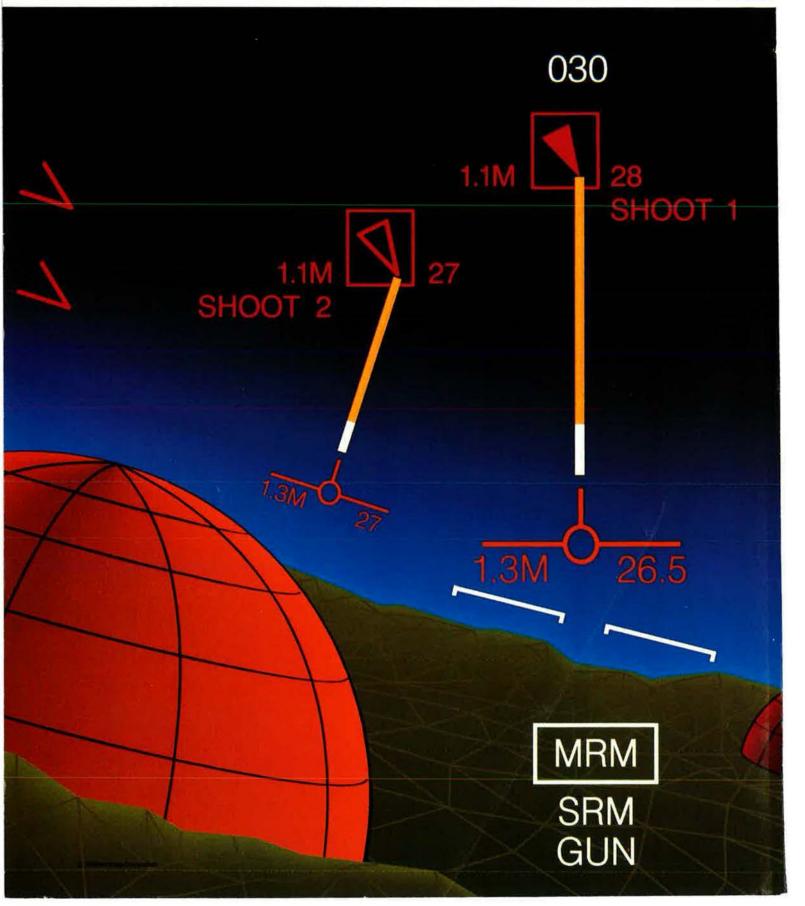


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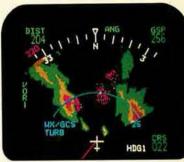
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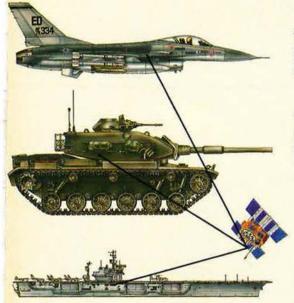
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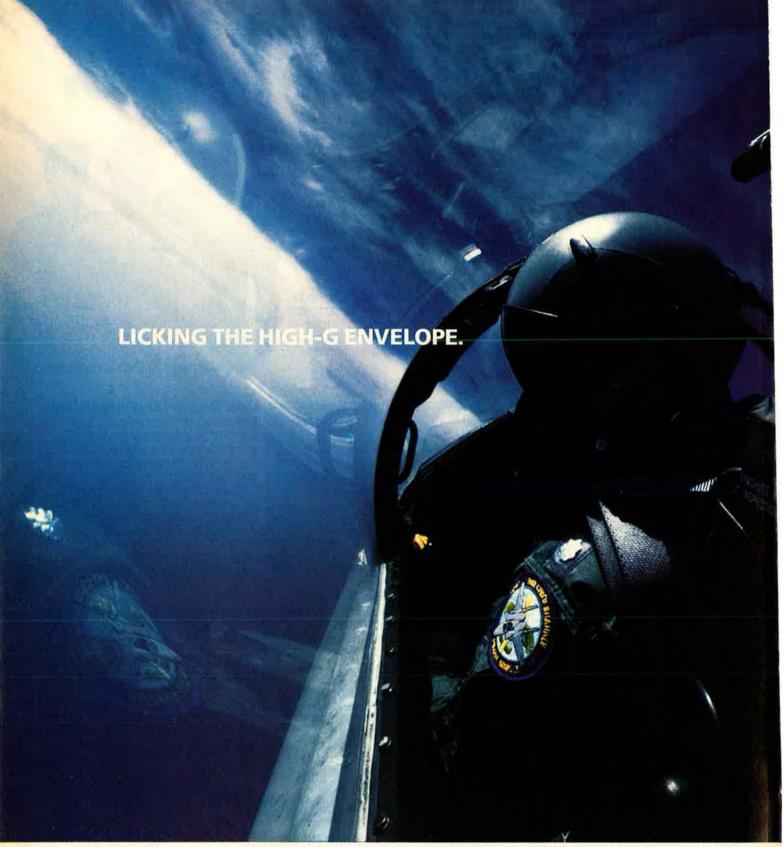
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About the cover: Members of the Army's 7th Light Infantry participate in a joint-service exercise in Honduras. A special section on the "US Military Posture" begins on p. 42. (Cover photo © International Defense Images)

