 10 mi. E of Iraklion. Phone (commercial, from CONUS) 011-30-81761-196/197; AUTOVON 668-1110. USAFE base. 7276th Air Base Gp. Provides administrative and logistical support to the 6931st Electronic Security Sqdn. Activated Oct. 1954; 7276th ABG activated Aug. 1978. Base named after Crete's capital city. Area 197 acres. Altitude 90 ft. Military 801; civilians 291. Payroll $9 million. Housing 180 units; 16 VOQ; 4 DV suites; 24 VAQ; 15 TLF; 362 dorm rooms. Hospital.

Kadena AB, Japan, APO San Francisco 96239-5000; 15 mi. N of Naha, Okinawa. Phone (commercial, from CONUS) 011-098-938-1111; AUTOVON 630-1110. PACAF base. Hq. 313th Air Div., host organization; 18th Tactical Fighter Wing, F-15C/D and RF-4C operations; 18th Combat Support Wing; 400th Munitions Maintenance Sqdn. (Theater); 376th Strategic Wing (SAC), KC-135 and RC-135 operations; 1962d Communications Gp. (AFCC); 6990th Electronic Security Gp. (ESC); 961st Airborne Warning and Control Sqdn. (TAC), E-3 operations; 603d Military Airlift Support Gp. (MAC); 33d Aerospace Rescue & Recovery Sqdn. (MAC), HH-3 and HC-130 operations; Western Pacific Rescue Coordination Center (MAC); Det. 1, 9th Strategic Reconnaissance Wing (SAC), SR-71 operations; 13th Military Airlift Sqdn. (MAC), C-12F operations. Base named for city of Kadena, Okinawa. Area 14,778 acres. Military 8,755; US citizens 1,109; local nationals 2,424. Housing: 6,702 on-base units (officer/enlisted); 533 transient; 67 temporary. Clinic. US Naval Hospital at Camp Lester.

Keesler AFB, Miss. 39534-5000; located in Biloxi. Phone (601) 377-1110; AUTOVON 868-1110. ATC base. Hq. Keesler Technical Training Center (avionics, communications, electronics, radar systems, computer and command and control systems, personnel, and administrative courses); Keesler USAF Medical Center. Hosts MAC and AFRES weather reconnaissance units; AFRES tactical airlift unit; TAC airborne command and control sqdn.; AFCC engineering installation gp.; AFCC NCO Academy/Leadership School; USAF First Sergeant's Academy. Base activated June 12, 1941; named for 2d Lt. Samuel R. Keesler, Jr., WW I aerial observer, killed in action Oct. 9, 1918, near Verdun, France. Area 3,600 acres. Altitude 26 ft. Military 8,933; civilians 2,109. Payroll $287 million. Housing: 291 officer; 1,666 NCO; 51 trailer spaces; 76 transient (376 VOQ and 1,348 VAQ units on space availability; technical training students may occupy many units). 350-bed hospital.

Kelly AFB, Tex. 78245-5000; 5 mi. SW of San Antonio. Phone (512) 925-1110; AUTOVON 945-1110. AFLC base. Hq. San Antonio Air Logistics Center provides logistics management, procurement, and distribution support for such USAF aircraft as the C-5A and C-5B, C-17, C-9, F-5, O-2, OV-10, and T-38. As a specialized repair activity, SA-ALC modernizes and performs heavy depot maintainance on the entire USAF fleet of C-5s, a significant portion of Strategic Air Command's B-52s, Military Airlift Command C-130s, and various engines, including the

Major Active Air Force Installations in the US



TF39, TF56, and F100. SA-ALC also manages more than half of the Air Force's engine inventory, all fuel lubricants used by the Air Force and NASA, the Air Force's fleet of boats and ships, and the Department of Defense Working Dog Program. Other major units include Hq. Electronic Security Command; Air Force Electronic Warfare Center; Air Force Cryptologic Support Center; Joint Electronic Warfare Center; USAF Service Information and News Center; Hq. Air Force Commissary Service; 433d Military Airlift Wing (AFRES); 149th Tactical Fighter Gp. (ANG); 1923d Communications Gp.; 1827th Electronics Installation Sqdn.; Defense Reutilization and Marketing Office; Air Force Audit Agency Office. Dating back to Nov. 21, 1916, Kelly AFB is the oldest continuously active air base in the US. Named for Lt. George E. M. Kelly, first Army pilot to lose his life in a military aircraft, killed May 10, 1911. Area 4,660 acres. Altitude 689 ft. Military 5,820; civilians 17,942. Payroll $678 million. Housing: 46 officer; 368 NCO. Clinic.

Kirtland AFB, N. M. 87117-5000; SE quadrant of Albuquerque. Phone (505) 844-0011; AUTOVON 244-0011. MAC base. 1606th Air Base Wing. Major agencies and units include Contract Management Div. (AFSC); Air Force Operational Test and Evaluation Center; Air Force Space Technology Center (AFSC); Air Force Weapons Laboratory (AFSC); Air Force Office of Security Police; 1550th Combat Crew Training Wing (MAC); 150th Tactical Fighter Gp. (New Mexico ANG); Field Command's Defense Nuclear Agency; Naval Weapons Evaluation Facility; Sandia National Laboratories; Lovelace Biomedical and Environmental Research Institute; Department of Energy's Albuquerque Operations Office; AFSC NCO Academy; 1960th Communications Sqdn. (AFCC); 3098th Aviation Depot Sqdn.; Det. 1, 1369th Audiovisual Sqdn.; Air Force Directorate of Nuclear Surety; Interservice Nuclear Weapons School. These agencies furnish contract management; nuclear and laser research, development, and testing; advanced helicopter training and search and rescue operations; pararescue training; and operational test and evaluation. Other major units include AFLC Nuclear Support Office; Albuquerque Seismological Laboratory; Command Control Communications Countermeasures Joint Test Force; University of New Mexico Civil Engineering Research Facility. Base activated Jan. 1941; named for Col. Roy C. Kirtland, air pioneer and commandant of Langley Field in the 1930s, who died May 2, 1941. Area 52,450 acres. Altitude 5,352 ft. Military 4,607; civilians 16,133. Payroll $945 million. Housing: 2,134 homes; BOQ/VOQ; officers 274 beds; enlisted 1,729 beds. Air Force/Veterans Administration joint hospital venture located outside base gates (inpatient); Kirtland Ambulatory Health Center on base (outpatient).

K. I. Sawyer AFB, Mich. 49843-5000; 20 mi. S of Marquette. Phone (906) 346-6511; AUTOVON 472-1110. SAC base. 410th Bomb Wing; ELF Transmitter Facility (Navy); 2001st Communications Sqdn. (AFCC); Det. 24, 26th Weather Sqdn. (AWS); Det. 2 (SATAF); 71st Flying Training Wing/OLA. Base activated 1959; named for Kenneth I. Sawyer, who proposed site for county airport, died 1944. Area 5,202 acres. Altitude 1,220 ft. Military 3,509; civilians 514. Payroll $92.8 million. Housing: 279 officer; 1,414 NCO; 199 trailer spaces; 26 BNCOQ; 22 BOQ; 74 transient (incl. 22 fully furnished TLFs, 18 VAQ, 26 VOQ, 3 DVQ, and 5 Senior NCO). 50-bed hospital.

Kunsan AB, Republic of Korea, APO San Francisco 96264-5000; 8 mi. SW of Kunsan City. Phone (commercial, from CONUS) 011-0654-7-2191; AUTOVON 782-1110. PACAF base. 8th Tactical Fighter Wing, F-16C/D aircraft operations providing air interdiction and close air support. Base built by Japanese in 1938. Area 2,556 acres. Altitude 29 ft. Military 3,500; US citizens 33; local nationals 739. Payroll $86 million. Housing: 264 officer; 2,500 enlisted; all unaccompanied housing (dormitory/BOQ); 211 transient. 3-bed hospital.

Lackland AFB, Tex. 78236-5000; 8 mi. WSW of San Antonio. Phone (512) 671-1110; AUTOVON 473-1110. ATC base. Provides basic military training for active-duty, Air National Guard, and Air Force Reserve airmen; technical training for basic and advanced security police/law enforcement personnel; cryptographic maintenance operators and technicians; patrol dog-handler courses; training of instructors, recruiters, and social actions/drug abuse counselors; Officer Training School; Defense Language Institute English Language Center; Wilford Hall USAF Medical Center (Air Force's largest medical center, with 1,000 beds, conducts medical education and clinical research); ATC NCO Academy; military training instructor reserve squadron; 539th Air Force Band; Det. 40, Air Force Logistics Center. Base activated 1941; named for Brig. Gen. Frank D. Lackland, early commandant of Kelly Field flying school, died 1943. Area 6,783 acres, incl. 3,872 acres at Lackland Training Annex. Altitude 745 ft. Military 19,522; civilians 6,671. Payroll $646.7 million. Housing: 106 officer; 619 NCO; 831 transient.

Lajes Field, Azores, Portugal, APO New York 09406-5000; Terceira Island, 900 mi. W of Portugal. AUTOVON 723-1410. MAC base. 1605th Military Airlift Support Wing. Support base for aircraft crossing the Atlantic Ocean. Wing is host unit to US Forces Azores; Navy Forces Azores; Army Transportation Terminal Unit Azores; Naval Security Gp. Activity Azores; 1936th Communications Sqdn. (AFCC); Det. 3, Air Force European Broadcasting Sqdn. Base provides en route support for MAC, USAF, USN, USMC, third nation, and other authorized aircraft crossing the Atlantic and supporting US Navy antisubmarine warfare missions. US operations began at Lajes Field in 1946. Area 1,148 acres. Altitude 180 ft. Military 1,704; civilians 1,940. Payroll $53.01 million. Housing: 99 officer; 390 enlisted; 25 TLF; 110 VOQ; 580 VAQ; 6 DVQ; 2 senior NCO. 7-bed hospital.

Langley AFB, Va. 23665-5000; 3 mi. N of Hampton. Phone (804) 764-9990; AUTOVON 574-1110. TAC base. Hq. Tactical Air Command. 1st Tactical Fighter Wing, host unit, F-15 fighter operations; Hq. 1st Air Force (TAC); Hq. CONUS NORAD region; 2d Aircraft Delivery Gp. (TAC); 480th Reconnaissance Technical Gp.; 1913th Communications Gp. (AFCC); 1912th Computer Systems Gp. (AFCC); 564th Air Force Band (TAC); US Army TRADOC Flight Det.; 48th Fighter Interceptor Sqdn. (TAC); Army-Air Force Center for Low Intensity Conflict; 20 other tenant units. Base activated Dec. 30, 1916. Langley is the second oldest continuously active air base in the US; named for aviation pioneer and scientist Samuel Pierpont Langley, who died in 1906. NASA Langley Research Center is located across base. Area 3,439 acres. Altitude 10 ft. Military 9,581; civilians 3,000. Payroll $308.6 million. Housing: 384 officer; 1,255 NCO; 304 transient rooms including VOQ, VAQ, VIP, and senior enlisted distinguished visitors. USAF regional 75-bed hospital.

Laughlin AFB, Tex. 78843-5000; 6 mi. E of Del Rio. Phone (512) 298-3511; AUTOVON 732-1110. ATC base. 47th Flying Training Wing, undergraduate pilot training. Base activated Oct. 1942; named for 1st Lt. Jack T. Laughlin, Del Rio native, B-17 pilot killed over Java on Jan. 29, 1942. Area 4,008 acres. Altitude 1,080 ft. Military 2,697; civilians 507 (265 contract civilians). Payroll $66 million. Housing: 202 officer; 401 NCO; 37 transient, 24 temporary family lodging facilities. 20-bed hospital.

Laurence G. Hanscom AFB *(see Hanscom AFB).*

Lindsey AB, W. Germany, APO New York 09633-5000; in Wiesbaden. Phone (commercial, from CONUS) 011-49-6121-82-0; AUTOVON 339-1110. USAFE base. Hq. 65th Air Division. 7100th Combat Support Wing is responsible for 17th Air Force's twenty-five collocated operating bases, five geographically separated munitions support squadrons, providing war- and peacetime health care through the 7100th Combat Support Wing Medical Center, and supporting approximately eighty associate units. Associate unit: 1st Combat Communications Gp. (AFCC). Established in 1897 as a German installation; became an Air Force installation on Sept. 18, 1947. Named for Medal of Honor recipient Darrell R. Lindsey, a WW II pilot killed during a bombing mission over France. Area 106 acres. Altitude 557 ft. Military 3,497; civilians 1,752. Payroll $116 million. Housing: No on-base housing (Wiesbaden Military Community housing is operated by the US Army); billeting (bachelor enlisted): 757 male and 168 female bed spaces. Medical center.

Little Rock AFB, Ark. 72099-5000; 15 mi. NE of Little Rock. Phone (501) 988-3131; AUTOVON 731-1110. MAC base. 314th Tactical Airlift Wing, only C-130 training base in DoD, training crew members from all branches of service and some foreign countries. Tenants include Hq. Joint Readiness Training Center, a high-priority US Army Center (JRTC trains all nonmechanized units within the Army, using Fort Chaffee, Ark., as the training ground); 189th Tactical Airlift Gp. (ANG); 2151st Communications Sqdn.; 22d Air Force NCO Leadership School; 1314th Ground Combat Readiness Evaluation Sqdn. Base activated 1955. Area 6,898 acres. Altitude 310 ft. Military 5,428; civilians 1,583. Payroll $157 million. Housing: 212 officer; 1,323 enlisted; 2,042 enlisted dormitory; 360 transient (140 VAQ, 220 VOQ). 35-bed hospital.

Loring AFB, Me. 04751-5000; 4 mi. W of Limestone. Phone (207) 999-1110; AUTOVON 920-1110. SAC base. 42d Bomb Wing was activated here Feb. 25, 1953, as Limestone AFB; renamed for Maj. Charles Loring, Jr., F-80 pilot killed Nov. 22, 1952, in North Korea and posthumously awarded Medal of Honor. Area 11,165 acres. Altitude 756 ft. Military 3,593; civilians 498. Payroll $84.6 million. Housing: 303 officer; 1,481 NCO; 122 transient; 4 VIP. New 20-bed hospital completed this year. The bomber mission converted to conventional as of Oct. 1, 1988.

Los Angeles AFB, Calif. 90009-2960; in metropolitan Los Angeles area, city of El Segundo, 3 mi. S of Los Angeles IAP. Phone (213) 643-1000; AUTOVON 833-1110. AFSC base. Headquarters of AFSC's Space Systems Division, which manages the design, development, acquisition, and launch of DoD's space program. Support unit is 6592d Air Base Gp. 24 tenant units on station; also provides support to 41 off-station units/activities. Activated Dec. 14, 1960 as Los Angeles AFS. Area 96 acres at Los Angeles AFB and 96 acres at Fort MacArthur Annex. Altitude 95 ft. Military 2,109; civilians 2,278. Payroll $116.6 million. Housing at Fort MacArthur Annex in San Pedro: 370 officer and enlisted townhomes; general officer houses; 27 enlisted dormitory rooms; 60 visiting and unaccompanied officer quarters. 23 TLF units. Clinic, commissary, child-care center, and Air Force Family Support Center.

Lowry AFB, Colo. 80230-5000; on border between Denver and Aurora. Phone (303) 370-1110; AUTOVON 926-1110. ATC base. Technical Training Center; Air Force Accounting and Finance Center; Air Reserve Personnel Center; 3320th Correction and Rehabilitation Sqdn. Lowry Technical Training Center conducts training in avionics, space operations, munitions, logistics, and audiovisual fields. Base activated Oct. 1, 1937; named for 1st Lt. Francis B. Lowry, killed in action Sept. 26, 1918, near Crepion, France, while on a photo mission. Area 1,863 acres. Altitude 5,400 ft. Military 8,093; civilians 5,132. Payroll $262.4 million. Housing: 87 officer; 780 NCO; 240 VOQ, 585 VAQ, 40 TLF. USAF clinic on base, with Fitzsimons Army Medical Center 15 minutes away.

Luke AFB, Ariz. 85309-5000; 20 mi. WNW of Phoenix. Phone (602) 856-7411; AUTOVON 853-1110. TAC base. 832d Air Div.; 405th Tactical Training Wing, F-15 operations; 58th Tactical Training Wing, F-16 operations; 944th Tactical Fighter Gp. (AFRES). Luke, the largest fighter training base in the free world, conducts training of USAF and foreign pilots in the F-15, F-15E, and F-16. Luke also conducts F-5 training through the 425th Tactical Fighter Training Sqdn. at nearby Williams AFB. Base activated 1941; named for 2d Lt. Frank Luke, Jr., observation balloon-busting ace of WW I and first flyer to receive the Medal of Honor, killed in action Sept. 29, 1918, near Murvaux, France. Area 4,197 acres, plus 2,700,000-acre Barry M. Goldwater Air Force range located near Gila Bend, Ariz. Altitude 1,090 ft. Military 5,543; civilians 1,450. Payroll $157 million. Housing: 95 officer; 779 NCO; 245 transient (160 VOQ, 85 VAQ); 40 temporary family lodging facilities. 105-bed hospital.

MacDill AFB, Fla. 33608-5000; adjacent to Tampa city limits. Phone (813) 830-1110; AUTOVON 968-1110. TAC base. 56th Tactical Training Wing, F-16 operations; Hq. Special Operations Command; Hq. US Central Command; Joint Communication Support Element. 56th Tactical Training Wing conducts replacement training in the F-16. Base activated Apr. 15, 1941; named for Col. Leslie MacDill, killed in an aircraft accident Nov. 8, 1938, near Washington, D. C. Area 5,631 acres. Altitude 6 ft. Military 6,849; civilians 1,894. Payroll $183 million. Housing: 130 officer; 674 enlisted; 360 transient. 75-bed 56th Tactical Training Wing hospital.

Malmstrom AFB, Mont. 59402-5000; 1.5 mi. E of Great Falls. Phone (406) 731-1110; AUTOVON 632-1110. SAC base. 341st Strategic Missile Wing; 301st Air Refueling Wing. Base activated Dec. 15, 1942; named for Col. Einar A. Malmstrom, WW II fighter commander killed in air accident Aug. 24, 1954. Site of SAC's first Minuteman wing. Area 3,573 acres, plus about 23,000 sq. mi. of missile complex. Altitude 3,525 ft. Military 4,261; civilians 720. Payroll $102 million. Housing: 258 officer; 1,148 NCO; 120 transient. Clinic.

March AFB, Calif. 92518-5000; 9 mi. SE of Riverside. Phone (714) 655-1110; AUTOVON 947-1110. SAC base. Hq. 15th Air Force; 22d Air Refueling Wing; Southwest Air Defense Sector (TAC); 22d Strategic Hospital; 452d Air Refueling Wing (AFRES); 943d Tactical Airlift Gp.; 163d Tactical Fighter Gp. (ANG). Base activated Mar. 1, 1918; named for 2d Lt. Peyton C. March, Jr., who died in Texas of crash injuries Feb. 18, 1918. Area 7,703 acres. Altitude 1,530 ft. Military 6,053; civilians 1,699. Payroll $154 million. Housing: 103 officer; 808 NCO; 215 transient. 105-bed hospital.

Mather AFB, Calif. 95655-5000; 12 mi. ESE of Sacramento. Phone (916) 364-1110; AUTOVON 828-1110. ATC base. DoD executive agent for Specialized Undergraduate Navigator Training (SUNT); USAF, Navy, and Marine Corps basic navigator training. Provides navigator training for 2d German Air Force and 90 other countries. Only navigator training base; also trains USAF electronic warfare officers. 323d Flying Training Wing (ATC); 320th Bomb Wing (SAC), B-52G operations; 940th Air Refueling Gp. (AFRES), KC-135E operations; 323d Air Base Gp. (ATC); 3506th Recruiting Gp. (ATC); 2034th Communications Sqdn. (AFCC); USAF Civil Air Patrol Pacific Liaison Region. Base activated 1918; named for 2d Lt. Carl S. Mather, killed in midair collision Jan. 30, 1918, in Texas. Area 5,800 acres. Altitude 96 ft. Military 6,183; civilians

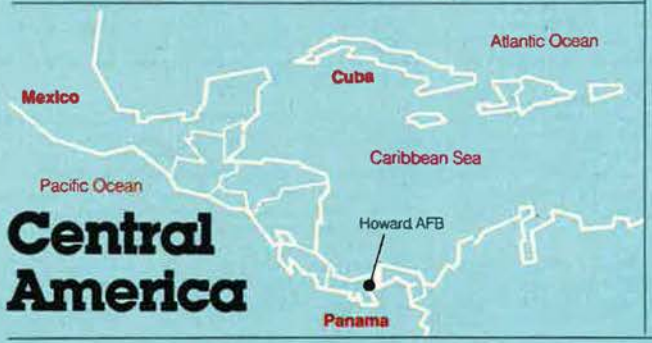
Europe

USAF's Major Installations Overseas

Atlantic

Pacific

Central America



2,014. Payroll $163.7 million. Housing: 452 officer; 820 NCO; 208 transient. 70-bed hospital.

Maxwell AFB, Ala. 36112; 1 mi. WNW of Montgomery. Phone (205) 293-1110; AUTOVON 875-1110. AU base. 3800th Air Base Wing; Hq. Air University, professional military education center for USAF; Air War College; Air Command and Staff College; Center for Aerospace Doctrine, Research, and Education; Ira C. Eaker Center for Professional Development; Squadron Officer School; Air Force Historical Research Center; Hq. Air Force ROTC (ATC); Hq. Civil Air Patrol-USAF; Community College of the Air Force (ATC); 908th Tactical Airlift Gp. (AFRES). (The Senior NCO Academy and Extension Course Institute are at Gunter AFB.) Base activated 1918; named for 2d Lt. William C. Maxwell, killed in air accident Aug. 12, 1920, in the Philippines. Area 2,524 acres. Altitude 168 ft. Military 4,326; civilians 1,632. Payroll $296.5 million. Housing: 264 officer; 436 NCO; 1,102 transient (1,029 VOQ, 43 VAQ, 30 TLF). 60-bed hospital.

McChord AFB, Wash. 98438-5000; 8 mi. S of Tacoma. Phone (206) 984-1910; AUTOVON 976-1110. MAC base. 62d Military Airlift Wing; Hq. 25th Air Div. (TAC); 318th Fighter Interceptor Sqdn. (TAC); 446th Military Airlift Wing (AFRES Assoc.). Base activated May 5, 1938; named for Col. William C. McChord, killed Aug. 18, 1937, while attempting a forced landing at Maidens, Va. Area 4,609 acres. Altitude 322 ft. Military 5,423; civilians 1,570. Payroll $162 million. Housing: 111 officer; 870 NCO; 284 transient. Dispensary.

McClellan AFB, Calif. 95652; 9 mi. NE of Sacramento. Phone (916) 643-2111; AUTOVON 633-1110. AFLC base. Hq. Sacramento Air Logistics Center provides logistics management, procurement, maintenance, and distribution support for F/FB/EF-111, A-10, A-7, and F-117A ("Stealth fighter") weapon systems. It will also be support center for the Advanced Tactical Fighter. Other responsibilities include more than 200 electronic systems and programs and eight space systems. Also, technology centers for very high speed integrated circuits, fiber optics, and advanced composites. The Center has unique capability for robotic nondestructive inspection using x-ray and neutron radiology on F-111-size aircraft. Other major units include 41st Rescue and Weather Reconnaissance Wing (MAC); 2049th Communications Gp. and 1849th Electronics Installation Sqdn. (AFCC); Technical Operations Division, Air Force Technical Applications Center (AFSC); 431st Test and Evaluation Sqdn. (TAC); Hq. 4th Air Force (AFRES); US Coast Guard Air Station, Sacramento (DOT). Named for Maj. Hezekiah McClellan, pioneer in Arctic aeronautical experiments, who was killed in crash May 25, 1936. Area 3,755 acres. Military 3,700; civilians 13,700. Payroll $545 million. Housing: 132 officer; 343 NCO; 21 transient. New USAF Medical Center.

McConnell AFB, Kan. 67221-5000; 5 mi. SE of Wichita. Phone (316) 652-6100; AUTOVON 743-1110. SAC base. 384th Bomb Wing; 184th Tactical Fighter Gp. (ANG). First B-1B arrived Jan. 1988. Base activated June 5, 1951; named for Capt. Fred J. McConnell, WW II B-24 pilot who died in crash of a private plane Oct. 25, 1945, and for his brother, 2d Lt. Thomas L. McConnell, also a WW II B-24 pilot, killed July 10, 1943, during attack on Bougainville in the Pacific. Area 3,066 acres. Altitude 1,371 ft. Military 3,259; civilians 415. Payroll $165 million. Housing: 96 officer; 493 NCO; 92 transient (26 VOQ, 41 VAQ, 25 TLF). 15-bed hospital.

McGuire AFB, N. J. 08641-5000; 18 mi. SE of Trenton. Phone (609) 724-1100; AUTOVON 440-0111. MAC base. 438th Military Airlift Wing; Hq. 21st Air Force; New Jersey ANG; New Jersey Civil Air Patrol; 170th Air Refueling Gp. (ANG); 108th Tactical Fighter Wing (ANG); 514th Military Airlift Wing (AFRES Assoc.); MAC NCO Academy East; Air Force Band of the East; and OLB, 1361st Audiovisual Sqdn. Base adjoins Army's Fort Dix; formerly Fort Dix Army Air Base. Activated as AFB 1949; named for Maj. Thomas B. McGuire, Jr., P-38 pilot, second leading US ace of WW II, recipient of Medal of Honor, killed in action Jan. 7, 1945, in the Philippines. Area 3,552 acres. Altitude 133 ft. Military 9,398 (incl. AFRES); civilians 5,684 (incl. AFRES). Payroll $239 million. Housing: 193 officer; 1,560 NCO; 863 transient (237 VOQ, 626 VAQ). Dispensary and 150-bed hospital at Fort Dix.

Minot AFB, N. D. 59705-5000; 13 mi. N of Minot. Phone (701) 723-1110; AUTOVON 344-1110. SAC base. 57th Air Div.; 91st Strategic Missile Wing, Minuteman III operations; 5th Bomb Wing, B-52H and KC-135 operations; 2150th Communications Sqdn. (AFCC); Det. 7, 37th Aerospace Rescue & Recovery Sqdn. (MAC), UH-1 operations; 64th Flying Training Wing OLB (ATC), T-38 operations; Det. 21, 9th Weather Sqdn. (AWS); AFOSI Det. 1312; Det. 35, 3904th Management Engineering Sqdn.; Det. 520, Air Force Audit Agency; 15th Air Force NCO Leadership School. Base activated Jan. 1957; named after the city of Minot, whose citizens donated $50,000 toward purchase of the land for the Air Force. Area 5,085 acres, plus additional 19,324 acres for missile sites. Altitude 1,668 ft. Military 5,405; civilians 679. Payroll $115.8 million. Housing: 480 officer; 1,981 enlisted; 163 private trailer spaces; 156 transient (incl. 32 VOQ, 84 VAQ, 40 TLF). 47-bed hospital.

Misawa AB, Japan, APO San Francisco 96519-5000; within Misawa city limits. Phone (commercial, from CONUS) 011-81-176-53-5181; AUTOVON 226-1110. PACAF base; joint service base. 432d Tactical Fighter Wing, F-16C/D operations; 6920th Electronic Security Gp. (ESC); 2114th Communications Sqdn. (AFCC); Det. 6, 1363d Aerospace Audiovisual Sqdn. (MAC); Det. 4, Air Force Pacific Broadcasting Sqdn.; Naval Air Facility (USN); Naval Security Gp. Activity (USN); Patrol Wing One Det. (USN); US Army field station; Company "E" US Marine Corps. Base occupied by US forces Sept. 1945. Area 3,873 acres. Altitude 119 ft. Military 5,137 (total US forces); US civilians 388; local nationals 791. Payroll $128.8 million. Housing: 348 officer; 1,632 NCO; 305 transient. 15-bed hospital.

Moody AFB, Ga. 31699-5000; 10 mi. NNE of Valdosta. Phone (912) 333-4211; AUTOVON 460-1110. TAC base. 347th Tactical Fighter Wing, F-16 fighter operations. Base activated June 1941; named for Maj. George P. Moody, killed May 5, 1941, while test-flying Beech AT-10. Area 6,050 acres. Altitude 233 ft. Military 3,493; civilians 664. Payroll $97 million. Housing: 36 officer; 268 NCO; 76 transient. 25-bed hospital.

Mountain Home AFB, Idaho 83648-5000; 10 mi. SW of Mountain Home. Phone (208) 828-2111; AUTOVON 857-1110. TAC base. 366th Tactical Fighter Wing, F-111A fighter and EF-111A electronic countermeasures operations. 2036th Communications Sqdn. (AFCC); 513th Field Training Det. (ATC); Det. 3, Tactical Air Warfare Center; AFOSI Det. 2007; Det. 454, Air Force Audit Agency; Det. 11, 4400th Management Engineering Sqdn.; Det. 18, 25th Weather Sqdn. Base activated Aug. 1943. Area 9,112 acres. Altitude 3,000 ft. Military 3,802; civilians 548. Payroll $92 million. Housing: 242 officer; 1,279 NCO; 144 transient; 16 TLF. 30-bed hospital.

Myrtle Beach AFB, S. C. 29579-5000; in south Myrtle Beach. Phone (803) 238-7211; AUTOVON 748-1110. TAC base. Shares runway with Myrtle Beach Jetport. 354th Tactical Fighter Wing, A-10 fighter operations; 2066th Communications Sqdn. (AFCC); 301st Field Training Det. (ATC); 1816th Reserve Advisor Sqdn.; Det. 3, 3d Weather Sqdn.; Det. 12, 440th Management Engineering Sqdn. (ATC); Det. 2105 (AFOSI); 73d Tactical Control Flight (TAC). Served as Army air base 1941–47; USAF base since 1956. Area 3,793 acres. Altitude 25 ft. Military 3,500; civilians 760. Payroll $85 million. Housing: 95 officer; 682 NCO; 65 trailer lots; 117 transient. 20-bed hospital.

Nellis AFB, Nev. 89191-5000; 8 mi. NE of Las Vegas. Phone (702) 652-1110; AUTOVON 682-1110. TAC base. USAF Tactical Fighter Weapons Center, F-117A, F-111, F-16, F-15, F-5, A-10, A-7, T-38; 57th Fighter Weapons Wing, including USAF Air Demonstration Sqdn. (Thunderbirds); USAF Fighter Weapons School; Deputy Commander for Adversary Tactics; 4513th Adversary Threat Training Gp.; 4440th Tactical Fighter Training Gp. (Red Flag); Deputy Commander Tactics and Test; 554th Operations Support Wing; 554th Range Gp.; 554th Medical Gp.; Deputy Commander Security Police (three security police sqdns.); Deputy Commander Resources Management; Deputy Commander Civil Engineers; 554th Combat Support Gp.; 474th Tactical Fighter Wing (F-16 operations scheduled to begin deactivation Apr. 1989 and be completed by July 1989); 4450th Tactical Gp.; 820th Civil Engineering Sqdn. RED HORSE; 3069th Aviation Depot Sqdn.; 2069th Communications Gp. Base activated July 1947; named for 1st Lt. William H. Nellis, WW II P-47 fighter pilot, killed Dec. 27, 1944, in Europe. Area 11,274 acres, with ranges totaling 3,014,566 acres. Altitude 1,869 ft. Military 10,260; civilians 1,200. Payroll $449.9 million. Housing: 107 officer; 1,275 enlisted; 100 trailer spaces; 707 temporary (192 officer, 515 enlisted); 60 TLF. 40-bed hospital.

Newark AFB, Ohio 43057; 1 mi. SW of Newark. Phone (614) 522-2171; AUTOVON 346-2171. AFLC base. Aerospace Guidance and Metrology Center repairs inertial guidance and navigation systems for most of the Air Force's missiles and aircraft as well as a variety of inertial systems for other branches of the armed forces. Also manages the Air Force's worldwide measurement and calibration program, providing the link between the National Bureau of Standards and the Air Force's 130 precision measurement equipment laboratories at bases around the world. Five tenant units. Activated as an Air Force station Nov. 7, 1962. Military 60; civilians 2,500. Payroll $83 million.

Norton AFB, Calif. 92409-5000; 59 mi. E of Los Angeles, within San Bernardino corporate limits. Phone (714) 382-1110; AUTOVON 876-1110. MAC base. 63d Military Airlift Wing; Hq. Air Force Inspection and Safety Center; Hq. Air Force Audit Agency; Hq. Aerospace Audiovisual Service (MAC); Ballistic Systems Division (AFSC); 445th Military Airlift Wing (AFRES Assoc.); MAC NCO Academy West and 22d Air Force NCO Leadership School. Base activated Mar. 2, 1942; named for Capt. Leland F. Norton, native of San Bernardino, WW II A-20 attack bomber pilot, killed in action May 27, 1944, near Amiens, France. Area 2,430 acres. Altitude 1,156 ft. Military 8,912 (incl. AFRES); civilians 2,626. Payroll $502 million. Housing: 56 officer; 208 NCO; 400 transient. Clinic.

Offutt AFB, Neb. 68113-5000; 8 mi. S of Omaha. Phone (402) 294-1110; AUTOVON 271-1110. SAC base. Hq. Strategic Air Command. 55th Strategic Reconnaissance Wing; 544th Strategic Intelligence Wing; Air Force Global Weather Central (MAC); 3d Weather Wing (MAC); Hq. Strategic Communications Div. (AFCC); 1st Aerospace Communications Wing (AFCC); 1000th Satellite Operations Gp. (AFSPACECOM); 6949th Electronic Security Sqdn. (ESC); 702d Air Force Band. Base activated 1896 as Army's Fort Crook; landing field named in 1924 for 1st Lt. Jarvis J. Offutt, WW I pilot, who died Aug. 13, 1918, from injuries received at Valheureux, France. Area 1,914 acres (incl. housing area and off-base sites). Altitude 1,048 ft. Military 12,932; civilians 3,506 (incl. 576 contractors). Payroll $481 million. Housing: 513 officer; 2,167 NCO; 60 transient. 93-bed hospital.

Onizuka AFB, Calif. 94088-3430; 37 mi. S of San Francisco at Sunnyvale. Phone (408) 752-3110; AUTOVON 359-3110. AFSPACECOM base. 1004th Space Support Gp.; 2d Satellite Tracking Gp.; Consolidated Space Test Center (AFSC); 1999th Communications Sqdn. (AFCC). Base activated Dec. 2, 1959, as Sunnyvale AFS, renamed for Lt. Col. Ellison S. Onizuka, killed Jan. 28, 1986, in the space shuttle *Challenger* accident. Area 20 acres. Altitude 34 ft. Military 950, civilians 300, contractors 2,000. Housing: 20 officer, 80 NCO (located at NAS Moffett Field). No transient housing.

Osan AB, Korea, APO San Francisco 96570-5000; 38 mi. S of Seoul. Phone (commercial, from CONUS) 011-82-0333-414-4111; AUTOVON 784-4110. PACAF base. Hq. 7th Air Force; 51st Tactical Fighter Wing, F-16C/D operations; 5th Tactical Air Control Gp.; 6th Tactical Intelligence Gp.; 2146th Communications Gp. (AFCC); 6903d Electronic Security Gp. (ESC); 611th Military Airlift Support Gp. (MAC); 554th Civil Engineering RED HORSE Sqdn. (PACAF); 38th Aerospace Rescue & Recovery Sqdn. (MAC). Originally designated K-55; runway opened Dec. 1952. Renamed Osan AB in 1956 for nearby town that was the scene of first fighting between US and North Korean forces in July 1950. Area 1,674 acres. Altitude 38 ft. Military 7,754; US citizens 215; local nationals 1,610. Payroll $206 million. Housing: 153 officer; 59 enlisted. Transient 420, 16 temporary lodging facility units. 30-bed hospital.

Patrick AFB, Fla. 32925-6655; 2 mi. S of Cocoa Beach. Phone (407) 494-1110; AUTOVON 854-1110. AFSC base. Operated by the Eastern Space and Missile Center in support of DoD, NASA, and other agency missile and space programs. Major tenants are Defense Equal Opportunity Management Institute; Air Force Technical Applications Center; Det. 15, 41st Rescue Weather Reconnaissance Wing; 2d Combat Communications Gp. (AFCC). Base activated 1940; serves as airhead for Cape Canaveral AFS. CCAFS has supported more than 3,000 launches since 1950. Named for Maj. Gen. Mason M. Patrick, chief of AEF's Air Service in WW I and chief of the Air Service/Air Corps, 1921–27. Area 2,341 acres. Altitude 9 ft. Military 3,233; civilians 1,626. Payroll $126.5 million (military, Civil Service). Housing: 157 officer; 1,419 NCO. 20-bed hospital.

Pease AFB, N. H. 03803-5000; 3 mi. W of Portsmouth. Phone (603) 430-0100; AUTOVON 852-1110. SAC base. 45th Air Div.; 509th Bomb Wing (FB-111 medium bomber and KC-135 tanker operations); 541st Air Force Band; 1916th Communications Sqdn. (AFCC); 3519th USAF Recruiting Sqdn. (ATC); 157th Air Refueling Gp. (ANG). Base activated 1956; named for Capt. Harl Pease, Jr., WW II B-17 pilot and Medal of Honor recipient, killed Aug. 7, 1942, during attack on Rabaul, New Britain Island. Area 4,254 acres. Altitude 101 ft. Military 3,607; civilians 654. Payroll $97.1 million. Housing: 196 officer; 1,015 NCO (plus 50 trailer spaces); 124 transient (incl. 41 VOQ, 55 VAQ, 28 TLF). 70-bed hospital.

Peterson AFB, Colo. 80914-5000; 8 mi. E of Colorado Springs. Phone (719) 554-7321; AUTOVON 692-7011. AFSPACECOM base. Hq. Air Force Space Command. Host unit is 3d Space Support Wing (AFSPACECOM). Provides support to Hq. North American Aerospace Defense Command; Hq. US Space Command; Hq. Army Space Command; Cheyenne Mountain AFB located 17 mi. SW of Colorado Springs; 1st Space Wing; 302d Tactical Airlift Wing (AFRES); and 2d Space Wing located 9 mi. E at Falcon AFB. Base activated 1942; named for 1st Lt. Edward J. Peterson, who was killed Aug. 8, 1942, in

aircraft crash at the base. Area 1,155 acres. Altitude 6,200 ft. Military active-duty 6,040; reserves 1,204; civilians 2,651. Payroll $268 million. Housing: 107 officer; 384 NCO; 228 transient (74 VOQ, 114 VAQ, 40 TLF). 50 trailer spaces. Clinic.

Plattsburgh AFB, N. Y. 12903-5000; adjacent to Plattsburgh. Phone (518) 565-5000; AUTOVON 689-5000. SAC base. 380th Bomb Wing, medium bomber and tanker operations with FB-111 and KC-135. 530th Combat Crew Training Sqdn., trains all FB-111 combat crews for SAC. 8th Air Force NCO Leadership School; FOLE, 71st Flying Training Wing (ATC); 2042d Communications Sqdn. (AFCC); 210th Field Training Det. Second oldest active military installation in the US, established 1814; AFB since 1955. Area 4,879 acres. Altitude 235 ft. Military 4,092; civilians 552. Payroll $112 million. Housing: 222 officer; 1,421 NCO. 20-bed hospital.

Pope AFB, N. C. 28308-5000; 12 mi. NNW of Fayetteville. Phone (919) 394-0001; AUTOVON 486-1110. MAC base. 317th Tactical Airlift Wing; USAF Airlift Center; 1st Aeromedical Evacuation Sqdn.; 1943d Communications Sqdn. (AFCC); 1721st Combat Control Sqdn.; 53d Mobile Aerial Port Sqdn. (AFRES); Det. 3, MACOS (Combat Control School); 215th Field Training Detachment (ATC); Tactical Air Control Party (TAC); OLC, 1361st Audiovisual Service and 1724th Special Tactics Sqdn. (23d Air Force). Base adjoins Army's Fort Bragg and provides intratheater airlift support for airborne forces and other personnel, equipment, and supplies. Base activated 1919; named after 1st Lt. Harley H. Pope, WW I flyer, killed Jan. 7, 1917, when his JN-4 "Jenny" crashed into the Cape Fear River near Fayetteville. Area 1,750 acres. Altitude 218 ft. Military 4,357; civilians 800. Payroll $184 million. Housing: 89 officer; 370 NCO; 218 transient. Clinic.

RAF Alconbury, United Kingdom, APO New York 09238-5000; 3 mi. NW of Huntingdon; 60 mi. N of London. Phone (commercial, from CONUS) 011-44-480-82300; AUTOVON 223-3000. Royal Air Force base. 10th Tactical Fighter Wing (USAFE) provides air-to-ground support for US and Allied forces in Europe. Major associate units include 17th Reconnaissance Wing (SAC); 2166th Communications Sqdn. (AFCC); 6952d Electronic Communications Sqdn. (AFCC); 819th Civil Engineering Sqdn. RED HORSE; Det. 36, 28th Weather Sqdn.; Det. 1, 1367th Audiovisual Sqdn.; 719th Air Base Flight; Det. 8, 7200th Management Engineering Sqdn.; and Det. 4, 7000th Contracting Sqdn. Initially activated in 1938; first used by US forces in September 1942. Area 2,954 acres. Altitude 160 ft. Military 4,567; civilians 1,034. Payroll $100 million. Housing: 103 officer, 738 enlisted; 300 leased units (enlisted only); 2,052 dorm spaces. Clinic.

RAF Bentwaters/RAF Woodbridge, United Kingdom, APO New York 09755-5000; 90 mi. NE of London. Phone (commercial, from CONUS) 011-44-394-433000; AUTOVON 225-1110. Royal Air Force base. 81st Tactical Fighter Wing (USAFE) operates the twin bases (which are four miles apart), four A-10 attack sqdns. (two at each base), and one sqdn. of F-16Cs flown by the 527th Aggressor Sqdn. The wing also supports three forward operating location detachments in W. Germany. Associate units include three sqdns. of the 39th Special Operations Wing-Woodbridge (MAC) and the 2164th Communications Sqdn. (AFCC). Bases opened by RAF in 1944 and 1943 and reactivated by the US in 1951 and 1952. Bases named after local landmark and nearby town, respectively. Area 1,990 acres. Altitude 86 ft. Military 4,417; civilians 970. Payroll $115 million. Housing: 156 officer; 1,034 enlisted; 1,321 dorm spaces; 180 transient quarters. Clinic.

RAF Chicksands, United Kingdom, APO New York 09193-5000; 9 mi. S of Bedford; 45 mi. N of London. Phone (commercial, from CONUS) 011-44-462-812571; AUTOVON 234-1110. Royal Air Force base. 7274th Air Base Gp. (USAFE) provides rapid radio relay, secure communications, and command control and communications countermeasures support to US and Allied forces. Major associate unit: 6950th Electronic Security Gp. (ESC). Base activated in 1939; US presence began in October 1978. Base named after the sandy soil on which it sits. Area 411 acres. Military 1,331; civilians 476. Payroll $15.7 million. Housing: 45 officer; 368 enlisted; 64 billeting rooms; four dorms with 603 bed spaces. Clinic.

RAF Fairford, United Kingdom, APO New York 09125-5000; 20 mi. N of Swindon. Phone (commercial, from CONUS) 011-44-285-714000; AUTOVON 247-1110. Royal Air Force base. 7020th Air Base Gp. (USAFE) provides operation and maintenance for the 11th Strategic Gp. (SAC) and other associate units; part of the European Tanker Task Force, flying KC-135 Stratotankers. Activated by the RAF in Jan. 1944 and reactivated by the US in Feb. 1979. Named after the town of Fairford. Area 1,170 acres. Altitude 286 ft. Military 1,200; civilians 450. Payroll $26.2 million. Housing: 86 officer; 467 enlisted; 200 dorm rooms; 60 VOQ; 31 VAQ; 24 TLF. Clinic.

RAF Greenham Common, United Kingdom, APO New York 09150-5000; 2 mi. S of Newbury and 47 mi. SW of London. Phone (commercial, from CONUS) 011-44-635-512000; AUTOVON 266-1110. Royal Air Force base. 501st Tactical Missile Wing (USAFE) maintains and operates BGM-109G ground-launched cruise missile; also the 850th Munitions Maintenance Sqdn. (USAFE). Base activated by RAF in 1941. Current US presence began in 1967. Named after the tract of common land on which it is situated. Area 1,005 acres. Altitude 398 ft. Military 1,520; civilians 482. Payroll $45.2 million. Housing: 664 units; 31 VAQ; 21 VOQ; 1 TLF. Clinic.