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An Editorial

Where's the Threat?

By John T. Correll, EDITOR IN CHIEF

WRITING in the Washington Post February 14, Patrick Cockburn of the Carnegie Endowment for International Peace declares that Kremlinology is a dead art. Mr. Cockburn argues that we no longer need to analyze scraps of information or search for subtle clues to understand Politburo intrigues. The increasing openness of information in Moscow, he says, is making it possible "to report Soviet politics much like anywhere else" as the "great fortress" built by Lenin and Stalin is dissolved.

This is but one example of the bright new image that the Soviet Union is projecting to the world. General Secretary Mikhail Gorbachev may encounter resistance at home to his programs of glasnost ("openness") and perestroika ("restructuring"), but the reaction abroad has been enthusiastic and loud. Mr. Gorbachev has been given credit beyond his due for progress in arms control. His international reputation as a peacemaker will no doubt be enhanced further as Soviet invasion forces withdraw from Afghanistan.

Against this backdrop, many people will be inclined to dismiss warnings of a Soviet military threat as a fantasy. The real fantasy is believing that the Soviet Union has suddenly turned benign. In its latest analysis of Soviet military power, the Defense Department reports that "we have seen no evidence of the USSR changing the offensive nature of its force structure and deployment patterns. Military output has not been reduced, nor has military spending decreased."

Available facts indicate that the Soviet military machine is bigger and more threatening than ever and that force modernization is proceeding full tilt. Growth is especially noticeable in ground forces, which now total 211 active divisions. More amply provisioned than ever, these forces are prepared to sustain combat for sixty to ninety days in Europe and for more than 100 days in the Far East. The Soviet Union maintains 50,000 tons of poisonous substances, the world's largest chemical weapon stockpile. The current five-year plan (1986–1990) ensures that military-related industries will continue to expand.

The Soviet Union remains an imperialist, totalitarian state. As Mr. Gorbachev comes close to admitting, the Soviet economy is a basket case. Communism is in retreat wherever people have free choice. Without the intimidating threat of Soviet military power, how long would the non-Slavic socialist republics and the satellite nations of Eastern Europe stay in the Kremlin's fold? Would Western Europe treat Soviet initiatives as gingerly as it does today? On what basis would a peaceful Soviet Union hold its position as a superpower?

There is, of course, a genuine element of change in *perestroika*. Mr. Gorbachev has some real problems, and the present apparatus isn't helping him solve them. The main change, though, will be in approach and tactics. The Soviets do not seem to be moving an inch on basic objectives. All of Mr. Gorbachev's voluntary moves have been to strengthen Soviet power, not to weaken it. He did not agree to the European missile drawdown—a Western proposal—as a concession to the West, but rather because he believed that it was the course of greatest advantage to the Soviet Union.