RAF Lakenheath, United Kingdom, APO New York 09179-5000; 70 mi. NE of London; 25 mi. from Cambridge. Phone (commercial, from CONUS) 011-44-638-52-3000; AUTOVON 226-1110. Royal Air Force base. 48th Tactical Fighter Wing (USAFE) flies the F-111 and trains for and conducts tactical air operations in support of NATO. Base activated in 1941; 48th TFW began operations in Jan. 1960. Named after nearby village. Area 2,226 acres. Altitude 32 ft. Military 4,732; civilians 2,167. Payroll $129.1 million. Housing: 651 units; 1,117 US Govt. leased housing; 125 billeting spaces. Regional medical center.

RAF Mildenhall, United Kingdom, APO New York 09127-5000; 30 mi. NE of Cambridge. Phone (commercial, from CONUS) 011-44-638-51-1110; AUTOVON 238-1110. Royal Air Force base. Hq. 3d Air Force (USAFE). 513th Airborne Command and Control Wing (USAFE) supports four major USAFE functions. Associate units include 306th Strategic Wing (SAC) (rotational), 313th Tactical Airlift Gp. (MAC) (rotational), Silk Purse Control Gp. (USEUCOM), and 2147th Communications Wing (AFCC). Base activated in 1934; US presence began in July 1950. Named after the village of Mildenhall. Area 1,144 acres. Altitude 33 ft. Military 2,850; civilians 916. Payroll $36 million. Housing: 272 officer; 1,828 enlisted; 1,115 US Govt. leased housing; 2,501 billeting spaces. Medical annex.

RAF Upper Heyford, United Kingdom, APO New York 09194-5000; 13 mi. N of Oxford. Phone (commercial, from CONUS) 011-44-869-232331; AUTOVON 263-1110. Royal Air Force base. 20th Tactical Fighter Wing (USAFE) provides long-range, all-weather tactical fighter and electronic combat sorties for NATO. Associate units include 2130th Communications Gp., 317th Contingency Hospital, 7520th Air Base Sqdn., and 2119th Communications Sqdn. Activated during WW I; 20th TFW began operations here in Dec. 1969. Named after local town. Area 1,191 acres. Altitude 412 ft. Military 4,973; civilians 7,641. Payroll $151 million. Housing: 197 officer; 640 enlisted; 350 enlisted US Govt. leased housing; 53 TLF; 8 BOQ; 42 VOQ; 104 senior enlisted and 1,970 junior NCO/airman BEQ; 30 VEQ. Hospital.

Ramstein AB, W. Germany, APO New York 09094-5000; adjacent to Ramstein; 10 mi. W of Kaiserslautern. Phone (commercial, from CONUS) 011-49-6371-47-1110; AUTOVON 480-1110. USAFE base. Hq. USAFE; Hq. Allied Air Forces Central Europe (NATO). 316th Air Div. is host unit for the Kaiserslautern Military Community and is composed of two major wings: the 377th Combat Support Wing and the 86th Tactical Fighter Wing, which flies the F-16C/D. Major associates include Hq. European Electronic Security Div. (ESC), Hq. 7th Air Div. (SAC), Hq. 322d Airlift Div. (MAC), 2d Weather Wing (MAC), 7455th Tactical Intelligence Wing (USAFE), 608th Military Airlift Gp. (MAC), 1856th Communications Gp. (AFCC), and the 1964th Communications Gp. (AFCC). Base activated and US presence began in 1953. Area 5,292 acres. Altitude 782 ft. Military 9,116; civilians 6,480. Payroll $426.2 million. Housing: 4,659 units; 735 US Govt. leased units; 5,116 billeting units. Clinic.

Randolph AFB, Tex. 78150-5000; 17 mi. ENE of San Antonio. Phone (512) 652-1110; AUTOVON 487-1110. ATC base. Hq. Air Training Command; 12th Flying Training Wing, T-37 and T-38 pilot instructor training; Air Force Military Personnel Center; USAF Occupational Measurement Center; Civilian Personnel Management Center; Hq. Joint Military Medical Command; Hq. USAF Recruiting Service. Base activated June 1930; named for Capt. William M. Randolph, killed Feb. 17, 1928, when his AT-4 crashed on takeoff at Gorman, Tex. Area 2,901 acres. Altitude 761 ft. Military 5,565; civilians 2,714. Payroll $258 million. Housing: 241 officer; 718 NCO; 243 transient. Clinic.

Reese AFB, Tex. 79489-5000; adjacent to Lubbock. Phone (806) 885-4511; AUTOVON 838-1110. ATC base. 64th Flying Training Wing, undergraduate pilot training. Base activated 1942; named for 1st Lt. Augustus F. Reese, Jr., P-38 fighter pilot killed during a train-strafing mission at Cagliari, in Sardinia May 14, 1943. Area 2,467 acres. Altitude 3,338 ft. Military 2,657; civilians 843. Payroll $70.6 million. Housing: 104 officer; 258 NCO (50 under renovation); 65 transient (8 suites, 25 TLF, 14 BOQ, 18 VAQ). 15-bed hospital.

Rhein-Main AB, W. Germany, APO New York 09097-5000; 5 mi. S of Frankfurt. Phone (commercial, from CONUS) 011-49-69-699-1110; AUTOVON (314) 330-1110. MAC base. 435th Tactical Airlift Wing is host at Rhein-Main, the only MAC base in Europe. The 37th Tactical Airlift Sqdn. flies C-130E aircraft in support of DoD and European theater airlift requirements. The 2d and 55th Aeromedical Airlift Sqdns. provide inter- and intratheater aeromedical airlift. The Army's 21st Replacement Battalion is also located at Rhein-Main. Base activated July 1936; US Forces began operations Apr. 1945. Named after the confluence of the Rhein and Main rivers west of Frankfurt. Area 923 acres. Altitude 365 ft. Military 4,079; civilians 1,952. Payroll $83.8 million. Housing (on-base, government-owned): 152 officer; 492 enlisted; (off-base, government-owned): 12 officer; 145 enlisted; (off-base, government-leased): 301 units; 266 rooms/564 beds at base hotel; 173 rooms/278 beds VAQ. USAF clinic.

Robins AFB, Ga. 31098; 15 mi. SSE of Macon at Warner Robins. Phone (912) 926-1110; AUTOVON 468-1110. AFLC base. Hq. Warner Robins Air Logistics Center provides worldwide logistics management for the F-15, C-7A, C-20, C-130, C-140, and C-141. Also manages utility helicopters, remotely piloted vehicles, and air-to-air, air-to-ground, and ground-to-ground missiles. Responsible for the management and repair of electronic components, including airborne communication and navigation equipment, airborne bomb and gun directing systems, and all Air Force airborne electronic warfare equipment. Other major units include Hq. Air Force Reserve (AFRES); 2853d Air Base Gp.; 19th Air Refueling Wing (SAC); 5th Combat Communications Gp. (AFCC); 3503d Recruiting Gp.; 1926th Communications Sqdn. (AFCC); 9th Missile Warning Sqdn. (AFSPACECOM). Base activated Mar. 1942; named for Brig. Gen. Augustine Warner Robins, an early Chief of the Materiel Division of the Air Corps, who died June 16, 1940. Area 8,790 acres. Altitude 294 ft. Military 4,423; civilians 15,076. Payroll $608 million. Housing: 225 officer; 1,171 NCO; 40 TLF, 118 VOQ, 95 VAQ; 100 trailer spaces. 20-bed hospital.

San Vito Dei Normanni AB, Italy, APO New York 09240-5000; 7 mi. NW of Brindisi; 200 mi. ESE of Naples. Phone (commercial, from CONUS) 011-39-831-42-3519; AUTOVON 622-1110. USAFE base. 7275th Air Base Gp. provides logistics, administrative, and air base management. Activated 1960; US presence began Sept. 1978. Named for nearby village. Area 318 acres. Altitude 15 ft. Military 1,700; civilians 540. Payroll $29.8 million. No base housing; 425 dorm spaces; 15 BOQ rooms; 30 TLF rooms. Clinic.

Sawyer AFB *(see K. I. Sawyer AFB).*

Scott AFB, Ill. 62225-5000; 6 mi. ENE of Belleville. Phone (618) 256-1110; AUTOVON 576-1110. MAC base. 375th Aeromedical Airlift Wing; Hq. Military Airlift Command; Hq. Air Force Communications Command; US Transportation Command; Hq. Aerospace Rescue & Recovery Service; Hq. Air Weather Service; Defense Commercial Communications Office; Environmental Technical Applications Center; USAF Medical Center, Scott; 7th Weather Wing; 932d Aeromedical Airlift Gp. (AFRES Assoc.); Airlift Communications Div.; 375th Air Base Gp. Base activated June 14, 1917; named for Cpl. Frank S. Scott, the first enlisted man to die in an aircraft accident, killed Sept. 28, 1912, while "hitching" a ride in one of the Wright Type B Flyers at College Park, Md. Area 3,000 acres. Altitude 453 ft. Military 7,000; civilians 4,000. Payroll $388.3 million. Housing: 309 officer; 1,396 NCO; plus 193 spaces for privately owned trailers; 300 transient. 325-bed hospital; 100-bed aeromedical staging facility.

Sembach AB, W. Germany, APO New York 09130-5000; 9 mi. NE of Kaiserslautern. Phone (commercial, from CONUS) 011-49-6302-67-1110; AUTOVON 496-1110. USAFE base. Hq. 17th Air Force (USAFE). Host unit is the 66th Electronic Combat Wing with a mission of employing electronic combat weapon systems in the European theater of operations. Base activated 1930; US presence began July 1953. Named after a nearby farming community. Area 843 acres. Altitude 1,037 ft. Military 5,353; civilians 258. Payroll $70.4 million. Housing: 92 officer; 314 enlisted; 813 billeting spaces. Clinic.

Seymour Johnson AFB, N. C. 27531-5000; within city limits of Goldsboro. Phone (919) 736-5400; AUTOVON 488-1110. TAC base. 4th Tactical Fighter Wing, F-4E fighter operations; 68th Air Refueling Wing (SAC); 916th Air Refueling Gp. (AFRES); 2012th Communications Sqdn. (AFCC); OLAD, 191st Fighter Interceptor Gp. (MichANG). Base activated June 12, 1942; named for Navy Lt. Seymour A. Johnson, Goldsboro native, killed Mar. 5, 1941, in an aircraft accident in Maryland. Area 3,230 acres. Altitude 109 ft. Military 5,100; civilians 800. Payroll $112.8 million. Housing: 154 officer; 1,543 enlisted; 86 VAQ, 46 VOQ, 8 UOQ, 26 UNCOQ, 27 temporary lodging facilities. 20-bed hospital.

Shaw AFB, S. C. 29152-5000; 10 mi. WNW of Sumter. Phone (803) 668-8110; AUTOVON 965-1110. TAC base. 363d Tactical Fighter Wing, F-16 fighter and RF-4C reconnaissance operations; Hq. 9th Air Force (TAC); 507th Tactical Air Control Wing, OV-10; manages 407L/485L tactical air control systems. Base activated Aug. 30, 1941; named for 2d Lt. Ervin D. Shaw, one of the first Americans to see air action in WW I, killed in France on July 9, 1918, when his Bristol fighter was shot down during a reconnaissance mission. Area 3,363 acres; supports another 8,078 acres. Altitude 244 ft. Military 5,232; civilians 510. Payroll $130 million. Housing: 170 officer; 1,534 NCO; 189 transient. 35-bed hospital.

Shemya AFB, Alaska (APO Seattle 98736-5000); located at western tip of the Aleutian Islands chain, midway between Anchorage, Alaska, and Tokyo, Japan. Phone (907) 392-3000; AUTOVON (317) 392-3000. AAC base. 5073d Air Base Gp. (AAC), host unit; 16th Surveillance Sqdn. (AFSPACECOM); Det. 1, 6th Strategic Reconnaissance Wing (SAC). Base activated 1943. Shemya was used as a bomber base in WW II. The International Date Line has been bent around Shemya so that the local date is the same as elsewhere in the US. Island area about 11.25 sq. mi. Altitude 270 ft. Military 596; civilian contract employees 399. Payroll $8.8 million. Housing: 70 transient. Dispensary.

Sheppard AFB, Tex. 76311-5000; 4 mi. N of Wichita Falls. Phone (817) 851-2511; AUTOVON 736-1001. ATC base. Sheppard Technical Training Center includes the 3700th Technical Training Wing, which conducts courses in aircraft maintenance, civil engineering, communication, comptroller, transportation, and instructor training; 3790th Field Training Wing, which provides training in biomedical sciences, dentistry, health service administration, medical readiness, medicine, and nursing; and the 3785th Field Training Wing, which provides training on specific weapon systems and on-the-job training advisory service at 77 field training detachments, 9 operating locations, and 1 field training flight worldwide; 80th Flying Training Wing (ATC), which conducts T-37 and T-38 undergraduate pilot training and instructor pilot training for 12 nations in the Euro-NATO Joint Jet Pilot Training Program; 2054th Communications Sqdn. (AFCC). Base activated June 14, 1941; named for US Sen. Morris E. Sheppard of Texas, who died April 9, 1941. Area 5,500 acres. Altitude 1,015 ft. Military 6,335; civilians 1,143. Payroll $239 million. Housing: 200 officer; 1,086 NCO; 286 VOQ, 965 VAQ, 50 TLF. 135-bed regional hospital.

Soesterberg AB, The Netherlands, APO New York 09292-5000; 3 mi. from Zeist; 26 mi. from Amsterdam. Phone (commercial, from CONUS) 011-31-3463-58199; AUTOVON 363-8199. Royal Netherlands air base. 32d Tactical Fighter Sqdn. (USAFE) prepares for and conducts all-weather operations in intercept, identification, and air-superiority roles in support of NATO using the F-15. Base activated 1913; US presence began 1954. Area 515 acres. Altitude 66 ft. Military 2,139; civilians 297. Payroll $63.6 million. Housing: 50; 190 US Govt. leased housing; 320 dorm spaces; 31 VAQ; 6 VOQ. Clinic.

Spangdahlem AB, W. Germany, APO New York 09126-5000; 8 mi. E of Bitburg; 20 mi. NE of Trier. Phone (commercial, from CONUS) 011-49-6565-61-1110; AUTOVON 452-1110. USAFE base. 52d Tactical Fighter Wing is the only Wild Weasel base in USAFE. Base activated and US presence began in 1953. Named after the local town. Area 1,282 acres. Altitude 1,196 ft. Military 4,800; civilians 900. Payroll $106 million. Housing: 43 officer; 615 enlisted; 385 US Govt. leased units; 1,062 billeting spaces. Clinic.

Thule AB, Greenland, APO New York 09023-5000; NW coast of Greenland; 700 mi. N of Arctic Circle; approx. 900 mi. S of North Pole. Phone (commercial, from CONUS) 011-299-50124; AUTOVON 834-1211 for Cheyenne Mountain AFB, then ask for Thule operator. AFSPACECOM base. 1012th Air Base Gp.; 12th Missile Warning Sqdn.; Det. 3, 2d Satellite Tracking Gp. Base activated in 1952. Area 2,600 acres. Altitude sea level. Military 180; civilians 180 American contractors and approx. 1,000 Danish contractors. Housing: no family housing; no visitor quarters; 11 permanent party dormitories for military and civilian personnel. Transient quarters available only for TDY personnel.

Tinker AFB, Okla. 73145-5990; 8 mi. SE of Oklahoma City. Phone (405) 732-7321; AUTOVON 884-4360. AFLC base. Hq. Oklahoma City Air Logistics Center furnishes logistics support for bombers, jet engines, instruments, and electronics. Other major units include Engineering Installation Div. (AFCC); 3d Combat Communications Gp. (AFCC); 28th Air Div. (TAC); 507th Tactical Fighter Gp. (AFRES). Base activated Mar. 1941; named for Maj. Gen. Clarence L. Tinker, whose LB-30 (an early model B-24) went down at sea southwest of Midway Island on June 7, 1942. Area 5,001 acres. Altitude 1,291 ft. Military 7,355; civilians 17,292. Payroll $626 million. Housing: 128 officer; 1,052 NCO. 35-bed hospital.

Torrejon AB, Spain, APO New York 09283-5000; 14 mi. NE of Madrid. Phone (commercial, from CONUS) 011-30-341-665-7777; AUTOVON 723-1110. USAFE base. Hq. 16th Air Force (USAFE). 401st Tactical Fighter Wing (USAFE) mission is to fly, maintain, and mobilize F-16C/D combat-ready aircraft in support of the NATO Southern Region and contingency taskings by Southern Air Command and USAFE; supports joint and combined forces through strike attack and air-superiority missions; combines one main operating base, one collocated operating base, and eight communications sites; responsible for the support and protection of 65 associate units, including Hq. 16th Air Force. Major associates include 625th Military Airlift Support Gp. (MAC); 1989th Communications Wing (AFCC); 2186th Communications Sqdn. (AFCC); Air Force Office of Special Investigations, District 68. Base activated and US forces began operation in June 1957. Named for the village of Torrejon de Ardoz. Area 3,206 acres. Altitude 2,000 ft. Military 4,200; civilians 2,940. Payroll $131.3 million. Housing: 67 units; 858 US Govt. leased units; 260 VOQ/VAQ rooms; 150 TLF; 616 dorm rooms. Hospital.

Travis AFB, Calif. 94535-5000; 50 mi. NE of San Francisco at Fairfield. Phone (707) 438-4011; AUTOVON 837-1110. MAC base. Hq. 22d Air Force; 60th Military Airlift Wing; 349th Military Airlift Wing (AFRES Assoc.); David Grant Medical Center; 1901st Communications Gp. (AFCC); 504th Air Force Band of the Golden Gate. Base activated May 17, 1943; named for Brig. Gen. Robert F. Travis, killed Aug. 5, 1950, in a B-29 accident. Area 7,580 acres. Altitude 62 ft. Military 12,214; civilians 3,066. Payroll $274.5 million. Housing: 258 officer; 1,113 Jr. NCO; 204 Sr. NCO; 792 transient (75 TLF, 241 VOQ, 446 VAQ, 26 DVQ, 4 Sr. NCO suites). 298-bed hospital.

Tyndall AFB, Fla. 32403-5000; 12 mi. E of Panama City. Phone (904) 283-1113; AUTOVON 523-1113. TAC base. USAF Air Defense Weapons Center; primary units are the 325th Tactical Training Wing, F-15 operations; 475th Weapons Evaluation Gp.; and 325th Combat Support Gp. Provides DoD a centralized location for operational and technical advice on air defense concepts and tactics and combat readiness training for tactical and strategic air defense aircrews and weapons controllers. Provides training of F-15 aircraft pilots and weapons controllers, centralized training for all F-15 maintenance personnel, and special training to enhance air-to-air combat skills. Single-point management for all continental USAF subscale and full-scale drone aerial target operations. TAC units include Southeast Air Defense Sector, home of Southeast Sector Operations Control Center, 4702d Computer Services Sqdn.; TAC NCO Academy East. Tenant units include Air Force Engineering and Services Center; 3625th Technical Training Sqdn. (ATC); 2021st Communications Sqdn. (AFCC). Base activated Dec. 7, 1941; named for 1st Lt. Frank B. Tyndall, WW I fighter pilot killed July 15, 1930, in crash of P-1 near Mooresville, N. C. Area 29,115 acres. Altitude 18 ft. Military 4,623; civilians 1,695. Payroll $250 million. Housing: 139 officer; 813 NCO. 50-bed hospital.

US Air Force Academy, Colo. 80840-5000; N of Colorado Springs. Phone (719) 472-3110; AUTOVON 259-3110. Direct Reporting Unit. Established Apr. 1, 1954. First class entered Lowry AFB, Colo., July 1955. Moved to permanent location Aug. 1958. Tenant units include 1876th Communications Gp.; Frank J. Seiler Research Lab (AFSC); DoD Medical Exam Review Board; Det. 470, Air Force Audit Agency. Aircraft flown: T-41; Cessna 150 (cadet flying team); UV-18 (Det. 1, Peterson AFB); ASK-21 (glider); SG-233 (sailplane); TG7A (motor glider). Area 18,000 acres. Altitude 7,280 ft. Military 2,723; cadets 4,469; civilians 2,363. Payroll $185 million. Housing: 445 officer; 772 enlisted; 76 transient; 26 temporary family quarters. 70-bed hospital.

Vance AFB, Okla. 73705-5000; 3 mi. SSW of Enid. Phone (405) 237-2121; AUTOVON 962-7110. ATC base. 71st Flying Training Wing, undergraduate pilot training. Base activated Nov. 1941; named for Lt. Col. Leon R. Vance, Jr., Enid native, 1939 West Point graduate, and Medal of Honor recipient, killed July 26, 1944, when air-evac plane returning him to the US went down in the Atlantic near Iceland. Area 1,829 acres. Altitude 1,307 ft. Military 1,212; civilians 1,320 (1,200 contract employees). Payroll $80.4 million. Housing: 132 officer; 98 enlisted; 34 transient, 10 TLF. Clinic.

Vandenberg AFB, Calif. 93437-5000; 8 mi. NNW of Lompoc. Phone (805) 866-1611; AUTOVON 276-1110. SAC base. 1st Strategic Aerospace Div. (SAC); Space and Missile Test Organization (AFSC); Western Space and Missile Center (AFSC). Host command conducts missile crew training and provides facilities and support for operational ballistic missiles in the SAC deterrent force. The Space and Missile Test Organization (SAMTO) is responsible for management of field-test and launch operations for all DoD-directed space programs as well as long-range ballistic missile research and development. SAMTO also develops, manages, and operates, through the Eastern and Western Space and Missile Centers, the National Test Ranges. The Western Test Range supports ballistic and space test operations as well as East Coast space shuttle flights and other aeronautical tests employing the same sensors and data-gathering equipment. The Western Space and Missile Center (WSMC) provides launch and launch support of research and development ballistic missile tests and polar-orbiting space launches for DoD, USAF, and NASA. WSMC plans and executes Peacekeeper research and development, supports antisatellite missile development, and will provide support for West Coast space shuttle operations scheduled to begin in 1992. Originally Army's Camp Cooke. Activated Oct. 1941. Base was taken over by USAF June 7, 1957; renamed for Gen. Hoyt S. Vandenberg, USAF's second Chief of Staff. Area 98,400 acres. Altitude 400 ft. Military 3,675; civilians 1,373; civilian contractors 4,888. Payroll $121.1 million (military and civilians); $181.3 million (contractors). Housing: 511 officer; 1,567 NCO; 172 mobile trailer spaces; 400 transient. 45-bed hospital.

Warren AFB *(see Francis E. Warren AFB).*

Wheeler AFB, Hawaii 96854-5000; near center of the island of Oahu, adjacent to the Army's Schofield Barracks. Phone (808) 471-7110 (Oahu military operator); AUTOVON 471-7110. PACAF base. Host unit 15th Air Base Sqdn. Associate units include 326th Air Div. (Hawaii Regional Operations Control Center); US Army aviation units from Schofield Barracks. Base activated Feb. 1922; named for Maj. Sheldon H. Wheeler, commanding officer of Luke Field, Hawaii, in 1919, who was killed there July 13, 1921, when his biplane crashed during an aerial exhibition. Area 1,369 acres. Altitude 845 ft. Military 881; civilians 125. Payroll included in entry for Hickam AFB. Housing: 102 officer; 390 enlisted. Dispensary run by 15th Medical Gp.

Whiteman AFB, Mo. 65305-5000; 2 mi. S of Knob Noster. Phone (816) 687-1110; AUTOVON 975-3727. SAC base. 351st Strategic Missile Wing. Whiteman AFB is responsible for 150 Minuteman II ICBMs and is scheduled to receive the first B-2 bombers when they become operational in the 1990s. Base activated 1942; named for 2d Lt. George A. Whiteman, nearby Sedalia resident, who was the first pilot to die in combat during the attack on Pearl Harbor. Area 3,706 acres, plus missile complex of about 10,000 sq. mi. Altitude 869 ft. Military 4,000; civilians 500. Payroll $132.5 million. Housing: 200 officer; 790 enlisted; 67 transient (incl. 4 guest houses, 45 VAQ, 18 VOQ). 30-bed hospital.

Williams AFB, Ariz. 85240-5000; 10 mi. E of Chandler. Phone (602) 988-2611; AUTOVON 474-1001. ATC base. 82d Flying Training Wing, largest undergraduate pilot training base; also provides F-5 combat crew training for foreign students via the 425th Tactical Fighter Training Sqdn. (TAC); 1922d Communications Sqdn. (AFCC); home of AFSC Human Resources Lab/Flying Training Div., doing extensive research on flight simulators. Base activated July 1941; named for 1st Lt. Charles L. Williams, killed in bomber crash near Fort DeRussy, Hawaii, July 6, 1927. Area 4,761 acres. Altitude 1,385 ft. Military 3,169; civilians 1,311. Payroll $189.5 million. Housing: 218 officer; 482 NCO; 40 transient. 15-bed hospital.

Wright-Patterson AFB, Ohio 45433; 10 mi. ENE of Dayton. Phone (513) 257-1110; AUTOVON 787-1110. AFLC base. Hq. Air Force Logistics Command; Hq. Aeronautical Systems Div. (AFSC); Air Force Institute of Technology; USAF Medical Center, Wright-Patterson; US Air Force Museum; Air Force Acquisition Logistics Center; Logistics Operations Center; Logistics Management Systems Center; AFLC International Logistics Center; 2750th Air Base Wing (AFLC); 906th Tactical Fighter Gp. (AFRES); more than 90 other DoD activities and government agencies. Originally separate, Wright Field and Patterson Field were merged and redesignated Wright-Patterson AFB on Jan. 13, 1948. Named for aviation pioneers Orville and Wilbur Wright and for 1st Lt. Frank S. Patterson, killed June 19, 1918, in the crash of a DH-4. The Wright brothers did much of their early flying on Huffman Prairie, now in Area C of present base. Area 8,145 acres. Altitude 824 ft. Military 10,700; civilians 17,500; contracted service and contractor employees 6,000. Payroll $865 million. Housing: 736 officer; 1,627 NCO. 314-bed hospital.

Wueschheim AB, W. Germany, APO New York 09122-5000; 97 mi. NE of Frankfurt. Phone (commercial, from CONUS) 011-49-6762-1110; AUTOVON 474-1110. USAFE base. 38th Tactical Missile Wing (USAFE) mission is to train personnel and to maintain and operate the BGM-109 ground-launched cruise missile. Base activated in 1954; 38th TMW activated April 1, 1985. Named

after nearby town. Area 121 acres. Altitude 1,465 ft. Military 862; civilians 17. Payroll $25.4 million. Support facilities provided by Hahn AB, Germany, 12 mi. away.

Wurtsmith AFB, Mich. 48753-5000; 3 mi. NW of Oscoda. Phone (517) 739-2011; AUTOVON 623-1110. SAC base. 379th Bomb Wing. Base activated 1924 as Camp Skeel, gunnery camp for Selfridge Field; became Oscoda Army Air Field during WW II; renamed in 1953 for Maj. Gen. Paul B. Wurtsmith, killed Sept. 13, 1946, in a B-25 crash. Base assigned to SAC Apr. 1, 1960. Area 5,221 acres. Altitude 634 ft. Military 3,225; civilians 619. Payroll $82.5 million. Housing: 224 officer; 1,118 NCO; 7 TLF units; 20 UOQ; 20 VOQ; 34 VAQ. 20-bed hospital.

Yokota AB, Japan, APO San Francisco 96328-5000; approx. 25 mi. W of Tokyo. Phone (commercial, from CONUS) 011-81-425-52-2511; AUTOVON 225-2511. PACAF base. Hq. US Forces, Japan; Hq. 5th Air Force; 475th Air Base Wing, UH-1N operations; 316th Tactical Airlift Gp. (MAC), C-130 and C-21 operations, primary aerial port in Japan; 1956th Communications Gp. (AFCC). Base opened as Tama Army Air Field by Japanese in 1940. Area 1,750 acres. Altitude 457 ft. Military 4,166; US citizens 1,493; local nationals 1,465. Payroll $178.8 million. Housing: 631 officer; 1,629 enlisted; 343 transient; 51 temporary lodging facility units. 35-bed hospital.

Zaragoza AB, Spain, APO New York 09286-5000; 12 mi. SW of Zaragoza. Phone (commercial, from CONUS) 011-34-76-32-67-11; AUTOVON 724-1110. USAFE base. 406th Tactical Fighter Training Wing provides air-to-ground and air-to-air training for USAFE's Central Region fighter bases. Current US presence began in Feb. 1970. Area 2,982 acres. Altitude 863 ft. Military 897, plus 300 TDY personnel per month; civilians 1,329. Payroll $36.6 million. Housing: 30 officer; 126 enlisted; 174 VOQ; 202 VAQ; 6 TLF. Clinic.

Zweibrücken AB, W. Germany, APO New York 09860-5000; 20 mi. S of Ramstein AB. Phone (commercial, from CONUS) 011-49-6332-47-1110; AUTOVON 498-1110. USAFE base. 26th Tactical Reconnaissance Wing has three primary and very diverse missions: all-weather tactical reconnaissance in central Europe, wartime medical support, and support of the European distribution system performed by the 10th Military Airlift Sqdn. (MAC). Base activated 1953; US presence began 1969. "Zweibrücken" translates into "two bridges," which were the essential monuments of the city. Area 694 acres. Altitude 1,133 ft. Military 4,176; civilians 813. Payroll $58.9 million. Housing: 32 officer; 315 enlisted; 40 VOQ; 118 VAQ; 23 TLQ. Clinic. ■

Guide to USAF's Minor Installations

In addition to the places listed in this "Guide to Major Air Force Installations Worldwide," USAF has a number of minor installations. These Air Force stations (AFS) and air stations (AS) perform various missions, including air defense and missile warning. Here is a listing of such installations with state (or APO), ZIP code, and major command. When an installation can be reached by a general-purpose AUTOVON number, that number (AV) is also listed. In some cases, the designation air base (AB) is used because of political sensitivities.

Ankara AS, APO New York 09254-5000 (USAFE)	AV 672-1110
Avon Park AFS, Fla. 33825 (TAC)	AV 968-1110
Cape Canaveral AFS, Fla. 32925-5000 (AFSC)	AV 467-1110
Cape Cod AFS, Mass. 02532-1419 (AFSPACECOM)	AV 557-2277
Cavalier AFS, N. D. 58220-5000 (AFSPACECOM)	AV 330-3297
Clear AFS, APO Seattle 99704-5000 (AFSPACECOM)	AV 317-585-6409
Decimomannu AB, APO New York 09161-5000 (USAFE)	AV 621-9267
Duke Field AFS, Fla. 32542 (MAC)	AV 872-1110
Eldorado AFS, Tex. 76936-5000 (AFSPACECOM)	AV 477-4279
Galena Airport, APO Seattle 98723 (AAC)	AV 317-446-3311
Gila Bend Air Force Auxiliary Field, Ariz. 85337-5000 (TAC)	AV 853-5220
Hessisch-Oldendorf AS, APO New York 09669-5000 (USAFE)	AV 331-1110
High Wycombe AS, APO New York 09241-5000 (USAFE)	AV 232-1110
Indian Springs Air Force Auxiliary Field, Nev. 89018-5000 (TAC)	AV 682-6201
Izmir AS, APO New York 09224-5000 (USAFE)	AV 675-1110
King Salmon Airport, APO Seattle 98713 (AAC)	AV 317-721-3301
Kwangju AB, APO San Francisco 96264-5000 (PACAF)	AV 272-2345
New Boston AFS, N. H. 03031-5000 (AFSPACECOM)	AV 881-1550
Pirinclik AS, APO New York 09294-5000 (USAFE)	AV 679-1110
Pruem AS, APO New York 09692-5000 (USAFE)	AV 453-1110
RAF Croughton, APO New York 09378-5000 (USAFE)	AV 236-1110
RAF Wethersfield, APO New York 09120-5000 (USAFE)	AV 224-1110
Sondrestrom AB, APO New York 09121-5000 (AFSPACECOM)	AV 834-1211, ask for Sondrestrom AB.
Suwon AB, APO San Francisco 96461-5000 (PACAF)	AV 784-4110
Taegu AB, APO San Francisco 96213-5000 (PACAF)	AV 766-1110
Tempelhof Central Airport AS, APO New York 09611-5000 (USAFE)	AV 332-1100
Woomera AS, APO San Francisco 96287-5000 (AFSPACECOM)	AV 730-1350

Guide to ANG and AFRES Bases

NOTE: This section of the Guide consolidates major Air National Guard (ANG) and Air Force Reserve (AFRES) bases into a single listing. Most ANG locations are listed alphabetically, according to the city where they are located. AFRES units are listed by the names of their bases and are designated as AFRES facilities. There are, in addition, some ANG and AFRES units that are located on active-duty bases. These may be found in the main "Guide to Major Air Force Installations Worldwide" elsewhere in this issue.

Anchorage, Alaska (Kulis ANG Base at Anchorage International Airport) 99502. Phone (907) 243-1145; AUTOVON (317) 626-1444. 176th Tactical Airlift Gp. (ANG); 144th Tactical Airlift Sqdn. (ANG). Base named for Lt. Albert Kulis, killed in training flight in 1954. Area 129 acres. Altitude 124 ft. Military 872, technicians 176. Payroll $22.6 million. 6-bed hospital.

Atlanta, Ga. (McCollum Airport, Kennesaw, Ga.) 30144; 27 mi. N of Atlanta, 10 mi. from Dobbins AFB. Phone (404) 422-2500; AUTOVON 925-2474. 129th Tactical Control Sqdn. and 118th Tactical Control Flt. Area 13 acres. Altitude 1,060 ft. Military 347, technicians 38. Payroll through Dobbins AFB.

Atlantic City International Airport, N. J. (400 Langley Rd., Pleasantville) 08232-9500; 10 mi. W of Atlantic City. Phone (609) 645-6000; AUTOVON 445-6000. 177th Fighter Interceptor Gp. (ANG). Area 268 acres. Altitude 76 ft. Military 893, full-time support 260. Payroll $15.1 million.

Baltimore, Md. (Glenn L. Martin State Airport) 21220-2899; 8 mi. E of Baltimore. Phone (301) 687-6270; AUTOVON 235-9210. 175th Tactical Fighter Gp. (ANG); 135th Tactical Airlift Gp. (ANG). Area 175 acres. Altitude 24 ft. Military 1,797, technicians 304. Payroll $24.3 million. Clinic.

Bangor ANG Base, Me. 04401-3099; 4 mi. NW of Bangor. Phone (207) 947-0571; AUTOVON 476-6210. 101st Air Refueling Wg. (ANG); 776th Radar Sqdn. (TAC). Area 300 acres. Altitude 192 ft. Military 1,039, technicians 224, Title 5 civilians 25. Payroll $20.9 million. Small BX-Foodland.

Battle Creek, Mich. 49015-1291; adjacent to W. K. Kellogg Airport. Phone (616) 963-1596; AUTOVON 580-3210. 110th Tactical Air Support Gp. (ANG). Area 315 acres. Altitude 941 ft. Military 895, technicians 167. Payroll $12.2 million.

Birmingham Municipal Airport, Ala. 35217. Phone (205) 841-9200; AUTOVON 694-2260. 117th Tactical Recon Wg. (ANG). Area 86 acres. Altitude 650 ft. Military 1,221, technicians 255. Payroll $17.1 million.

Boise Air Terminal, Idaho (Gowen Field) 83707; 6 mi. S of Boise. Phone (208) 389-5011; AUTOVON 941-5011. 124th Tactical Recon Gp. (ANG). Also host to ARNG (Army field training site) and Marine Corps Reserve. Airport named for Lt. Paul R. Gowen, killed in B-10 crash in Panama July 11, 1938. Area 1,994 acres. Altitude 2,858 ft. Military 1,285, technicians 276. Payroll $23 million. Limited transient facilities available during Army Guard camps.

Bradley ANG Base, Conn. 06026-5000; 15 mi. N of Hartford at East Granby, adjacent to Bradley International Airport. Phone (203) 623-8291; AUTOVON 636-8310. 103d Tactical Fighter Gp. (ANG); Army National Guard aviation battalion. Base named for Lt. Eugene M. Bradley, killed in P-40 crash Aug. 1941. Area 125 acres. Altitude 173 ft. Military 981, technicians 207. Payroll $16.3 million.

Buckley ANG Base, Colo. 80011; 8 mi. E of Denver. Phone (303) 366-5363; AUTOVON 877-9011. 140th Tactical Fighter Wg. (ANG); 154th Tactical Control Gp.; Hq. Colorado ANG. Also host to Navy Reserve, Marine Corps Reserve, ARNG, and Air Force units. Base activated Apr. 1, 1942, as a gunnery training facility. ANG assumed control from US Navy in 1959. Base named for Lt. John H. Buckley, National Guardsman, killed in the Argonne, France, Sept. 27, 1918. Area 3,328 acres. Altitude 5,663 ft. Military 1,380, technicians 288, Title 5 civilians 323. Payroll $29.6 million. Dispensary.

Burlington, Vt. (Burlington International Airport) 05401; 3 mi. E of Burlington. Phone (802) 658-0770; AUTOVON 689-4310. 158th Fighter Interceptor Gp. (ANG). Area 241 acres. Altitude 371 ft. Military 1,926, technicians 238. Payroll $15.9 million.

Charleston, W. Va. (Yeager Airport) 25311-5000; 4 mi. NE of Charleston. Phone (304) 357-5100; AUTOVON 366-9210. 130th Tactical Airlift Gp. (ANG). Airport named for Brig. Gen. Charles "Chuck" Yeager, first man to break the sound barrier. Area 59 acres. Altitude 981 ft. Military 929, technicians 167. Payroll $12.9 million. Dispensary, clinic.

Charlotte, N. C. (Charlotte/Douglas Municipal Airport) 28208. Phone (704) 399-6363; AUTOVON 583-9210. 145th Tactical Airlift Gp. (ANG). Area 69 acres. Altitude 749 ft. Military 1,273, technicians 233. Payroll $18.3 million. Clinic.

Cheyenne, Wyo. (Cheyenne Municipal Airport) 82001. Phone (307) 772-6201; AUTOVON 943-6201. 153d Tactical Airlift Gp. (ANG). Area 68 acres. Altitude 6,156 ft. Military 961, technicians 179. Payroll $13.9 million.

Dallas Naval Air Station, Tex. (Hensley Field) 75211. Phone (214) 266-6111; AUTOVON 874-6111. 136th Tactical Airlift Wg. (ANG). Area 49 acres. Altitude 495 ft. Military 969, technicians 176. Payroll $14.2 million.

Des Moines Municipal Airport, Iowa 50321; in city of Des Moines. Phone (515) 285-7182; AUTOVON 939-8210. 132d Tactical Fighter Wg. (ANG). Area 114 acres. Altitude 957 ft. Military 1,057, technicians 256. Payroll $17 million.

Dobbins AFB, Ga. 30069-5000; 2 mi. S of Marietta, 16 mi. NW of Atlanta. Phone (404) 421-5000; AUTOVON 925-1110. AFRES base. Hq. 14th Air Force (AFRES); 94th Tactical Airlift Wg. (AFRES); 116th Tactical Fighter Wg. (ANG); 151st Military Intelligence Battalion (ARNG); 145th Medical Detachment (USAR). Base activated 1943; named for Capt. Charles Dobbins, WW II pilot killed in action near Sicily. Area 1,656 acres (ANG 55 acres). Altitude 1,068 ft. AFRES: active duty 33, technicians 158, civilians 698, Reservists 1,744. Payroll $29.5 million. ANG: military 1,167, technicians 217. Payroll $25.2 million. USAR: active duty 3; reservists 69. Housing: 5 NCO; VOQ, VAQ. Dispensary. NAS Atlanta, Lockheed Aeronautical Systems Company-Ga./Air Force Plant 6 adjoin Dobbins AFB and use airfield facilities.

Duluth International Airport, Minn. 55811-5000; 5 mi. NW of Duluth. Phone (218) 727-6886; AUTOVON 825-7210. 148th Fighter Interceptor Gp. (ANG). Area 409 acres. Altitude 1,429 ft. Military 1,026, technicians 250 (+ 25 civilians). Payroll $17.6 million.

Ellington ANG Base, Tex. 77034-5586; adjacent to Ellington Field, a City of Houston Airport 17 mi. SE of downtown Houston. Phone (713) 929-2221; AUTOVON 954-2110. 147th Fighter Interceptor Gp. (ANG). Other tenants include NASA Flight Operations, US Coast Guard, Army National Guard, FAA. Base named for Lt. Eric L. Ellington, a pilot killed Nov. 1913. Area 213 acres. Altitude 40 ft. Military 1,071, technicians 285. Payroll $18.6 million.

Fargo, N. D. (Hector Field) 58105-5536. Phone (701) 237-6030; AUTOVON 362-8110. 119th Fighter Interceptor Gp. (ANG). Area 133 acres. Altitude 900 ft. Military 1,104, technicians 282. Payroll $17.4 million.

Forbes Field, Kan. 66619-5000; 2 mi. S of Topeka. Phone (913) 862-1234; AUTOVON 720-1234. 190th Air Refueling Gp. (ANG). Area 200 acres. Altitude 1,079 ft. Military 930, technicians 215 (+ 43 civilians). Payroll $15.3 million.

Fort Smith Municipal Airport, Ark. 72906. Phone (501) 646-1601; AUTOVON 962-8210. 188th Tactical Fighter Gp. (ANG). Area 98 acres. Altitude 468 ft. Military 961, technicians 204. Payroll $13 million.

Fort Wayne, Ind. (Fort Wayne Municipal Airport) 46809-5000; 5 mi. SSW of Fort Wayne. Phone (219) 478-3210; AUTOVON 786-1210. 122d Tactical Fighter Wg. (ANG). Area 87 acres. Altitude 800 ft. Military 1,257, technicians 268. Payroll $18.1 million.

Fresno Air Terminal, Calif. 93727-2199; 5 mi. NE of Fresno. Phone (209) 454-5155; AUTOVON 949-9210. 144th Fighter Interceptor Wg. (ANG); 194th Fighter Interceptor Sqdn. (ANG). Area 127 acres. Altitude 332 ft. Military 990, technicians 274. Payroll $16.7 million.

General Mitchell International Airport, Wis. 53207; downtown Milwaukee. AFRES base. Altitude 722 ft. ANG and AFRES have separate phones and facilities. ANG phone (414) 747-4410; AUTOVON 580-8410. 128th Air Refueling Gp. (ANG). ANG area 110 acres. Military 1,024, technicians 226. Payroll $15 million. AFRES phone (414) 481-6400; AUTOVON 786-9110. 440th Tactical Airlift Wg. (AFRES). AFRES area 100 acres. Military 6, technicians 154, Reservists 985, civilians 219. Payroll $15 million.

Greater Peoria Airport, Ill. 61607-1498; 7 mi. SW of Peoria. Phone (309) 633-3000; AUTOVON 724-9210. 182d Tactical Air Support Gp. (ANG). Area 385 acres. Altitude 624 ft. Military 1,005, technicians 174. Payroll $12.8 million. Dispensary.

Greater Pittsburgh International Airport, Pa. 15231-0459; 15 mi. NW of Pittsburgh. Altitude 1,203 ft. AFRES base. ANG and AFRES have separate phones and facilities. 171st Air Refueling Wg. (ANG); phone (412) 269-8402, AUTOVON 277-8402. 112th Tactical Fighter Gp. (ANG); phone (412) 269-8441, AUTOVON 277-8441. ANG area 94 acres. Military 1,718, technicians 354. Payroll $25.2 million. AFRES phone (412) 269-8000; AUTOVON 277-8000. 911th Tactical Airlift Gp. (host unit). AFRES area 165 acres. Military 15, technicians 135, civilians 200, Reservists 1,059. Payroll $12.5 million. Other units include 2185th Communications Installation Gp. (AFCC). Base activated 1943. Housing: 50 VOQ, 230 enlisted qtrs.

Great Falls International Airport, Mont. 59401-5000; 5 mi. SW of Great Falls. Phone (406) 727-4650; AUTOVON 279-2301. 25th NORAD Region and 25th Air Div. (TAC); 120th Fighter Interceptor Gp. (ANG). Area 139 acres. Altitude 3,674 ft. Military 1,040, technicians 279. Payroll $18.3 million. Dispensary.

Gulfport-Biloxi Regional Airport, Miss. 39501; within city limits of Gulfport. Phone (601) 868-6200; AUTOVON 363-8200. Training site; also host to 255th Combat Communications Sqdn., the Army National Guard Transportation Repair Shop, and 173d Civil Engineering Flt. An air-to-ground gunnery range is located 70 mi. due N of site. Area 252 acres. Altitude 28 ft. ANG military 439, technicians 36. Payroll $4.4 million. 2-bed dispensary.

Harrisburg International Airport, Middletown, Pa. 17057; 10 mi. E of Harrisburg. Phone (717) 948-2201; AUTOVON 454-9201. 193d Special Operations Gp. (ANG). ANG area 72 acres. Altitude 310 ft. Military 1,106, technicians 225. Payroll $18 million.