The Soviets are not leaving Afghanistan because of idealism

about self-rule. They are pulling out because they were beaten, unable to subdue the Afghan rebels after eight years of trying. Mr. Gorbachev will take the cheers where he can get them, but this is not the conclusion he would have chosen to the Afghanistan adventure. The pullout will be seen within the Soviet power structure and among Third World client states as a defeat.

Mr. Gorbachev's own explanation of the reform movement is in his 1987 book, *Perestroika*. Some interesting points shine through the propaganda. "Any hopes that we will begin to build a different, nonsocialist society and go over to the other camp are unrealistic and futile," he writes. "Those in the West who expect us to give up socialism will be disappointed. It is high time they understood this and, even more importantly, proceeded from that understanding in practical relations with the Soviet Union."

He says that the "inevitable evolution" of human society progresses from feudalism through capitalism to socialism. Revolutions and liberation movements will emerge to hustle the evolution along, he says, but the "hand of Moscow" has nothing to do with this. He acknowledges some "difficulties and complexities" in Hungary in 1956, in Czechoslovakia in 1968, and in Poland in the 1950s and 1980s, but reminds us that "a return to the old order did not occur in any of the socialist nations."

Remember how the Kremlinologists, before they became obsolete, kept telling us that a primary Soviet objective was to drive a wedge between the United States and Europe? In his book, Mr. Gorbachev makes a special pitch to those who share "a common European home" that reaches "from the Atlantic to the Urals."

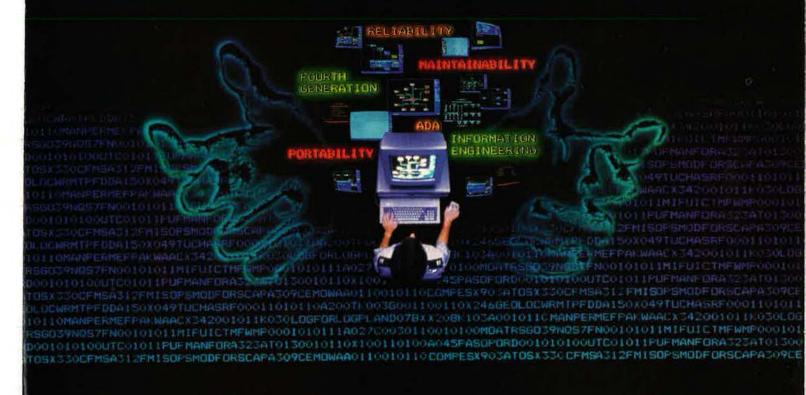
Western Europe, he urges, should "quickly get rid of the fears of the Soviet Union that have been imposed on it," disassociate itself from "the dangerous extremes of American policy," and reassert the independence that has been "carried off across the oceans." He sympathizes with Europeans about the "onslaught of mass culture from across the Atlantic . . . primitive revelry of violence and pornography and the flood of cheap feelings and thoughts."

Lest anyone take this as naked anti-Americanism, he adds that "our idea of a common European home certainly does not involve shutting its doors to anybody. True, we would not like to see anyone kick in the doors of the European home and take the head of the table at somebody else's apartment. But then that is the concern of the owner of the apartment."

To help build the common European home, Mr. Gorbachev says "we are raising the question of broad scientific and technological cooperation." He regrets that "artificial barriers are being erected in this area" and says his concern applies "first and foremost to electronics." (Score another one for the Kremlinologists, who said that the Soviets would use glasnost and perestroika as smokescreens to acquire Western technology, especially electronics.)

It seems abundantly clear that the Soviet Union does not mean us well and that it has plenty of wherewithal to do us harm. In the old days, the Kremlinologists used to call that a threat

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The AirLand Battle

The article "Sorting Out the Air-Land Partnership" (April '88 issue, p. 50) was a timely effort to portray the agony our Air Force is experiencing as its leadership tries to make the best of a bad situation.

The only part of close air support (CAS) that USAF wants any part of is the force structure and mission-associated funds. The pathetic part is how they struggle to try to convince Congress that they are really interested in providing direct and responsive fire support for infantry. It would be unusual if they were, for no other major air force in the world is.