Jackson, Miss. (Allen C. Thompson Field) 39208-0810; 7 mi. E of Jackson. Phone (601) 939-3633; AUTOVON 731-9310. 172d Military Airlift Gp. (ANG). ANG area 84 acres. Altitude 346 ft. Military 1,156, technicians 215. Payroll $15.8 million. 6-bed dispensary.

Jacksonville International Airport, Fla. 32229; 15 mi. NW of Jacksonville. Phone (904) 757-1360; AUTOVON 460-7210. 125th Fighter Interceptor Gp. (ANG). Area 332 acres. Altitude 26 ft. Military 970, technicians 259. Payroll $21.4 million. 5-bed dispensary.

Kingsley Field, Ore. 97603-0400; 5 mi. SE of Klamath Falls. Phone (503) 883-6350; AUTOVON 830-6350. 114th Tactical Fighter Training Sqdn. (ANG); 142d OLAD (ANG). Field named for Lt. David R. Kingsley of Oregon, WW II Medal of Honor winner, killed June 23, 1944, over Ploesti, Romania. Area 375 acres. Altitude 4,000 ft. Military 340, technicians 74, Title 5 civilians 20. Payroll $38.2 million. Clinic.

Knoxville, Tenn. (McGhee Tyson Airport) 37901; 10 mi. SW of Knoxville. Phone (615) 970-3077; AUTOVON 588-8210. Host unit is 134th Air Refueling Gp. (ANG). Tenants include 228th Combat Communications Sqdn. and ANG's I. G. Brown Professional Military Education Center. Area 271 acres. Altitude 980 ft. Military 1,177, technicians 258 (+ 5 civilians). Payroll $18.2 million. Dispensary.

Lincoln Municipal Airport, Neb. 68524-1897; 1 mi. NW of Lincoln. Phone (402) 473-1326; AUTOVON 720-1210. 155th Tactical Recon Gp. (ANG). Also hosts Army National Guard unit. Area 175 acres. Altitude 1,207 ft. Military 1,137, technicians 237. Payroll $15.6 million. Tactical clinic.

Louisville, Ky. (Standiford Field) 40213. Phone (502) 566-9400; AUTOVON 989-4400. 123d Tactical Recon Wg. (ANG). Area 66 acres. Altitude 497 ft. Military 1,155, technicians 231. Payroll $16.8 million.

Mansfield Lahm Airport, Ohio 44901-5000; 3 mi. N of Mansfield. Phone (419) 522-9355; AUTOVON 696-6210. 179th Tactical Airlift Gp. (ANG). Airport named for nearby city and aviation pioneer Brig. Gen. Frank P. Lahm. Area 210 acres. Altitude 1,296 ft. Military 957, technicians 171. Payroll $12.4 million. Clinic. Limited dependent ID card service. Coast Guard exchange.

Martinsburg, W. Va. (Shepherd Field) 25401; 4 mi. S of Martinsburg. Phone (304) 267-5100; AUTOVON 242-9210. 167th Tactical Airlift Gp. (ANG). Area 349 acres. Altitude 556 ft. Military 1,188, technicians 218. Payroll $15.5 million. Dispensary.

McEntire ANG Base, S. C. 29044; 12 mi. E of Columbia. Phone (803) 776-5121; AUTOVON 583-8201. 169th Tactical Fighter Gp. (ANG). Also host to 240th Combat Communications Sqdn. (ANG) and Army Guard aviation unit. Base named for ANG Brig. Gen. B. B. McEntire, Jr., killed in an F-104 accident in 1961. Area 2,473 acres. Altitude 250 ft. Military 1,387, technicians 250. Payroll $18 million. Dispensary.

Memphis International Airport, Tenn. 38181-0026; within Memphis city limits. Phone (901) 369-4111; AUTOVON 966-8210. 164th Tactical Airlift Gp. (ANG). ANG occupies 85 acres. Altitude 332 ft. Military 924, technicians 178. Payroll $12.7 million. Clinic.

Meridian, Miss. (Key Field) 39302-1825; located at municipal airport near Highways 20 and 59. Phone (601) 693-5031; AUTOVON 694-9210. 186th Tactical Recon Gp. (ANG); host to 238th Combat Communications Sqdn. (ANG). Area 64 acres. Altitude 297 ft. Military 1,278, technicians 256. Payroll $17.5 million. 2-bed dispensary.

Minneapolis-St. Paul International Airport, Minn. 55450; in Minneapolis, near confluence of the Mississippi and Minnesota Rivers. AFRES base. Altitude 840 ft. ANG and AFRES have separate phones and facilities. ANG phone (612) 725-5011; AUTOVON 825-5681. 133d Tactical Airlift Wg. (ANG). ANG area 128 acres. Military 1,392, technicians 238. Payroll $17.5 million. AFRES phone (612) 725-5011; AUTOVON 825-5100. 934th Tactical Airlift Gp. (AFRES). AFRES area 300 acres. Reservists 1,067, technicians 126, civilians 226. Payroll $15 million. Other units include 210th Engineering and Installation Sqdn. (ANG); 237th Air Traffic Control Flt. (ANG); 133d Field Training Flt. (ANG); Navy Readiness Comd., Region 16; Naval Air Reserve Center; Marine Wg. Support Gp., Det. 47; Defense Investigative Service; USAF-CAP/NCLR and CAP MNLO; Det. 3, 1974th Teleprocessing Gp. (USAF).

Moffett Naval Air Station, Calif. 94035; 2 mi. N of Mountain View. ANG phone (415) 966-4700; AUTOVON 462-4700. 129th Aerospace Rescue and Recovery Gp. (ANG). Area 12 acres. Altitude 34 ft. Military 751, technicians 170. Payroll $14.7 million.

Montgomery, Ala. (Dannelly Field) 36196; 7 mi. SW of Montgomery. Phone (205) 284-7210; AUTOVON 742-9210. 187th Tactical Fighter Gp. (ANG). Hosts 232d Combat Communications Sqdn. Field named for Ens. Clarence Dannelly, Navy pilot killed at Pensacola, Fla., during WW II. Area 51 acres. Altitude 221 ft. Military 1,022, technicians 274. Payroll $16.4 million. Dispensary.

Nashville Metropolitan Airport, Tenn. 37217-0267; 6 mi. SE of Nashville. Phone (615) 361-4600; AUTOVON 446-6210. 118th Tactical Airlift Wg. (ANG). Area 84 acres. Altitude 597 ft. Military 1,321, technicians 287. Payroll $19.2 million.

New Orleans Naval Air Station, La. (Alvin Callender Field) 70143-5000; 15 mi. S of New Orleans. Altitude 3 ft. ANG and AFRES have separate phones and facilities. ANG phone (504) 393-3392; AUTOVON 363-3399. 159th Tactical Fighter Gp. (ANG). ANG military 1,196, technicians 286. Payroll $21.1 million. AFRES phone (504) 393-3293; AUTOVON 363-3293. 926th Tactical Fighter Gp. (AFRES). Military 820, technicians 177. Payroll $10 million. NAS New Orleans was the first joint Air Reserve Training Facility. Field named for Alvin A. Callender, who served with the British Royal Flying Corps during WW I and who was shot down over France in 1918. Area 3,245 acres (ANG 19 acres). Dispensary.

Niagara Falls International Airport, N. Y. 14304-5000; 6 mi. E of Niagara Falls. Phone (716) 236-2000; AUTOVON 489-3011. AFRES base. 914th Tactical Airlift Gp. (AFRES); 107th Fighter Interceptor Gp. (ANG). Base activated Jan. 1952. Area 979 acres (ANG 104 acres). Altitude 590 ft. AFRES: technicians 134, civilians 250, Reservists 1,176. Payroll $16 million. ANG: military 1,006, technicians 271. Payroll $16.5 million.

O'Hare Air Reserve Forces Facility, Ill. 60666; 22 mi. NW of Chicago's Loop. Phone (312) 694-6000; AUTOVON 930-1110. AFRES base. 928th Tactical Airlift Gp. (AFRES); 126th Air Refueling Wg. (ANG); Defense Contract Administration Services Region. Base activated Apr. 1946; named for Lt. Cmdr. Edward H. "Butch" O'Hare, USN Medal of Honor recipient, killed Nov. 26, 1943, during battle for Gilbert Islands. Area 391 acres (ANG 36 acres). Altitude 643 ft. Reservists 1,500, technicians and civilians (all units) 1,440, Illinois ANG 1,421, technicians 256. Payroll for total facility $43.3 million ($16.5 million for ANG).

Ontario International Airport, Ontario, Calif. 91761. Phone (714) 984-2705; AUTOVON 898-1895. 148th Combat Communications Sqdn. (ANG). Area 39 acres. Altitude 900 ft. Military 178, technicians 17. Payroll $0.8 million.

Otis ANG Base, Mass. 02542-5001; 7 mi. NNE of Falmouth. Phone (617) 968-4003; AUTOVON 557-4003. 102d Fighter Interceptor Wg. (ANG); 567th USAF Band (ANG); 101st and 202d Weather Flts. (ANG). Adjacent installations and organizations include Cape Cod AFS (6th Missile Warning Sqdn., 2165th Communications Sqdn.); US Coast Guard Air Station Cape Cod; Camp Edwards Army National Guard Training Site; 26th Aviation Brigade (ARNG); 1st Battalion, 25th Marines (Re-

serve); Massachusetts National Cemetery (VA). Base named for 1st Lt. Frank J. Otis, ANG flight surgeon and pilot killed in 1937 crash. Area 3,858 acres. Altitude 132 ft. ANG military 1,131, ANG technicians 309 (+ 278 Title 5 Civil Service). Payroll $26.9 million.

Phelps Collins ANG Base, Alpena, Mich. 49707; 7 mi. W of Alpena. Phone (517) 354-6291; AUTOVON 741-3500. Training site detachment. Facilities used by ANG and AFRES units for annual field training and by ARNG and Marine Reserve for special training. Base named for Capt. W. H. Phelps Collins, American Flying Corps, killed in France Mar. 1918. Area 2,708 acres. Altitude 689 ft. Military 56, civilian full-time support 31. Payroll $2 million. Housing: 1,500 personnel. 14-bed hospital. Dispensary.

Phoenix, Ariz. (Sky Harbor International Airport) 85034. Phone (602) 244-9841; AUTOVON 853-9211. 161st Air Refueling Gp. (ANG). Area 51 acres. Altitude 1,230 ft. Military 963, technicians 205. Payroll $15.7 million.

Portland International Airport, Portland, Ore. 97218-2797. Phone (503) 288-5611; AUTOVON 891-1701. 142d Fighter Interceptor Gp. (ANG); 244th Combat Communications Sqdn. (ANG); 244th Combat Communications Flt. (ANG); 116th Tactical Control Sqdn. (ANG); Det. 5, 2036th Communications Sqdn. (AFCC); 12th Special Forces Gp. (USAR); Oregon Wg., CAP. Also host to 939th Aerospace Rescue and Recovery Gp. (AFRES) and 83d Aerial Port Sqdn. (AFRES). Area 232 acres. Altitude 26 ft. Military 1,413, technicians 338 (+ 58 civilians). Payroll $23.6 million.

Providence, R. I. (Quonset Point State Airport) 02852; 20 mi. S of Providence. Phone (401) 885-3960; AUTOVON 476-3210. 143d Tactical Airlift Gp. (ANG). Area 17 acres. Altitude 9 ft. Military 954, technicians 182. Payroll $17.5 million.

Puerto Rico International Airport, Puerto Rico (Muniz ANG Base) 00914; E of San Juan. Phone (809) 728-5450; AUTOVON 860-9210. 156th Tactical Fighter Gp. (ANG). Base named for Lt. Col. José A. Muniz, killed in an aircraft accident July 4, 1960. Area 86 acres. Military 932, technicians 206. Payroll $17.4 million.

Reno-Cannon International Airport, Nev. (May ANG Base) 89502; 5 mi. SE of Reno at 1776 ANG Way. Phone (702) 788-4500; AUTOVON 830-4500. 152d Tactical Recon Gp. (ANG). Base named for Maj. Gen. James A. May, state Adjutant General. Area 64 acres. Altitude 4,411 ft. Military 1,071, technicians 222. Payroll $15.8 million. Dispensary.

Richards-Gebaur AFB, Mo. 64030-5000; 17 mi. S of Kansas City. Phone (816) 348-2000; AUTOVON 463-1110. 442d Tactical Fighter Wg. (AFRES); Navy and Army Reserve units. Base activated Mar. 1944; named for 1st Lt. John F. Richards and Lt. Col. Arthur W. Gebaur, Jr. Richards was killed Sept. 26, 1918, in France, while on an artillery spotting mission; Gebaur, an F-84 pilot, was killed Aug. 29, 1952, over North Korea during his 99th mission. Area 620 acres; another 120 acres occupied by non-Air Force military units and federal agencies. Joint-use airport facility with Kansas City, Mo. Altitude 1,090 ft. AFRES and active-duty USAF military 1,471, technicians/civilians 398. Payroll $13 million. On-base, Marine Corps-operated, all-service housing: 27 officer, 214 enlisted. Consolidated open mess and 300 transient quarters available.

Richmond, Va. (Byrd International Airport) 23150; 4 mi. SE of downtown Richmond. Phone (804) 222-8884; AUTOVON 274-8210. 192d Tactical Fighter Gp. (ANG). Airport named for Adm. Richard E. Byrd, famous Arctic and Antarctic explorer. Area 137 acres. Altitude 167 ft. Military 1,024, technicians 227. Payroll $16.9 million.

Rickenbacker ANG Base, Ohio 43217; 13 mi. SSW of Columbus. Phone (614) 492-8211; AUTOVON 950-1110. Base transferred from SAC to ANG Apr. 1, 1980. 121st Tactical Fighter Wg. (ANG); 907th Tactical Airlift Gp. (AFRES); 160th Air Refueling Gp. (ANG); 2032d Communications Sqdn. (AFCC); Naval Air Reserve and Naval Construction (USNR). Base activated 1942. Formerly Lockbourne AFB; renamed May 7, 1974, in honor of Capt. Edward V. Rickenbacker, top US WW I ace and Medal of Honor recipient who died July 23, 1973. Area 2,017 acres. Altitude 744 ft. ANG military 1,825, technicians 374, Title 5 civilians 299. Payroll $35.9 million.

Roslyn ANG Station, Roslyn, N. Y. 11576-2399; 27 mi. E of New York City. Phone (516) 299-5201; AUTOVON 456-5201. 274th Combat Communications Sqdn.; 213th Engineering Installation Sqdn. Also hosts two Army National Guard units. Area 50 acres. Altitude 320 ft. Military 406. Payroll through Stewart IAP, N. Y.

Salt Lake City International Airport, Utah 84116; 3 mi. W of Salt Lake City. Phone (801) 521-7070; AUTOVON 790-9210. 151st Air Refueling Gp. (ANG). Also hosts ANG's 130th Engineering Installation Sqdn. and 106th and 109th Tactical Control Flts. Area 82 acres. Altitude 4,220 ft. Military 1,420, technicians 262 (+ 41 civilians). Payroll $19.9 million. Dispensary.

Savannah International Airport, Ga. 31402; 4 mi. NW of Savannah. Phone (912) 964-1941; AUTOVON 860-8210. 165th Tactical Airlift Gp. (ANG). Also field training site. Area 232 acres. Altitude 50 ft. Military 1,037, technicians 239. Payroll $17.2 million. Housing: 156 officer, 736 enlisted. 3-bed dispensary.

Schenectady County Airport, Scotia, N. Y. 12302-9752; 2 mi. N of Schenectady. Phone (518) 381-7300; AUTOVON 974-9221. 109th Tactical Airlift Gp. (ANG). Area 106 acres. Altitude 378 ft. Military 962, technicians 176. Payroll $13 million. Dispensary.

Selfridge ANG Base, Mich. 48045; 3 mi. NE of Mount Clemens. Phone (313) 466-4011; AUTOVON 273-0111. 127th Tactical Fighter Wg. (ANG); 191st Fighter Interceptor Gp. (ANG); 927th Tactical Airlift Gp. (AFRES). Also hosts Air Force, Navy Reserve, Marine Air Reserve, Army Reserve, Army units, and US Coast Guard Air Station for Detroit. Base activated July 1917; transferred to Michigan ANG July 1971. Named for 1st Lt. Thomas E. Selfridge, first Army officer to fly an airplane and first fatality of powered flight, killed Sept. 17, 1908, at Fort Myer, Va., when plane piloted by Orville Wright crashed. Area 3,666 acres. Altitude 583 ft. ANG military 2,026, ANG technicians 473 (+ 482 civilians). Payroll $45.7 million. Dispensary.

Sioux City Municipal Airport, Iowa 51110; 7 mi. S of Sioux City. Phone (712) 255-3511; AUTOVON 939-6210. 185th Tactical Fighter Gp. (ANG). Area 92 acres. Altitude 1,098 ft. Military 932, technicians 218. Payroll $13.4 million. Dispensary.

Sioux Falls, S. D. (Joe Foss Field) 57104; N side of Sioux Falls. Phone (605) 336-0670; AUTOVON 939-7210. 114th Tactical Fighter Gp. (ANG). Field named for Brig. Gen. Joseph J. Foss, WW II ace, former governor of South Dakota, former National President of AFA, and founder of the South Dakota ANG. Area 163 acres. Altitude 1,428 ft. Military 937, technicians 211. Payroll $13.4 million.

Springfield, Ill. (Capital Airport) 63707-5000; 2 mi. NW of Springfield. Phone (217) 753-8850; AUTOVON 892-8210. 183d Tactical Fighter Gp. (ANG). Area 91 acres. Altitude 592 ft. Military 1,137, technicians 257. Payroll $17.1 million. Dispensary.

Springfield-Beckley Municipal Airport, Ohio 45501-1780; 5 mi. S of Springfield. Phone (513) 323-8653; AUTOVON 346-2311. 178th Tactical Fighter Gp. (ANG); 251st Combat Information Systems Gp. (ANG). Area 90 acres. Altitude 1,052 ft. Military 1,240, technicians 244. Payroll $16.9 million. 6-bed dispensary.

Stewart ANG Base, N. Y. (Stewart International Airport) 12550-0031; 4 mi. W of Newburgh, 15 mi. N of USMA (West Point). Phone (914) 563-2000; AUTOVON 247-2000. Hq. New York ANG; 105th Military Airlift Gp. (ANG); USMA subpost airport. Stewart AFB until 1969; acquired by state of New York in 1970. ANG area 264 acres. Altitude 491 ft. ANG military 1,400, technicians 305. Payroll $21.8 million. Dispensary. Most military services available through West Point or subpost.

St. Joseph, Mo. (Rosecrans Memorial Airport) 64503; 4 mi. W of St. Joseph. Phone (816) 271-1300; AUTOVON 720-9210. 139th Tactical Airlift Gp. (ANG). Area 302 acres. Altitude 724 ft. Military 891, technicians 180. Payroll $14.2 million.

St. Louis International Airport, Mo. (Lambert Field) 63145. Phone (314) 263-6356; AUTOVON 693-6356. 131st Tactical Fighter Wg. (ANG). Area 49 acres. Altitude 589 ft. Military 1,471, technicians 290. Payroll $22.6 million.

Suffolk County Airport, Westhampton Beach, N. Y. 11978-1294; within corporate limits of Westhampton Beach. Phone (516) 288-4200; AUTOVON 456-7210. 106th Aerospace Rescue and Recovery Gp. (ANG). Area 70 acres. Altitude 67 ft. Military 784, technicians 210. Payroll $12.9 million.

Syracuse, N. Y. (Hancock Field) 13211-7099; 5 mi. NE of Syracuse. Phone (315) 470-6100; AUTOVON 587-9100. 174th Tactical Fighter Wg. (ANG). Base operations for Hancock ANG Base. 152d Tactical Control Gp.; 108th and 113th Tactical Control Flts. Area 376 acres. Altitude 421 ft. Military 1,299, technicians 272. Payroll $19.1 million. Dispensary.

Terre Haute, Ind. (Hulman Regional Airport) 47803-5000; 5 mi. E of Terre Haute. Phone (812) 877-5210; AUTOVON 724-1210. 181st Tactical Fighter Gp. (ANG). Area 279 acres. Altitude 585 ft. Military 1,201, technicians 222. Payroll $16.2 million. 5-bed dispensary.

Toledo Express Airport, Swanton, Ohio 43558; 14 mi. W of Toledo. Phone (419) 866-2078; AUTOVON 580-2078. 180th Tactical Fighter Gp. (ANG). Area 79 acres. Altitude 684 ft. Military 986, technicians 224. Payroll $15.2 million. 4-bed clinic.

Truax Field, Madison, Wis. (Dane County Regional Airport) 53704-2591; 2 mi. N of Madison. Phone (608) 241-6200; AUTOVON 273-8210. 128th Tactical Fighter Wg. (ANG). Activated June 1942 as AAF base; taken over by Wisconsin ANG in Apr. 1968. Field named for Lt. T. L. Truax, killed in a P-40 training accident in 1941. Area 153 acres. Altitude 862 ft. Military 949, technicians 220. Payroll $13.9 million. Housing: 7 transient. Dispensary.

Tucson International Airport, Ariz. 85734; within Tucson city limits. Phone (602) 573-2210; AUTOVON 853-4210. 162d Tactical Fighter Gp. (ANG). Area 86 acres. Altitude 2,650 ft. Military 1,488, technicians 544. Payroll $32.5 million.

Tulsa International Airport, Okla. 74115. Phone (918) 832-5208; AUTOVON 956-5297. 138th Tactical Fighter Gp. (ANG); 219th Electronic Installation Sqdn. Area 80 acres. Altitude 676 ft. Military 1,096, technicians 233. Payroll $14.3 million.

Van Nuys, Calif. (Van Nuys Airport) 91409. Phone (213) 781-5980; AUTOVON 873-6310. 146th Tactical Airlift Wg. (ANG); 147th Combat Communications Sqdn. (Contingency). Area 60 acres. Altitude 799 ft. Military 1,424, technicians 298. Payroll $21.7 million.

Volk Field ANG Base, Wis. 54618-5001; 90 mi. NW of Madison. Phone (608) 427-1210; AUTOVON 798-3210. ANG field training site featuring air-to-air and air-to-ground gunnery ranges and providing training for ANG flying units. Base and field named for Lt. Jerome A. Volk, first Wisconsin ANG pilot killed in the Korean War. Area 2,259 acres. Altitude 910 ft. Military 59. Payroll $2.2 million. 6-bed dispensary.

Westfield, Mass. (Barnes Municipal Airport) 01085; 3 mi. N of Westfield. Phone (413) 568-9151; AUTOVON 636-1210/11. 104th Tactical Fighter Gp. (ANG). Area 133 acres. Altitude 270 ft. Military 948, technicians 197. Payroll $14.5 million.

Westover AFB, Mass. 01022-5000; 5 mi. NE of Chicopee. Phone (413) 557-1110; AUTOVON 589-1110. AFRES base. 439th Military Airlift Wg. (AFRES). Also home of Army, Navy, and Marine Corps Reserve and Massachusetts Army National Guard. Base dedicated Apr. 6, 1940; named for Maj. Gen. Oscar Westover, Chief of the Air Corps, killed Sept. 21, 1938, in crash near Burbank, Calif. Area 2,386 acres. Altitude 244 ft. Reservists 2,632, technicians (AFRES and tenant units) 211, civilians 744. Payroll $35.9 million. Housing: 300 family quarters, 360 VAQ rooms (656 beds), 44 VOQ (168 beds).

Willow Grove Air Reserve Forces Facility, Pa. 19090; 14 mi. N of Philadelphia. Altitude 356 feet. ANG and AFRES have separate phones and facilities. ANG phone (215) 443-1500; AUTOVON 991-1500. 111th Tactical Air Support Gp. (ANG). ANG area 39 acres. Military 1,037, technicians 191. Payroll $12.8 million. AFRES phone (215) 443-1062; AUTOVON 991-1062. 913th Tactical Airlift Gp. (AFRES). AFRES area 162 acres. Reservists 856, technicians 147, civilians 122. Payroll $9.3 million. Other units include Army, Navy, and Marine Corps Reserve. Defense Contract Administration Services Region, Philadelphia; 92d Aerial Port Sqdn. (MAC) off-base tenant. Base activated Aug. 1958. Navy transient quarters available, but limited.

Will Rogers World Airport, 5624 Air Guard Dr., Oklahoma City, Okla. 73169-5000; 7 mi. SW of Oklahoma City. Phone (405) 686-5210; AUTOVON 956-8210. 137th Tactical Airlift Wg. (ANG). Area 71 acres. Altitude 1,290 ft. Military 1,233, technicians 198. Payroll $14.7 million.

Wilmington, Del. (Greater Wilmington Airport) 19720; 5 mi. S of Wilmington. Phone (302) 322-3361; AUTOVON 455-3000. 166th Tactical Airlift Gp. (ANG); Army National Guard aviation company. Area 57 acres. Altitude 80 ft. Military 956, technicians 161. Payroll $13.3 million. 2-bed dispensary.

Youngstown Municipal Airport, Ohio 44473-5000; 16 mi. N of Youngstown. Phone (216) 392-1000; AUTOVON 346-1000. AFRES base. 910th Tactical Airlift Gp. (AFRES); 757th Tactical Airlift Sqdn. (AFRES). Other units include OLC, 2046th Communications Gp.; Defense Contract Administration Services. Base activated 1952. Area 230 acres. Altitude 1,196 ft. Reservists 809, technicians 136, civilians 368. Payroll $10.7 million. ■

The first one was nothing more than a Chinese toy. Now, it's the world's most versatile flying machine.

The Choppy Course of the Helicopter

BY BRUCE D. CALLANDER

WHEN its spy balloons failed to do the job, the Union Army cast about for new ways to scout the enemy. Someone demonstrated a small, toy flying top. Impressed, the Army ordered a full-size model. The South was at work on a similar craft when Appomattox obviated both aviation projects.

The toy top, however, continued to exert an influence. In 1878, Bishop Milton Wright came back from a trip bearing a similar gadget for his boys. Wilbur was eleven years old, Orville not yet seven. Historians date the Wright brothers' lifelong interest in flight from the moment that they gazed upon the odd little hovering device.

The flying toy—nothing more than a wooden stick fitted with a propeller on one end—is traceable to fourth-century China. In Europe, where it arrived in the fourteenth century, it was known as a "Chinese top." Westerners later combined Greek words for "spiral" and "wing" to coin its name: "helicopter."

This ancient toy, precursor of the twentieth century's most versatile flying machine, held the secret of flight. Its wooden shaft, spun between one's palms, set the propeller rotating. Then the toy would rise, hover briefly, and float to earth.

Centuries passed, however, before it was discovered that the propeller's curved surface, churning through the air, produced the mysterious force that could lift an object. More years were needed to build a lightweight, powerful engine and even more to solve the problem of flight control. Progress was spurred by the thought that the flying machine might have military uses.

Military potential might not have been in the mind of Leonardo da Vinci, the Renaissance genius, when he sketched a version of the helicopter, but he had more than a slight interest in weapons. Before turning his attention to flight, he had designed cannons, mortars, finned bombs, and a tank-like armored vehicle.

Leonardo designed a helicopter featuring a screw-like propeller driven by a clockwork mechanism. From all appearances, it may have been airworthy. But Leonardo evidently never produced a working model. Like many inventors, he became sidetracked, wasting his ener-

—Photo by Paul Kennedy

gy on complicated wing-flapping machines that had no chance of working.

Probing the Top's Secret

Others continued to probe the secret of the Chinese top. In 1784, a French naturalist named Launoy and an artisan named Bienvenu made a model containing a novel powerplant—a steel bow whose string was wrapped around the shaft.

They wound it up and released it at a meeting of the French Academy of Sciences. The scientists are said to have been amazed, but nobody seemed to know where to take the idea from there. A bow big enough to power a man-carrying vehicle clearly would be too heavy to lift itself. Anyway, other Frenchmen a year earlier had invented the hot-air balloon, a simpler means of vertical flight.

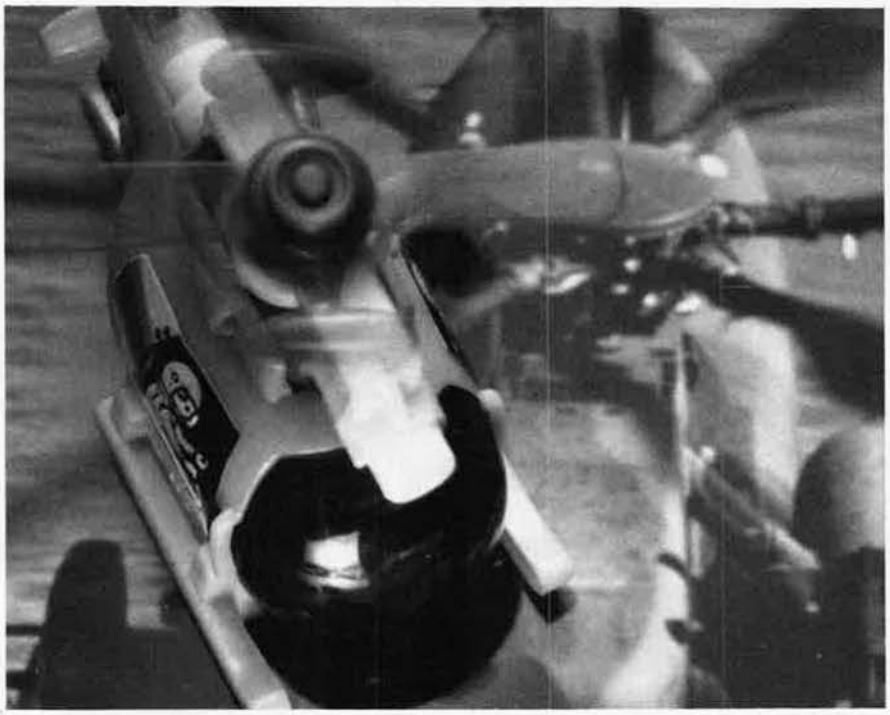
Sixty years later, an English inventor came up with a different kind of power. W. H. Phillips used a kind of slow-burning gunpowder to heat water in a tiny boiler. The steam passed through a hollow shaft and was let out through small nozzles at the tips of the rotor blades. The force set them rotating like the arms of a lawn-sprayer. Although his model weighed about forty pounds, it lifted off and flew some distance before crashing in a neighbor's field. Phillips never went beyond the model stage. In effect, however, he had invented jet propulsion.

Like earlier inventors, Phillips was so absorbed with getting his machine off the ground that he hadn't thought much about what he would do with it once it did become airborne. Britain's Sir George Cayley, however, thought about the problem of forward propulsion.

In his youth, Cayley had been fascinated by the Chinese top. He too was frustrated by the lack of a suitable engine and gave his primary attention to fixed-wing machines. In 1843, however, he built a string-powered version of the top with tin blades. He envisioned, but never built, an "aerial carriage" with contrarotating blades to make it rise, plus two pusher propellers for forward flight. He planned to use friction plates in a kind of clutch to put both sets of propellers into motion gradually as needed to convert from vertical to horizontal flight. Cayley died before making his craft a reality.

Cayley inspired Vicomte de Ponton d'Amécourte of France, who built a model similar to the aerial carriage. It also had contrarotating blades, one above the other on separate shafts, one shaft inside the other. Power came from a small aluminum engine that generated steam in a boiler. The idea caught the imagination of science-fiction writer Jules Verne, who used the idea in a novel. While the steam engine worked fine in fiction, it was too heavy to get aloft when tried in the real world.

Early inventors were up against basic physics. The top worked because it was small and light. However, the mass and weight of an object increase by a factor of four every time its volume doubles. Cayley, having done these basic calculations, concluded that helicopter flight could be achieved only after the development of a new power source—the internal combustion engine.



—Photo by Paul Kennedy

The War Between the States

Meanwhile, in the New World, the bloody American Civil War was bringing hardheaded military men face-to-face with the child's magic flying top. By 1864, a variety of problems had forced the Northern Army to disband its balloon corps. That left Maj. Gen. B. F. Butler, commander of the Union Army of the James, without air-observation support for his assault on Petersburg, Va. When the queer little hovering toy was demonstrated, Butler was intrigued. He ordered an engineer, Edward W. Serrell, to design a man-carrying version.

Serrell sketched a machine resembling Cayley's carriage, with four fans for lift and two more for propulsion and steering. It was to have wings for gliding, moving weights for balance, and a steam engine for power. Each sheet-iron airscrew weighed 500 pounds, but tests showed that it could lift more than its own weight, given enough power. A New York firm set to work on a high-pressure engine.

It's interesting to speculate that, had the Civil War lasted a few years longer, it might be remembered not only for the first clash of ironclad warships but also for the first contest of military flying machines.

In the South, the pain inflicted by the Union blockade of Confederate ports inspired William C. Powers of Alabama to propose a similar flying machine, one that could bombard US warships from the air. Powers made a model with four vaned screws that looked like long worm gears. Two were for lift and two were to drive the machine forward. Like the Union helicopter, however,

the Confederate machine was never completed.

In 1870, France's Alphonse Pénaud skirted the power question by giving his Chinese tops motors made of twisted rubber bands. He made promising models, but ultimate failure made Pénaud so despondent that the Frenchman, at age thirty, committed suicide. In 1878, Italian Enrico Forlanini again tried steam power. To eliminate the heavy firebox and boiler, he employed a metal sphere into which he forced superheated steam just before takeoff. This drove a small piston engine that kept his model helicopter in the air for thirty seconds. Although it worked, the problem of endurance was obvious.

In 1880, American inventor Thomas A. Edison decided it was time to find out exactly how much power it would take to lift a helicopter. After a series of tests, Edison came to a conclusion: No helicopter would fly until engines weighed less than four pounds per horsepower. Edison decided that the answer was an internal combustion engine and made one using guncotton as fuel. It worked a few times, then blew up, singeing the inventor's hair.

By the turn of the century, Charles Manley had built a gasoline engine that fit Edison's specifications. It weighed only 125 pounds and developed 52.4 horsepower. However, Manley was working for aviation pioneer Samuel P. Langley, whose interests focused on fixed-wing aircraft rather than on helicopters. The Wright brothers, too, built an aluminum-block engine that met requirements; it was used not on a helicopter but on the aircraft that made history's first powered flight, on December 17, 1903.

One Foot for Twenty Seconds

Emphasis shifted strongly to winged planes, but a few inventors continued to find helicopters more promising. In 1906, Frenchman Paul Cornu—like the Wrights, a bicycle-maker—built and tested a model with contrarotating blades and a two-horsepower engine. A full-scale version, sporting a twenty-four-horsepower engine, came a year later. On November 13, 1907, Cornu climbed aboard his machine, fired up the engine, and rose to a height of one foot for twenty seconds. Brief though his flight was, Cornu was aloft long enough to discern a problem that would plague designers for decades. His fragile machine was almost uncontrollable.

World War I, though it focused even greater attention on fixed-wing airplanes, helped bring the helicopter to life by stimulating development of light, powerful, inexpensive new powerplants. One rotary engine that became popular with helicopter designers was the Le Rhône, used on Nieuport trainers bought by the US Army.

George de Bothezat, a Russian émigré working for the Army, designed a new helicopter that was tested at McCook Field (now Wright-Patterson AFB) in Ohio. Its four, huge, six-blade rotors were driven by a 180-horsepower Le Rhône. Steering was provided by two other propellers. In late 1922, de Bothezat got it about six feet off the ground for more than a minute. The next year, it carried two persons. One who flew it, Col. Thurman Bane, declared the contraption the "biggest aeronautical achievement since the first flight of the Wright brothers." But the Army decided the design was too complicated and gave up on it.

The Army also had invested in the efforts of a Washington, D. C., inventor, Emile Berliner, and his son Henry, who sought to combine the best features of fixed- and rotary-wing aircraft. They mounted twin rotors atop monoplanes, biplanes, and even triplanes, adding a smaller rotor to lift the tail. While the Berliners achieved modest successes, they never licked the control problem. The Army lost interest.

Birth of the Autogyro

Another inventor piqued the Army's curiosity. Juan de la Cierva, a young Spanish aristocrat, also had been drawn to the Chinese top. He became convinced that helicopters held more promise than fixed-wing aircraft, but he sought a new solution to the control problem. He found it in the action of the Chinese top.

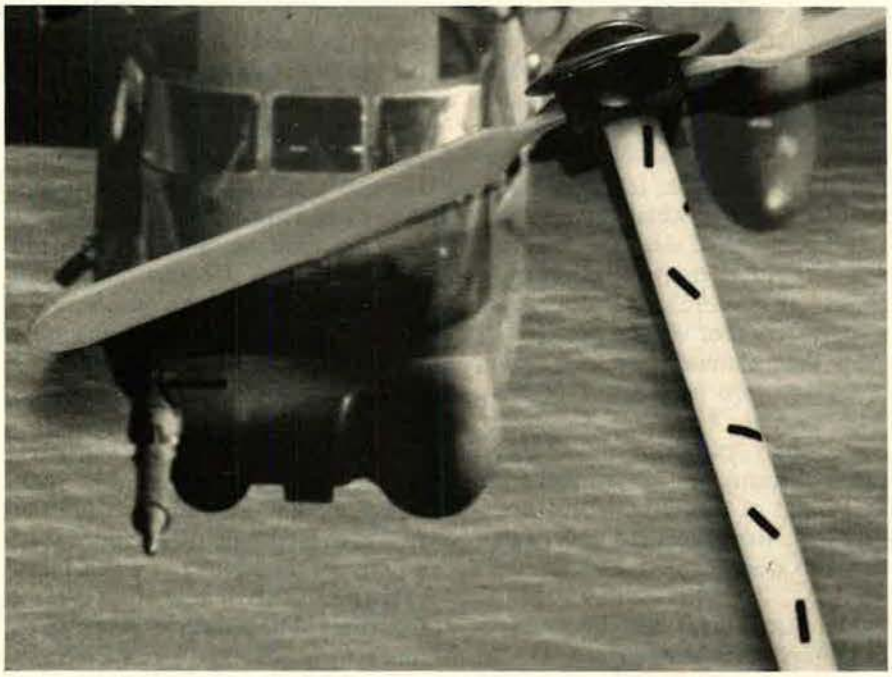
De la Cierva observed that the toy, though its propeller lost power as it reached the top of its climb, nevertheless floated to earth as the propeller continued to windmill on its own. The rotor itself did not necessarily need to be powered, he realized. So long as it was moving through the air, it could provide lift the same way as a conventional wing does.

Like the Berliners, de la Cierva fitted his rotor to a conventional fuselage with a propeller for forward motion. He removed the wings and added an unpowered rotor in their place. In its early tests, the machine left the ground but then threatened to tip over. De la Cierva added stubby wings fitted with ailerons. When his machine still tipped to one side, he was baffled. Finally, it struck him that the models he flew had flexible rattan rotors, which flattened and twisted again as they rotated and thus gained and then lost lift. On his next machine, he hinged each blade of the rotor so it could rise or fall naturally and reach its own best angle. By January 1923, his machine worked smoothly, and de la Cierva spent the next two years refining his design.

In 1925, Britain's Air Ministry said it would be interested in what de la Cierva was calling his "autogyro," provided it could do more than a conventional plane. De la Cierva recruited British test pilot Frank Courtney. The autogyro was able to meet most of the Air Ministry's tests, but came to grief on the most demanding one—an almost vertical descent from 1,500 feet. The rotors slowed the fall, but not enough. Courtney hit hard, the landing gear crumpled, and the seat gave way. Even so, Courtney walked away from the crash, and the Ministry bought the autogyro.

After resolving several other problems, de la Cierva took his autogyro into volume production. He built more than ninety himself and licensed firms in Japan, Germany, Russia, and France to do the same. He sold a franchise in the United States, where by the 1930s the radically new flying machine was causing a sensation. Newsreels were filled with images of the new wonder, and futurists predicted that, in no time, average Americans would have these flying automobiles. In 1935, the US Army bought a commercial autogyro, the KD-1, renaming it the YG-1. When the US entered World War II, its fleet numbered sixteen.

Widespread use of the autogyro was not to be, however. The cost of owning and operating the aircraft was too great for commercial users, much less for the common man. Moreover, the Army, having concluded that the autogyro had insufficient range and lifting power, was starting to put its money into another, more promising machine developed by yet another Russian émigré.



—Photo by Paul Kennedy

Igor Ivanovich Sikorsky, like so many others, found boyhood fascination in the Chinese top. One story is that he swiped whalebone stays from his sister's corsets to make bowstring engines for his own versions of the top. By 1909, he had studied engineering and built his first helicopter, which, though powered by a twenty-five-horsepower motorcycle engine, obstinately refused to rise. When his second model also failed to get off the ground, Sikorsky gave up vertical flight—temporarily—and focused his attention on fixed-wing planes. In 1913, he built the world's first four-engine airplane and, during World War I, made bombers for the Russian Army. When the revolution broke out in 1917, Sikorsky left Russia and settled in the United States.

Not until the late 1930s did Sikorsky return to his work on helicopters. This time, he designed one with a single lifting rotor and a smaller vertical rotor at the rear. The tail rotor solved the torque problem, the downfall of many other inventors. As the rotor turned in one direction, the machine tended to turn in the opposite direction. Sikorsky and others had used two contrarotating rotors in earlier machines to counter the effect, but these required a more complicated set of shafts and gears. The single rotor was simpler, and the smaller tail rotor canceled out torque and provided some steering capability as well.

On September 14, 1939, Sikorsky got his VS-300 helicopter off the ground. Two years later, the Army gave him a contract to build another experimental model, the XR-4, with a 165-horsepower engine. Later versions were fitted with more powerful engines.

Sikorsky had solved not only the problem of getting his machine to fly, but also the far more difficult one of controlling it once it was airborne. His system of flight controls remains standard in many of today's helicopters. It included a stick and rudder like that of a conventional plane and one additional lever. With his left hand, the pilot operated the "collective pitch lever." Moving it backward or forward changed the pitch of all the rotors at the same time, increasing or decreasing their lift and making the helicopter rise or descend. The top of the lever twisted like the throttle of a motorcycle to control power.

With his right hand, the pilot ran a second, "cyclic pitch lever" forward, backward, or sideways. It changed the pitch of each rotor at a specific point in its rotation to move the helicopter forward, backward, or sideways. The pilot's feet changed the pitch of the blades in the tail rotor. The system was more complex than the controls of a fixed-wing plane and required better coordination—but it worked.

Four decades after the Wrights gave the world its first heavier-than-air flying machine, Sikorsky had given it the means for practical vertical flight. In their own ways, both inventions changed the nature of human travel and of warfare.

Sikorsky produced fewer than 200 helicopters over the course of World War II. They were used mainly by the Army's Air Rescue Service and the US Coast Guard, but some went to Britain's RAF. In Korea and later in Vietnam, the helicopter became as familiar as the ubiquitous Jeep—and remains so today. Vietnam-era helicopters still could not fly as fast or as far as airplanes or lift as much weight. But they could operate from small clearings, hover over battlefields, and drop into jungles. They became flying scout cars, observation posts, ambulances, troop transports, airborne cranes, and lethal gunships.

In the civilian world, helicopters serve the police, hospitals, firefighters, newspapers, construction workers, aerial taxi services, mountain climbers, shipping firms, and movie producers, among others. The toy that delighted children and baffled scientists for at least sixteen centuries has blossomed into one of the most versatile vehicles of the modern world. ■

A World War II B-24 bombardier, Bruce D. Callander was recalled to active duty during the Korean War. Between tours of active duty, he earned a B.A. in journalism at the University of Michigan. In 1952, he joined Air Force Times, *becoming Editor in 1972. Mr. Callander is a regular contributor to* Air Force *Magazine. His most recent article was "The Knuckle-Busters" in the January '89 issue.*

Airman's Bookshelf

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

New Books in Brief

The Doolittle Raid: America's First Strike Against Japan, by C. V. Glines. The daring April 18, 1942, Doolittle raid on Japan did little actual damage, but the psychological effects of the sixteen-plane raid were far-reaching. The Japanese, now aware that their home islands weren't invulnerable, retained several fighter squadrons for home defense instead of sending them to the Solomons. For America, it was a badly needed morale boost. While much has been written about the mission, only now are full details about the planning and execution of the raid emerging. C. V. Glines, the Doolittle Raiders' historian, has based this new look at the raid on more than twenty-five years of research. Using newly available information and numerous interviews with the participants, a complete picture emerges of the raid, its implications, and what has happened to the crews since. Orion Books, New York, N. Y., 1988. 272 pages with photos, appendices, notes, and bibliography. Foreword by Gen. Curtis E. LeMay, former USAF Chief of Staff. $17.95.

Federal Aviation Regulations/Airman's Information Manual (FAR/AIM), edited by Walter P. Winner. The thirteenth annual update to the FAR manual includes a reprint of the regulations applicable to all pilots as well as all amendments through January 1989. Also included is a special section that highlights the sections of the FAR that pilots need to review before taking the FAA's written test for six different certificate categories. The twenty-fourth edition of the AIM includes basic flight information for all pilots and detailed explanations of such things as air traffic control and emergency procedures. Also included is a comprehensive pilot/controller glossary and keys to reading aeronautical charts and NOTAMs. As a bonus, an application for a free supplement to cover the January/August changes to both the FAR and AIM is included. Aviation Book Co., Glendale, Calif., 1989. 240 pages with index. $6.95 (FAR). 304 pages with index. $7.95 (AIM). Combined volume is $12.95.