The job of serving infantry, being at their beck and call, killing tanks, and milling about the battlefield down in the terrain flight environment (between the mud and 300 feet) is not consistent with the career-enhancing activity that is advertised to attract the cream of our youth crop. To get into this mission, you have to "think of yourself as a ground combat soldier who has an extra degree of freedom and firepower to kill." This was said to me in 1973 by one Col. Hans Rudel, who learned his trade on the Eastern Front.

If you want to understand USAF, think "trip wire." Versions of the F-16 on the ramp in Europe make a lot more sense than a couple hundred dedicated "mudfighters." Paint them green and brown and designate them for CAS. It becomes ever more logical as we give away our intermediaterange missile capability.

Besides, from a national perspective, we have lots of CAS aircraft, and they are organic. Unfortunately, they are helicopters, but that is the best the Army could do because of past and recent "agreements."

Will the vast resources being absorbed by tactical aviation of the four services counter the infantryman's primary menace, the tank? No. Does that concern DoD and congressional leadership? Why not? Is it technically and operationally feasible to have lots of dedicated aircraft that could operate in the chaotic environment of fluid battle and subdue tanks? Yes, and

probably ten times more effectively than ever before.

Should we try? Is it worth the cost of an experiment? Would such an experiment threaten heavily endowed Army and USAF factions? Do we have DoD and congressional leadership with the strength to make it happen?

Chuck Myers Gordonsville, Va.

Air-to-mudders have read numerous articles and letters lately on congressional reactions to the Air Force's remedy for the next-generation CAS aircraft—the A-16. Although I'm a naturally biased A-10 driver, I believe that most are missing the point. Be it a remodeled A-10, A-7, or A-16, the key to the CAS mission is not the aircraft—the key is target identification and communications on an everchanging battlefield. Someone or something will have to put the CAS pilot's eyes on the target.

It's cost-effective to use a fully tested and capable airframe—the F-16—as the next-generation CAS aircraft (rather than to go through another long, arduous process for a new system) and to apply the savings to developing and deploying a target ID/comm system to put eyes on the target (no matter how fast or slow one flies). We have those systems now, but limited funds put these systems and their integration low on the priority list.

Let's face it. With today's projected threat array at the FEBA, when we unmask and our eyes go into the search mode, time is life whether you are traveling at 500 feet per second or there and can't find what to hit, then you might as well not even have a stick between your legs (no pun intended to the Electric Jet drivers).

Smart money should be on a

1,000 feet per second. If you are up

proven airframe. Use the winnings to solve the target ID/comm problems.

Lt. Col. Thomas A. Spada, USAF RAF Bentwaters, UK

In the article "Sorting Out the Air-Land Partnership" in the April 1988 issue, I failed to see any mention of the close air-to-ground interdiction capabilities of the A-7s flown by the Air National Guard. It seems that Guard tactical forces consistently do not receive the press due them.

Is the Total Force concept real? If so, why not include the Guard more in the reporting?

Capt. David W. Fletcher, USAF Barksdale AFB, La.

Missing Maintenance?

As an aircraft and munitions maintenance officer, I began "Eagles 17, Bean Counters 4" (April '88 issue, p. 74) expecting to read about how an aircraft maintenance unit, with help from a component repair squadron (CRS) and equipment maintenance squadron (EMS), could deploy bare base and beat the models. It's old news to maintenance, of course, since we've been doing it for years, but it's nice to get some recognition. Unfortunately, that's not the story I read.

To the uninitiated, the story was about the poor quality of the models and the importance of an AIS and a computer that can keep track of spares in the deployed repair cycle to keep up the WRSK. The author, while talking about how maintenance made liars out of the experts, apparently couldn't find anyone in maintenance to interview. He managed to talk to the 94th TFS commander, the squadron safety officer, the chief of supply, the squadron plans officer, and one of the supply NCOs, but no one in maintenance. And as important as all

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Airmail

those folks are to the mission and this exercise, not one of them kicked a chock, loaded a missile, marshaled an aircraft, performed a postflight, or generated a sortie. And that's what the exercise was about.