Fighter Missions: Modern Air Combat—The View from the Cockpit, by Bill Gunston and Lindsay Peacock. This unique book breaks down fighter employment into seven major mission types such as interception, air superiority, antitank, and maritime scenarios. Each mission is described in its historical and evolutionary context, then is taken through its likely role in a future conflict. The "future missions" are not idealized versions of how the planes would best perform—they are realistic epi-

Airman's Bookshelf

sodes, featuring real units. The minute-by-minute accounts of the activity on each mission are recorded in great detail and supplemented with diagrams and informative photographs, depicting everything from cockpit layouts to ribbon diagrams of flight paths. Each section also includes a chart describing the comparative capabilities of adversaries in each mission area. Orion Books, New York, N. Y., 1989. 208 pages with index. $24.95.

Four Stars: The Inside Story of the Forty-Year Battle Between the Joint Chiefs of Staff and America's Civilian Leaders, by Mark Perry. More than just a military history of the Joint Chiefs of Staff, this book also is a political history of the post-World War II era as seen from the military high command's point of view. Author Perry used a wide variety of materials to build this history. He talked with numerous civilian and military officials and interviewed every living former JCS chairman. The most startling revelation in this book is that the Joint Chiefs nearly resigned en masse in August 1967 over the civilian handling of the Vietnam conflict. Although the resignations were not carried out, the Joint Chiefs made increasingly open political efforts to win a stronger voice in policymaking. The book contains a few errors, but these only slightly mar this otherwise worthwhile effort. Houghton Mifflin, Boston, Mass., 1989. 480 pages with photos, notes, bibliography, and index. $24.95.

General Patton's Principles for Life and Leadership, by Porter B. Williamson. Gen. George S. Patton, Jr., in addition to being one of the greatest field generals in the history of the Army, was also quite a philosopher. Mr. Williamson, who was on General Patton's staff, groups some bits of Patton's philosophy into areas such as command and management, success, and life and death. Once grouped, the General's individual sayings, such as, "The mission is all important! Think about standard rules later," or, "No one is thinking if everyone is thinking alike," or, "Success is how you bounce when you hit bottom," are backed up by anecdotes or other stories about General Patton or his men. The one thing missing, though, is General Patton's swearing. But, as the author states in the preface, "No one could imitate General Patton's profanity." An interesting book holding many truths for today. Management and Systems Consultants, Inc., Tucson, Ariz., 1988. 259 pages with photos.

The Jolly Rogers: The Story of Tom Blackburn and Navy Fighting Squadron VF-17, by Tom Blackburn. The World War II history of one of the Navy's legendary fighter squadrons is also the personal history of the squadron's first skipper, Lt. Cmdr. Tom Blackburn. Under Commander Blackburn's leadership, VF-17 established a record 154½ Japanese air-to-air victories in a period of seventy-six combat days in the South Pacific. Thirteen "Jolly Rogers" aviators became aces during this time. Nearly two-thirds of the book details the combat experiences of VF-17, but the author also shares some invaluable insights on the creation and training of a fighting organization. He also gives the reader an understanding of what day-to-day carrier operations were like in preparation for combat in the 1940s. Orion Books, New York, N. Y., 1989. 288 pages with glossary, photos, maps, appendix, bibliography, and index. Introduction by retired Vice Adm. James B. Stockdale, a longtime POW during the Vietnam War. $22.95.

Preventing World War III: A Realistic Grand Strategy, by David M. Abshire. The author, whose experiences range from a front-line company commander in Korea to US Ambassador to NATO, argues that it is time for the US to adopt a new, comprehensive grand strategy—one that covers the globe and takes into account military and economic security, technology, history, moral legitimacy, and leadership—to ensure stability and prosperity. In two major sections, the book first analyzes the chief threats to world peace, including the conventional vs. nuclear debate, the fragmentation of power in Washington, and the unpredictability of Soviet behavior, especially in light of *glasnost* and *perestroika.* The author draws on the lessons of history as well as his personal experience in international relations to outline his plan for a coherent strategy and what we must do to make it work. Bessie/Harper & Row, New York, N. Y., 1989. 332 pages with notes and index. $19.95. ■

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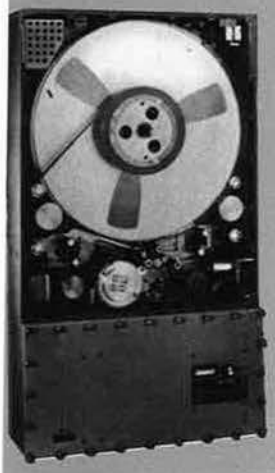

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Four-Star Ace

There's an old saying among fighter pilots, "I'd rather be an ace than a general." John Meyer was both.

BY JOHN L. FRISBEE

SEVERAL World War II fighter aces who remained on active duty became general officers, but only a few reached four-star rank. One of them was John C. Meyer, fourth-ranking US ace in Europe, with twenty-four confirmed air-to-air victories, including one German jet. Of the top fifteen Eighth Air Force aces, Meyer also was the leader in aircraft destroyed on the ground, the most hazardous of fighter operations.

During the Korean War, General Meyer, then a colonel with the 4th Fighter Wing, added two jet victories to become the seventh-ranked all-time Air Force ace. He was the only Air Force officer to be three times awarded the Distinguished Service Cross, predecessor to the Air Force Cross and second only to the Medal of Honor.

Like all successful fighter pilots, John Meyer was an aggressive hunter with complete confidence in his own ability. He was also a smart pilot and an imaginative combat leader. One of his college professors said Johnny Meyer had the best mind of any student he ever taught at Dartmouth.

General Meyer's career as a fighter pilot began in July 1940 when he graduated from flying school. Three years later, when the 352d Fighter Group arrived in England during the summer of 1943, Meyer was in command of its 487th Squadron. He had earned a reputation as a no-nonsense commander, but he demanded no more of his men than he did of himself. That approach was to pay off in the highly disciplined arena of air combat. On November 26, 1943, Major Meyer won his first victory, flying a P-47.

For a mission on May 8, 1944, Meyer was awarded the first of his three DSCs. Leading a flight of eight P-51s, to which the group had converted the previous month, he attacked a large formation of enemy fighters that was about to intercept a stream of Air Force heavy bombers. During the engagement, which dispersed the enemy fighters, Meyer and his wingman became separated from the rest of the flight. While climbing back to altitude, he sighted fifteen enemy fighters closing on the bombers. Meyer attacked immediately, shooting down two Luftwaffe fighters and breaking up their attack. He then destroyed another fighter before heading for Bodney, the group's base in England, low on fuel and ammunition.

Meyer, now a lieutenant colonel, was awarded an oak leaf cluster to the Silver Star for downing three Me-109s and one FW-190 on November 11, 1944. Ten days later, he earned his second DSC for leading eleven P-51s in an air battle east of Leipzig, Germany, against more than forty enemy fighters. Meyer maneuvered his formation into position for a surprise attack, himself shooting down three FW-190s. In one case, he used the contrail of an FW-190 for cover, firing at the unseen enemy until he could see strike flashes through the contrail, then breaking off just before ramming the burning enemy plane.

England, January 1945: Lt. Col. John C. Meyer sits in the cockpit of his P-51D, a few days after the mission that earned him his third DSC.

John Meyer was awarded his third DSC for a mission on January 1, 1945, during the Luftwaffe's desperate mass strike on airfields in Belgium and Northern France. The 352d Group, of which Meyer was then deputy commander, was operating temporarily from a field in Belgium under IX Tactical Air Command. As Meyer was about to lead twelve P-51s off the runway, the field was attacked by an estimated fifty enemy fighters. Taking off with full wing tanks, Meyer shot down one FW-190 just after he had raised his landing gear. Then, in a forty-five-minute running battle, he downed another -190. The 352d was credited with destroying twenty-three enemy fighters that day.

On January 9, 1945, after completing 200 combat missions, John Meyer was en route to Paris to make a radio broadcast when he was seriously injured in an automobile accident that ended his World War II career. He would not see combat again until 1951 in Korea.

After Korea, General Meyer served in Air Defense Command, led SAC divisions, and commanded Twelfth Air Force. Later he was appointed Director of Operations on the Joint Staff, then was Vice Chief of Staff of the Air Force before his final assignment as Commander in Chief, Strategic Air Command. He was the second fighter ace to command SAC, following Gen. Bruce Holloway who had been the leading ace in China during the early days of World War II.

General Meyer retired in July 1974 and in December of the following year suffered a fatal heart attack. ■

Intercom

By J. R. "Doc" McCauslin, CHIEF, FIELD ORGANIZATION DIVISION

AFA Around the World

AFAers in the Pacific now have a Vice President to be their connection with the Commander in Chief of PACAF, his staff and commanders, and National AFA Headquarters. President Jack C. Price recently named Col. Charles A. Tucker (Fifth Air Force, Yokota AB, Japan) the **first AFA Vice President/Pacific.** Colonel Tucker will be the liaison for chapters and members in Japan (including Okinawa), Korea, the Philippines, and Southeast Asia.

The **Zweibrücken AB Warrior (Germany) Chapter** has been inactivated, but AFA is pleased to learn of great interest in establishment of an active chapter at Spangdahlem AB, Germany.

At Nellis AFB, Nev., AFA National President Jack Price, center, is suited up and ready to make his first flight in an F-16 while attending AFA's recent Board Meeting at Las Vegas. Wishing him a good flight is (at right) USAF Tactical Fighter Weapons Center Commander Maj. Gen. Joseph W. Ashy, and at the left is the F-16 pilot, Lt. Col. Tim Albin from the USAF Fighter Weapons School.

Delaware State AFA

Delaware State AFA held its State Awards Recognition Banquet at Dover AFB with more than 200 people in attendance. Col. F. Keith Tedrow, Commander, 436th Military Airlift Wing, Dover AFB, welcomed the large audience and the guest speaker, AFA Executive Director Gen. Charles L. Donnelly, Jr., USAF (Ret.).

Honorees from Dover AFB's 436th Military Airlift Wing were 1st Lt. Susan Duquette, Junior Officer of the Year; SMSgt. Gary Winings, Senior NCO of the Year; MSgt. Angelita F. Lewis, NCO of the Year; and A1C Roland J. Lemieux, Airman of the Year. Awards also went to the 512th MAW's Capt. Patrick J. Riley, Junior Officer of the Year; MSgt. Dean E. Mills, Senior NCO of the Year; TSgt. Gerald A. White, Jr., NCO of the Year; and SrA. Marian E. Kellogg, Airman of the Year. Both of Dover AFB's MAWs also received state awards, as did Col. Richard B. Harper, USAF (Ret.).

Local Junior ROTC Cadets also were honored, including Dover's Cadet Maj. Stanley H. Burris and Cadet Maj. Harry J. Whiteman and Middletown's Cadet Maj. Gregg Kennedy and Cadet Capt. Sheri Dickinson. Delaware Wing Civil Air Patrol award winners were Cadet Maj. John W. McGaha and Cadet Col. Jerry L. McKinney. University of Delaware ROTC honorees were Cadet Col. Freddie McSears, Jr., and Cadet A1C Robbie McAnnally.

Members of two Delaware AFA chapters also received awards: Wilmington Chapter's Preston A. Leap, Garnell R. Purcell, Jr., Marie T. Tark, Samuel Cook, and Carol Cook, and Blue Hen Chapter's Christine K. Barrett and Walter J. Bartlett.

Chapter Awards and Donations

The **John Currie Memorial (N. J.) Chapter** selected SMSgt. John Mastrogiovanni of Lanoka Harbor, N. J., as its 1989 "Airman of the Year." Sergeant Mastrogiovanni was honored at a chapter dinner-dance in Forked River. Nearly 200 guests attended, including Christopher Connors, Mayor of Lacey Township, N. J., and Robert

Walter Cronkite was recently honored by the Iron Gate (N. Y.) Chapter for his interest in and support of the Chapter's annual National Air Force Salutes, which have raised more than $1.5 million for USAF-oriented charities. Shown with Mr. Cronkite are Dorothy Welker, Chapter Secretary and Salute Coordinator, and Richard A. Freytag, Iron Gate Chapter President.

Gregory, New Jersey State AFA President. Sergeant Mastrogiovanni, who received many military awards and decorations during his tour of duty in Southeast Asia, is currently Maintenance Superintendent of the 108th Tactical Fighter Wing, an ANG unit based at McGuire AFB, N. J.

The **Chautauqua (N. Y.) Chapter** supported the city's 25th Annual Military Ball with Chapter Secretary Richard Barkstrom as Chairman of the event. During the evening's patriotic program, Barkstrom presented a check for $1,000 to the Chautauqua County Veterans Council. This money will go toward maintaining the County's veterans' van, which is used to transport vets to area VA medical facilities. Another highlight of the evening was presentation of a plaque to John Householder, Chautauqua Chapter Treasurer, for his twenty years of support of the Military Ball.

Chapter Activities

The **York-Lancaster (Pa.) Chapter** recently held its chapter meeting with the Commander of the Pennsylvania Air National Guard, Maj. Gen. Robert E. Harris, as guest speaker. During the program, Bill Jefferies, past Chapter President, and his wife, Gladys, were presented with an illustration of an F-4 "Wild Weasel" from the current Chapter President, Bernard J. "Nick" Nicols.

The **Panhandle (Tex.) Chapter** held its Veterans Day Jazz Salute, featuring the famed Commodores of the US Navy Band, in the Amarillo Civic Center Auditorium. The concert also included performances by the Amarillo College Jazz Ensemble and the West Texas State University Jazz Band. The free concert was cosponsored by the Amarillo *Globe-News,* American Legion Hanson Post 54, and the Panhandle Chapter. The chapter also held a Military Ball at the La Paloma Inn, with AFA's Executive Director, Gen. Charles L. Donnelly, USAF (Ret.), as guest speaker.

More than 250 people attended a sold-out luncheon meeting of the **Sacramento (Calif.) Chapter** at the McClellan AFB Officers' Club when Maj. Gen. Trevor Hammond, Commander of the Sacramento Air Logistics Center, was guest speaker. In the audience were active-duty officers and enlisted people; the incoming President of the Sacramento Chamber of Commerce, Dr. Arliss Pollock; and leaders of major Sacramento social and service clubs. Chapter President Doug Baldwin and AFA were praised by General Hammond for their advocacy and support of the Air Force mission. The General spoke of the need for "the kind of strength to be secure today in this era of a violent, uneasy peace, a strength that relies on the capabilities of high technology weapon systems and a strong logistic system. That's what we are all about."

The **Mid-Ohio Chapter** sponsored annual Veterans Day ceremonies at Newark AFB with numerous civic leaders in attendance, including Ohio State Representative Marc Guthrie; Newark Mayor William Moore; Heath Mayor John Geller; Daniel Dupps, Heath Superintendent of Schools; and Cecil Hopper, Ohio State AFA President. While a local high school band played patriotic music, AFA membership applications, "white papers," and magazines were distributed. The ceremonies received favorable coverage in the Newark media.

The **Joe Walker (Pa.) Chapter** orga-

AFA National President Jack C. Price (left) chats with James C. Binnicker, Chief Master Sergeant of the Air Force, during a recent AFA-sponsored symposium in Orlando, Fla. Chief Binnicker continues to support AFA and the Aerospace Education Foundation during his travels.

nized and distributed valentines to patients at the VA hospitals in Aspinwall and Pittsburgh. The valentines were made by students at the Monessen Elementary Center in Monessen, Pa., as part of the Center's Young Astronaut Program. The Chapter was highly praised by the Monessen Chamber of Commerce for its support of 1988 Christmas season events, including a parade and a host of philanthropic activities.

The **Eglin (Fla.) Chapter** recently held its quarterly luncheon with a local Fort Walton Beach resident as guest speaker. Astronaut Dick Covey, pilot of the recent space shuttle *Discovery* mission, gave an excellent illustrated presentation on the shuttle mission and future space efforts. During the program, Covey presented Nick Masone, President/CEO of the Air Force Enlisted Widows Home Foundation, with a photo that Covey had flown in space for the Foundation.

The **Greater Seattle (Wash.) Chapter** hosted a Strategic Air Command Soviet Awareness Briefing attended by more than 500 people. AFA Life Member Capt. (Maj. selectee) David D. Moore, Chief of the Presentations Division, SAC Intelligence, spoke on USSR military force structure, R&D

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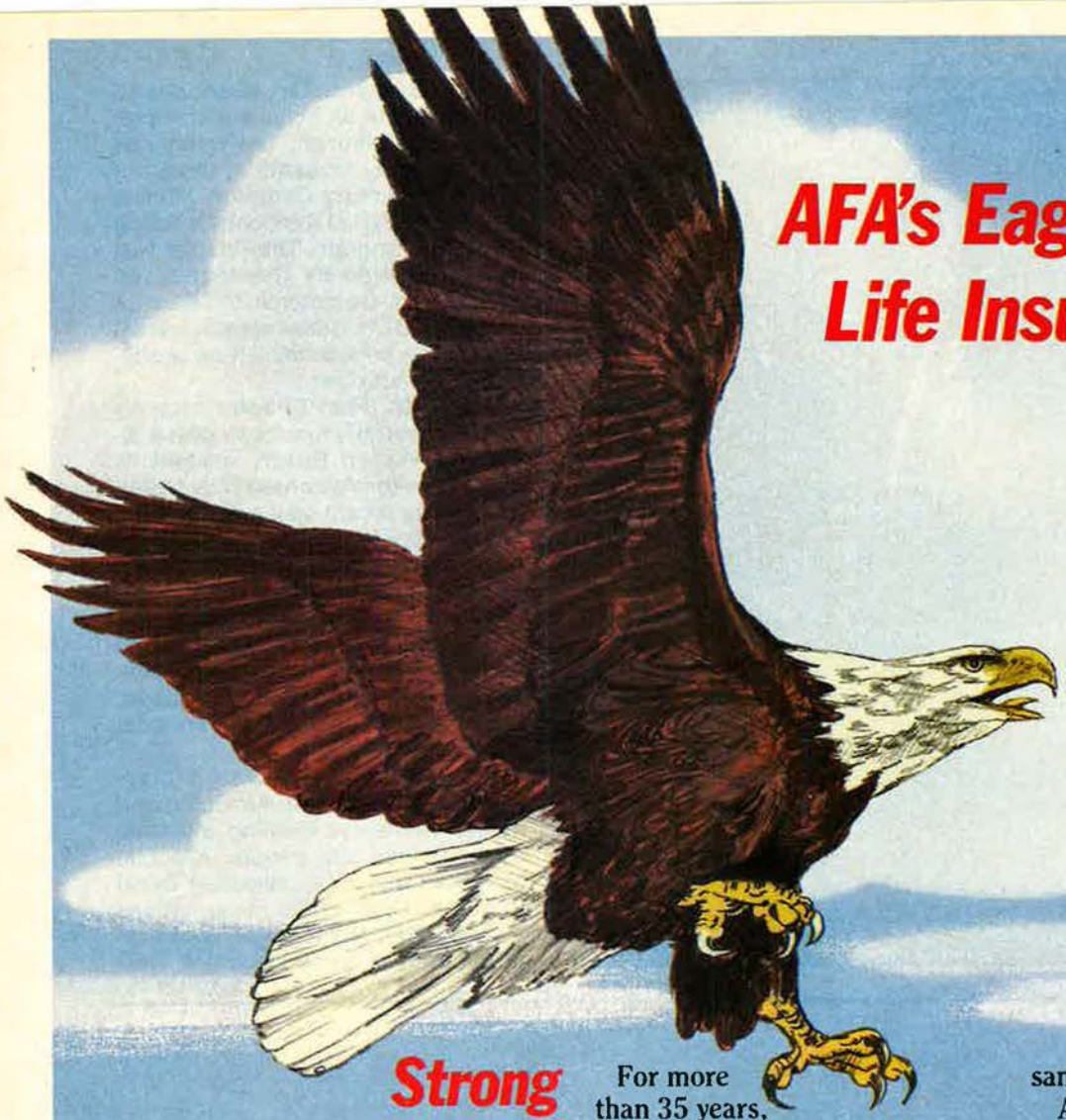

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Gen. Richard L. Lawson, USAF (Ret.), was guest speaker at the Fort Worth (Tex.) Chapter's second annual Community Partner Appreciation banquet. During the program AFA Medals of Merit were presented to Bob Copley, Al Leferink, and Wayne Calhoun. Shown from left to right are Tom Kemp, Chapter President; Mr. Calhoun, Past President of the Chapter; General Lawson; Mr. Leferink; Mr. Copley; and Sam E. Keith, Jr., AFA Chairman of the Board.

programs, space efforts, command and control structure, and economic and political changes in the USSR. His talk also provided insights into Soviet culture.

Did You Know?

The **Cleveland (Ohio) Chapter** claims the oldest active AFAer: Frederick C. Crawford, aged ninety-eight, a Life Member.

Air Force Village West will open its doors in November 1989 as a nonprofit retirement community for officers and spouses and officers' survivors. The retirement facilities are located at 100 Village West Dr., Riverside, Calif., adjacent to March AFB. Details about the facility may be obtained by calling (714) 656-6781 collect.

Outstanding Large AFA Chapters

Congratulations to the following "Outstanding Large Air Force Association Chapters of the Year": 1977—Wright Memorial (Ohio) and Steele Valley (Pa.); 1978—First Connecticut, Gen. Robert F. Travis (Calif.), Mississippi Gulf Coast, Central Indiana, Greater Pittsburgh (Pa.), and Lawrence D. Bell Museum (Ind.); 1979—Alamo (Tex.), Central Oklahoma/Ger-

Aerospace Education Foundation President James Keck accepts an autographed copy of* Dowry of Uncommon Women *from the author, Jane Metcalf, whose book chronicles many stories of military wives and commemorates their heritage along with the history of Officers' Wives Clubs. Signed copies may be ordered at $21.50 each from Jane Metcalf, 4917 Ravenswood Drive, San Antonio, Tex. 78227; proceeds benefit the Air Force Village Foundation, Inc.