I would have found the article more interesting with a quotation from Maj. Gail Duke, the detachment chief of maintenance. And pictures of an AIS with a net aren't nearly as interesting as pictures of a CRS technician fixing a box for the next sortie.

I appreciate the words of Maj. Gen. Henry Viccellio, Jr., on the professionalism of his maintenance force, and he has every reason to be proud of their accomplishments. But Major Duke and her people only proved what most of us wearing the badge already knew—that they could do it.

Hats off to the men and women of the 94th AMU, 1st EMS, and 1st CRS who showed the rest of the Air Force how to make airplanes fly.

Lt. Col. Stephen H. Farish, USAF Westford, Mass.

 Author Jeffrey P. Rhodes responds: "I'm sorry if the article was not the one that Colonel Farish expected to read. I reported on what TAC felt was the major point of the exercise. Moreover, I talked with approximately ten of the maintenance troops during the preparation of the story, one of whom was quoted in the article (page 76). Their information went a long way toward making the story complete. And I agree that a picture of a CRS technician would have been interesting, but there is only so much space to illustrate an article. Most readers have probably never seen an AIS, and the AIS was a significant part of the story."

Thorough Research

When I first looked at the cover of the April 1988 issue of AIR FORCE Magazine, my reaction was: "Great. The artist transposed the blue and white on the wing markings and reversed the tail flash, making the Nieuport 28 French instead of American. Wonderful."

I then read the article "The First Victory" on page 68 of the same issue and learned that when the French turned over the Nieuports to American airmen, they still had the French markings. Initially, only the "Hat-inthe-Ring" insignia was added to the fuselages to differentiate them from the aircraft of the French Air Force.

I am impressed with the thorough research of both author Theodore

Hamady and Frank Wootton, artist of the cover painting. Please relay my thanks to both of them for their accuracy and attention to detail, and accept my thanks for publishing a fine magazine.

> Chuck Hansen Altus AFB, Okla.

"The Best Aeroplanes"

I was saddened to read Philippe Cauchi's letter in your April 1988 issue concerning my comments on buying American (see "Jane's Aerospace Survey 1988," January '88 issue, p. 46). Anyone familiar with my writings should know the immense respect I have for US aerospace capabilities and achievements, but I can never favor the Soviet system of single-nation design and manufacture of all major combat and commercial aircraft imposed on allies and friends.

Dealing with the individual points raised by Mr. Cauchi:

- The IDS Tornado has proved its outstanding qualities in US bombing competitions and needs no praise from me. It was logical to develop an interceptor from the same basic, proven design. Arrival of the Sukhoi Su-27 has compelled the RAF to require Tornado radar enhancement. This will give it a fine aircraft, tailored to the UK's needs.
- The AEW Nimrod seemed right in 1977 and an economical way of meeting the UK's maritime early warning requirements as well as AEW&C tasks. The surplus airframes proved too small and unsuitable, but it is significant that Lockheed still planned to offer the UK radar in a C-130 as recently as 1985.
- Nobody disputes that the AH-64 would be ideal to meet European needs for an attack helicopter, but it is costly, as the US appreciates.
- I am no fan of the Eurofighter, as my writings confirm. The future lies in STOVL.
- Far from European governments all pressuring their state-owned airlines to purchase Airbus aircraft instead of US-built jetliners, British Airways has always been encouraged to purchase Boeings, whether stateowned or privatized. Everyone uses 747s and other Boeing types when they are best for the job to be done. However, the Airbus aircraft have an unrivaled safety record, make good sense economically on many routes, have the best wings on any jetliners, and keep the (invaluable) European aerospace industry alive and at work, which is in everyone's interest.

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Narrated by Edward Mulhare. Featuring incredible combat footage, this award-winning film tells the story of the daring daylight bombings that changed the course of WWII.