Coming Events

May 6, **Connecticut State Convention,** Meriden; May 12–13, **Tennessee State Convention,** Nashville; May 19–20, **Mississippi State Convention,** Biloxi; May 19–21, **New York State Convention,** Buffalo; June 2–4, **Georgia State Convention,** Warner Robins; June 16–17, **Louisiana State Convention,** Bossier City; June 16–18, **New Jersey State Convention,** Cape May; June 16–18, **Ohio State Convention,** Newark; June 22–25, **National Aerospace Symposium for Educators,** Arlington, Va.; June 23–24, **Maine State Convention,** Bangor; June 24, **Massachusetts State Convention,** Auburn; June 28–30, **Alaska State Convention,** Fairbanks; July 7, **Montana State Convention,** Bozeman; July 14–15, **Arkansas State Convention,** Blytheville; July 14–15, **Colorado State Convention,** Pueblo; July 21–23, **Pennsylvania State Convention,** State College; July 21–23, **Texas State Convention,** South Padre Island; July 22–23, **North Carolina State Convention,** Seymour Johnson AFB; July 29–30, **Florida State Convention,** Daytona Beach; August 4–6, **North Dakota State Convention,** Grand Forks; August 11–12, **Utah State Convention,** Wendover; August 11–13, **Arizona State Convention,** Sedona; August 12, **Indiana State Convention,** West Lafayette; August 12–13, **Delaware State Convention,** Dover AFB; August 24–26, **California State Convention,** San Francisco; September 18–21, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.; October 21–22, **25th Annual Orientation of New AFA National/State Officers,** Arlington, Va.; October 27–29, **North Central Regional Workshop,** Sioux Falls, S. D.

At a recent dinner meeting of the Gus Grissom (Ind.) Chapter, the guest speaker was Robert Foerster, a science teacher and principal in West Lafayette, Ind., and one of the nation's top ten teachers picked for the NASA "teachers in space" program. Shown here left to right are Don McKellar, Indiana State AFA President; Mr. Foerster; Jim Wagner, Grissom Chapter President; and B. C. "Buck" Hudgens, former Chapter President and now Vice President.

rity, H. H. Arnold (Tenn.), and Colonel Stuart E. Kane (Pa.); 1980—Middle Georgia and Union Morris (N. J.); 1981—Central Oklahoma/Gerrity and Mobile (Ala.); 1982—Frank Luke (Ariz.) and Lake Region (Fla.); 1983—Anchorage (Alaska); 1984—General David C. Jones (N. D.); 1985—Fresno (Calif.); 1986—Union Morris (N. J.); 1987—Cheyenne Cowboy (Wyo.); 1988—Del Rio (Tex.) and Paul Revere (Mass.)

New Senior Enlisted Advisors

Congratulations to these new senior enlisted advisors: **CMSgt. Gerald L. Burd,** Air Training Communications Division, Randolph AFB, Tex.; **CMSgt. Jack D. Case,** 52d Tactical Fighter Wing, Spangdahlem AB, Germany; and **CMSgt. Larry A. Sahr,** 12th Air Force, Bergstrom AFB, Tex.

How to Have Your Say

Contributions to "Intercom" should be sent to J. R. "Doc" McCauslin, AFA Headquarters, 1501 Lee Highway, Arlington, Va. 22209-1198. ■

Unit Reunions

Reunion Notices

Readers wishing to submit reunion notices to "Unit Reunions" should mail their notices well in advance of the event to "Unit Reunions," Air Force Magazine, 1501 Lee Highway, Arlington, Va. 22209-1198. Please designate the unit holding the reunion, a time and location, and a contact for more information.

Burtonwood Ass'n
Members who were stationed at Burtonwood Airdrome, England, will hold a reunion October 5–7, 1989, in Dayton, Ohio. **Contact:** Wally Baldwin, 6467 Locust Lane, Franklin, Ohio 45005. Phone: (513) 396-5677 (office) or (513) 442-4973 (home).

Ellington Navigators Ass'n
The Ellington Navigators Association will hold a reunion on September 26, 1989, in Orlando, Fla., for anyone who trained in navigation at Ellington (1942–58). **Contact:** Clarke S. Lampard, 5830 Robin Hill Dr., #2, Lakeport, Calif. 95453. Phone: (707) 263-7397.

Flamingo Wing Ass'n
The Flamingo Wing Association will hold a reunion for members of the 435th Troop Carrier Wing and affiliated units (1947–79) May 12–14, 1989, in Miami, Fla. **Contact:** Ray Dunkman, 1370 N. E. 200 Terrace, North Miami Beach, Fla. 33179.

Hobbs Army Airfield
The Hobbs Chamber of Commerce is hosting a reunion September 8–10, 1989, at Hobbs, N. M., for military and civilian personnel stationed at Hobbs Army Airfield in the 1940s. **Contact:** Sandy Clark, Hobbs Chamber of Commerce, 400 N. Marland, Hobbs, N. M. 88240. Phone: (505) 397-3202.

Orientation Group, USAF
Former members of the US Air Force Orientation Group will hold a reunion on August 19, 1989, at Wright-Patterson AFB, Ohio. **Contact:** Tony Tonon, 369 Forestview Dr., Fairborn, Ohio 45324. Phone: (513) 878-7979.

Women Military Aviators, Inc.
Women military aviators will hold a convention/reunion September 1–4, 1989, at the J. W. Marriott Hotel in Washington, D. C. **Contact:** Capt. Marcelyn A. Adkins, USAF, 9130 Blarney Stone Dr., Springfield, Va. 22152. Phone: (703) 569-9544.

1st Motion Picture Unit
The 1st Motion Picture Unit, USAAF, will hold a reunion in July or August 1989. **Contact:** MSgt. George J. Siegel, USAAF (Ret.), 17226 Weddington St., Encino, Calif. 91316.

1st Strategic Air Depot
Personnel of the 1st Strategic Air Depot stationed at Honington-Troston, England, between 1942 and 1946 will hold a reunion September 21–24, 1989, in San Antonio, Tex. **Contact:** Warren L. Stanley, 3207 Myles Ct., #3, San Jose, Calif. 95117.

3d Composite Squadron
The 3d Composite Squadron, which was stationed at Lawson Field, Ga., will hold a reunion September 22–24, 1989, at Wright-Patterson AFB, Ohio. **Contact:** Col. Nester Cole, USAF (Ret.), 2732 Warwick Dr., Bloomfield Hills, Mich. 48013.

3d Emergency Rescue Squadron
Members of the 3d Emergency Rescue Squadron will hold a reunion September 8–10, 1989, in Prairie du Chien, Wis. **Contact:** Glenn Meyer, 314 S. State St., Prairie du Chien, Wis. 53821. Phone: (608) 326-8011.

7th Ferrying Group
The 7th Ferrying Group, which was sta-

tioned at Gore Field, Mont., will hold a reunion September 13–16, 1989, in Seattle, Wash. **Contact:** John Radzis, 560 Ruskin Dr., Elk Grove, Ill. 60007. Phone: (312) 437-0054.

8th Fighter Group
Members of the 8th Fighter Group (World War II) will hold a reunion September 7–10, 1989, in Alexandria, Va. **Contact:** Vincent W. Steffanic, 1028 Main St., West Warwick, R. I. 02893. Phone: (401) 828-1769.

9th Air Service Squadron
The 9th Air Service Squadron of the 321st Air Service Group, Thirteenth Air Force, will hold its reunion June 8–11, 1989, in Hot Springs, Ark. **Contact:** C. B. or Mary Ann Harrell, 4636 Crest Ave. S. E., Albuquerque, N. M. 87108.

12th Tactical Recon Squadron
Members and veterans of the 12th Tactical Reconnaissance (Observation) Squadron will hold a reunion September 28–October 1, 1989, at the Airport Ramada Inn in Charlotte, N. C. **Contact:** Marshall C. Pratt, 1636 Lombardy Circle, Charlotte, N. C. 28203. Phone: (704) 334-0378.

20th Fighter Group
The 20th Fighter Group will hold a reunion October 5–8, 1989, in Denver, Colo. **Contact:** Jack Ilfrey, 50 Ridge Dr., New Braunfels, Tex. 78130-6624. Phone: (512) 629-0391.

22d Bomb Group
Members of the 22d Bomb Group, Fifth Air Force (World War II), including the 2d, 19th, 33d, and 408th Bomb Squadrons, will hold a reunion September 14–16, 1989, in Lexington, Ky. **Contact:** John E. Clark, P. O. Box 560967, Rockledge, Fla. 32956-0967.

30th Bomb Group
Veterans of the 30th Bomb Group who served in the Central Pacific and Alaska (Aleutian Islands) during World War II will hold a reunion September 28–30, 1989 in Dayton, Ohio. **Contact:** CMSgt. Jose A. Garcia, USAF (Ret.), P. O. Box 485, Charleston, S. C. 29402-0485.

30th Mobile Reclamation Squadron
The 30th Mobile Reclamation and Repair Squadron will hold a reunion September 22–23, 1989, in Alger, Ohio. **Contact:** Glenn W. Corder, 415 E. Smith, McAlester, Okla. 74501. Phone: (918) 423-4648.

40th Bomb Group
Members of the 40th Bomb Group and the 28th Air Service Group will hold a reunion September 14–17, 1989, at the Marriott Hotel in Omaha, Neb. **Contact:** Richard A. Veach, 1030 Palamino Rd., Omaha, Neb. 68154. Phone: (402) 333-4124.

Class 43-E
Pilot Class 43-E will hold a reunion November 9–12, 1989, in Orlando, Fla. **Contact:** Hugh K. Myers, 624 San Luis Rey Rd., Arcadia, Calif. 91006. Phone: (818) 447-6140.

Class 43-G
Class 43-G (Williams Field, Ariz.) will hold a reunion May 21–23, 1989, at the Riviera Hotel/Casino in Las Vegas, Nev. **Contact:** Earvie T. Cloyd, 4236 N. 34th Pl., Phoenix, Ariz. 85018. Phone: (602) 956-3318.

45th Air Depot Group
The 45th Air Depot Group and attached units will hold a reunion September 21–24, 1989, in Sandusky, Ohio. **Contact:** Charles F. Guemelata, 119 Aigler Blvd., Bellevue, Ohio 44811. Phone: (419) 483-4371.

49th Fighter Group
Members of the 49th Fighter Group (World War II, Korea, Vietnam) will hold a reunion September 20–23, 1989, at the Holiday Inn in Mesa, Ariz. **Contact:** Bill Schultz, P. O. Box 1270, Phoenix, Ariz. 85001. Phone: (602) 833-8187.

49th Fighter-Interceptor Squadron
The 49th Pursuit Fighter and Fighter-Interceptor Squadron will hold a reunion September 22–24, 1989, in Kansas City, Mo. **Contact:** S. D. Huff, 3200 Chetwood Dr., Del City, Okla. 73115-1933. Phone: (405) 677-2683.

50th Materiel Service Squadron
Members of the 50th Materiel Service

Unit Reunions

Squadron of the 324th Air Service Group, attached to the 97th Bomb Group (England, Africa, Italy) will hold a reunion September 28–30, 1989, in Jackson, Mo. **Contact:** Edwin R. Clark, M&D Park, East Dorsey Lane, Poughkeepsie, N. Y. 12601. Phone: (914) 452-8899.

Class 54-06
Class 54-06 aircraft observers (Ellington AFB, Tex.) will hold a reunion July 28–29, 1989, at the Hilton Palacio del Rio in San Antonio, Tex. **Contact:** George G. Hull, 3127 Colony Dr., San Antonio, Tex. 78230-3417.

55th Strategic Recon Wing
Members of the 55th Strategic Reconnaissance Wing (1948–89), including assigned attached units and direct support personnel, will hold a reunion September 28–30, 1989, in New Orleans, La. **Contact:** Robert A. Dibbell, 8902 E. Maple Leaf Dr., Tucson, Ariz. 85710.

Class 63-B
Class 63-B (Williams AFB, Ariz.) will hold a reunion September 15–17, 1989, in Mesa, Ariz. **Contact:** Lewis Aaronson, 5022 Cascade Ct., Culver City, Calif. 90230-4243. Phone: (213) 836-9260.

64th Fighter-Interceptor Squadron
The 64th Fighter-Interceptor Squadron will hold a reunion September 22–24, 1989, at the Aladdin Hotel in Las Vegas, Nev. **Contact:** Lt. Col. George H. Sewell, Jr., USAF (Ret.), 4876 W. Red Rock Dr., Larkspur, Colo. 80118.

75th Fighter Squadron
Members of the 75th Fighter Squadron, 23d Fighter Group, Fourteenth Air Force, who served in China during World War II will hold a reunion September 1–4, 1989, in Washington, D. C. **Contact:** Myron D. Levy, 11933 Claychester Dr., Des Peres, Mo. 63131.

86th Fighter-Bomber Group
Members of the 86th Fighter-Bomber Group which comprised the 525th, 526th, 527th, and Hq. Squadrons, will hold a reunion September 14–16, 1989, in San Antonio, Tex. **Contact:** Gil Hurt, 4920 Montcrest Dr., Chattanooga, Tenn. 37416. Phone: (615) 344-6077.

86th/72d Air Service Squadrons
The 86th and 72d Air Service Squadrons, 52d Air Service Group (World War II), will hold a reunion September 14–16, 1989, at the Holiday Inn in Lionville, Pa. **Contact:** William Jacoby, Box 523, Lincoln Hwy., Parksburg, Pa. 19365. Phone: (215) 857-1308.

93d Troop Carrier Squadron
The 93d Troop Carrier Squadron, 439th Troop Carrier Group, will hold a reunion September 14–17, 1989, at the Holiday Inn/Parkside in Missoula, Mont. **Contact:** Lt. Col. Thomas L. Morris, USAF (Ret.), 456 St. George's Ct., Satellite Beach, Fla. 32937. Phone: (407) 773-6960.

94th Fighter Squadron
The 94th "Hat in the Ring" Fighter Squadron of the 1st Fighter Group (World War II) will hold a reunion October 12–15, 1989, in San Antonio, Tex. (This squadron is the successor to the World War I 94th Pursuit Squadron.) **Contact:** Jack Ilfrey, 50 Ridge Dr., New Braunfels, Tex. 78130-6624. Phone: (512) 629-0391.

306th Bomb Group
The 306th Bomb Group, Eighth Air Force (1942–45), will hold a reunion September 21–24, 1989, at the Arkansas Excelsior Hotel in Little Rock, Ark. **Contact:** Hugh E. Phelan, Rte. 1, Box 800, Donaldson, Ark. 71941.

340th Fighter Squadron
Members of the 340th Fighter Squadron of the 348th Fighter Group will hold a reunion September 21–24, 1989, in Rochester, N. Y. **Contact:** Norman W. Townsend, 75 Fawn Hill Rd., Rochester, N. Y. 14612. Phone: (716) 865-8009.

356th Fighter Group
The 356th Fighter Group, including the 359th, 360th, and 361st Fighter Squadrons and attached units, will hold a reunion September 22–24, 1989, in Colorado Springs, Colo. **Contact:** Kenneth J. Male, 2988 Hillcrest Rd., Schenectady, N. Y. 12309. Phone: (518) 783-0207.

451st Bomb Squadron
Members of the 451st Bomb Squadron, 322d Bomb Group (World War II), will hold a reunion September 21–23, in Phoenix, Ariz. **Contact:** James J. Crumbliss, 2014 Shady Grove Dr., Bossier City, La. 71112. Phone: (318) 742-1225.

452d Bomb Group
The 452d Bomb Group (World War II) will hold a reunion September 6–10, 1989, in Colorado Springs, Colo. **Contact:** Rom Blaylock, P. O. Box 2526, New Bern, N. C. 28561.

452d Bomb Wing
Members of the 452d Bomb Wing (Korea) will hold a reunion August 12, 1989, at the Long Beach Naval Base (Allen Center) in Long Beach, Calif. **Contact:** Gene Hoffman, P. O. Box 3785, Long Beach, Calif. 90803.

459th Fighter Squadron
Members and friends of the 459th "Twin Dragon" Fighter Squadron will hold a reunion June 29–July 2, 1989, at the Hyatt Hotel in San Jose, Calif. **Contact:** Len Boyd, 6113 Montoro Ct., San Jose, Calif. 95120. Phone: (408) 997-3366.

485th Bomb Group
The 485th Bomb Group, Fifteenth Air Force, will hold a reunion September 7–10, 1989, in San Antonio, Tex. **Contact:** E. L. Bundy, 5773 Middlefield Dr., Columbus, Ohio 43235.

487th Bomb Group
Members of the 487th Bomb Group, Eighth Air Force (World War II), will hold a reunion September 13–16, 1989, in Cincinnati, Ohio. **Contact:** Robert Ballman, 613 Cottie Ct., Reading, Ohio 45215.

490th Bomb Squadron
Members of the 490th Bomb Squadron will hold a reunion June 14–18, 1989, in Seattle, Wash. **Contact:** Ivo Greenwell, 5122 W. 27th St., Tulsa, Okla. 74107.

507th Fighter Group
Members of the 507th Fighter Group, which comprised the World War II 463d, 464th, and 465th Fighter Squadrons, will hold a reunion September 1–3, 1989, at the Sheraton Hotel in St. Louis, Mo. **Contact:** William A. Jenner, 307 Alma St., O'Fallon, Ill. 62269. Phone: (618) 632-5459.

529th Aircraft Control/Warning Group
The 529th Aircraft Control and Warning Group will hold a reunion October 20–22, 1989, at Wright-Patterson AFB, Ohio. **Contact:** Col. Nester Cole, USAF (Ret.), 2732 Warwick Dr., Bloomfield Hills, Mich. 48013.

559th Bomb Squadron
The 559th Bomb Squadron, 387th Bomb Group (World War II), will hold a reunion in September 1989 in Lancaster, Pa. **Contact:** Pasquale A. Razzano, 75 Fallen Timbers Trail, Rockaway, N. J. 07866. Phone: (201) 328-4130.

6910th Security Squadron
Air Force personnel of Detachment 2, 6910th Security Squadron, who were stationed at Camp Pierie (Wiesbaden, Germany) will hold a reunion June 23–25, 1989, in the Chicago, Ill., area. **Contacts:** Tom Hampson, 680 Hillcrest Blvd., Hoffman Estates, Ill. 60195. Phone: (312) 885-0431. Capt. Donald B. Cork, USAF (Ret.), 10889 Hillcrest Dr., Laurel, Md. 20707. Phone: (301) 498-9073.

24th Fighter Squadron
I would like to hear from members of the 24th Fighter Squadron, Sixth Air Force, who would be interested in holding a reunion.
Please contact the address below.
Lt. Col. James E. Thomas, Jr., USAF (Ret.)
5536 Verbena
San Antonio, Tex. 78240

Class 43-I and 414th FG
I would like to hear from members of Class 43-I, Southeast Flying Training Command, and from members of the World War II 414th Fighter Group who would be interested in holding a reunion.
Please contact the address below.
Anthony J. Carmen
100 Little Creek Dr., RR2
Lockport, Ill. 60441
Phone: (312) 349-9296

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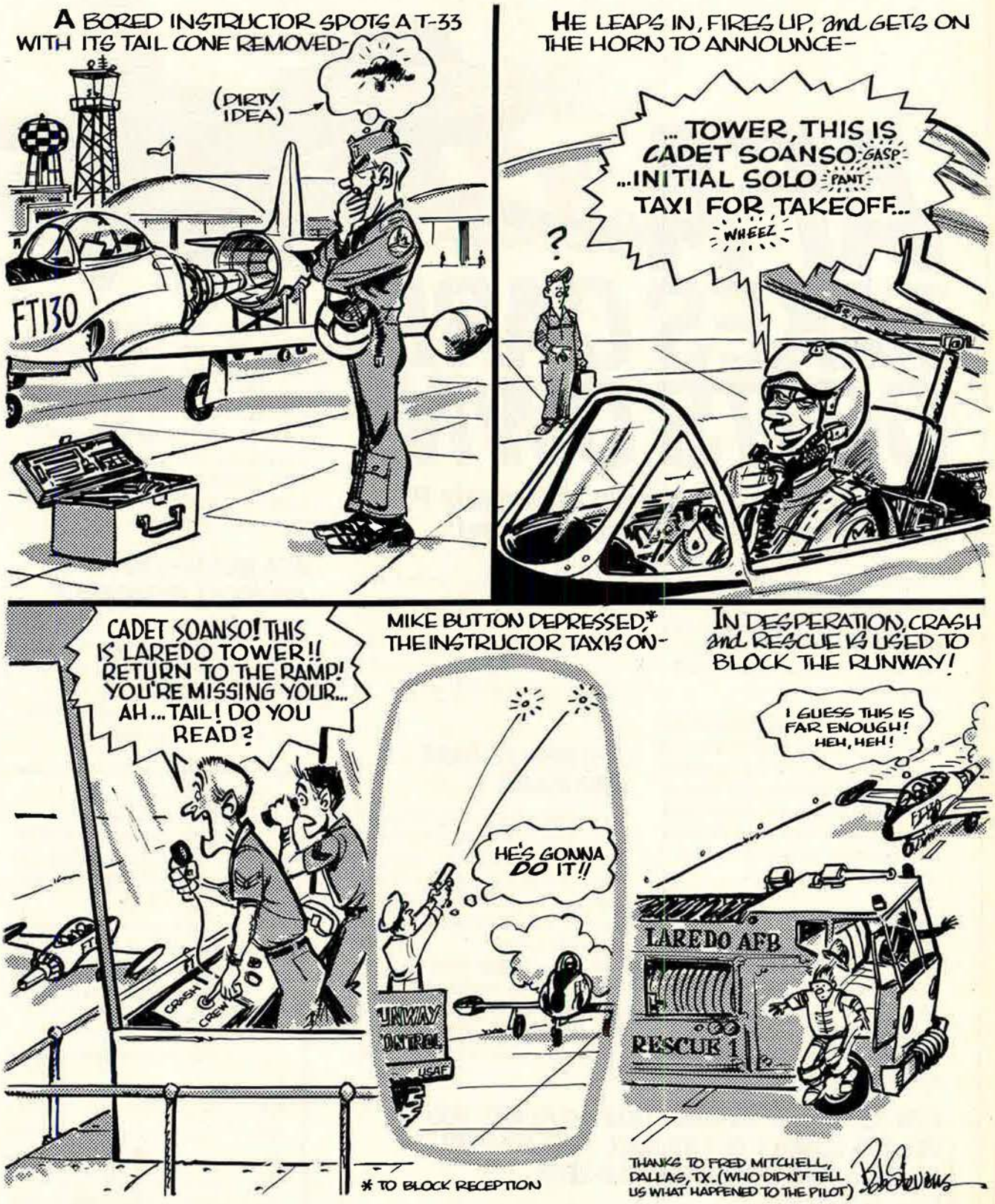

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