TT 8057

30 Minutes

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An exciting overview of America's current front line jet fighters that puts you in the cockpit for a 9G ride you won't soon forget. This is a close-up look at the F-14, F-15, F-16, F/A-18, and the new F-20. Jet Fighter puts you in the cockpit as you can expe-

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U.S. Air Power

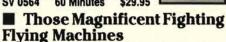
The Aircraft and the weaponry the U.S. military air forces deploy is the most oevastating in military history. US Air Power tells the full story of these amazing war machines utilizing specially declassi-fied footage that shows how they react in combat situations. Essential viewing for every aviation and military enthusiast. ST 0600

60 Minutes

Airshow

Tomcats...Hornets...Thunderbolts Blackbirds; Airshow puts you in the pilot's seat of the world's fastest and most formidable aircraft. Special USN Blue Angels show off their renowned precision flying and will give you the ultimate power surge.

SV 0564 60 Minutes \$29.95



This thrilling history of the fighter plane includes fascinating footage of aerial doglights and will thoroughly entertain anyone with an interest in combat or aviation.

MP 1083

60 Minutes

\$24.95

VIDEO-PICK-OF-THE-MONTH

Combat Helicopters

The remarkable versatility of the helicopter is revolutionizing modern warfare. From the land and sea the helicopter is a crucial newcomer on today's battlefield. Action footage includes "tank killing" sequences never before released for public viewing. Over twelve different combat helicopters are featured in this visually stunning and exciting program. ST 0200 60 Minutes

\$59.95

■ Vietnam: The Weapons of War

Vietnam was a war fought in the jungles and in the

sky. Each type of fighting required special "weapons of war". This film documents the role of advanced American military weapons in Vietnam. The footage of firepower has never been matched anywhere on a video cassette.

NE 7636 98 Minutes \$29.95

NE 7636

■ WildBlue Yonder

The United States Air Force Story. The story of the American "Flyboys" from the first war-plane in 1909 is vividly told in

this fascinating program.

MP 1184 45 Minutes \$29.95

■ 75th Year of **Naval Aviation**

Made in cooperation with the US Navy, in this tape you'll see spectacular flight demos by the AV-8 Harrier, A-10's, F-14's and F-15's. Also included is the final public performance of the Blue Angels in the A-4. One fantastic tape to add to your collection!

110 Minutes

\$39.95

Advantage Hornet

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ST 6010 62 Minutes \$59.95



■ The MiG-29 "Fulcrum"

Here it is, recently declassified, this formerly TOP SECRET footage was taken as part of a covert photo mission by daring Finnish cameramen. This is a close look at the all-new Soviet counter & air jet fighter. Combined with this exciting new program is a hard-hitting cockpit view of the state of the art F/A-18. Two superb fighting, flying machines for your collection!

FG 9100 30 Minutes

Falklands: Task Force South

Shot aboard the British flagship, this video documents the British defenses of the Falkland Islands during the Argentine invasion.

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aeroplanes, wherever they are built which was the point of my comments on "buying American"—and perish all forms of protectionism and prejudice!

> John W. R. Taylor Surbiton, Surrey United Kingdom

Wide Load

Bob Stevens's "There I Was..." on the B-36 hit home (April '88 issue, p. 120). Although I didn't know what a "Peacemaker" was until about 1980, I've developed quite a feeling for the critters, which still are the combat planes with the greatest wingspan ever flown (so far as I can tell).

I volunteer at the Pima Air Museum in Tucson, Ariz., and one of the most heartbreaking pictures I've seen is one of acres of B-36s stored at Davis-Monthan AFB. They were gone by 1962, and no one started working on the Museum until 1966, so we missed out on displaying one.

My fiancée is at Offutt AFB, Neb., home of the SAC Museum. The running gag is that when I come to marry her, I'm bringing a very large trailer hitch.

MSgt. Geoff Brown, USAF Tucson, Ariz.

Fred Castle

I enjoyed John L. Frisbee's "Valor" article, "The Quiet Hero" (March '88 issue, p. 107). It was a fitting tribute.

We in the New Jersey National Guard are proud of the fact that General Castle served in the New Jersey Guard from October 1924 to June 1926, where he launched his illustrious career in the service of his country. He was discharged for the purpose of accepting an appointment to the US Military Academy.

He was also a member of the New York Guard's 102d Observation Squadron prior to the start of World War II. I remember several flights that I made with him in an O-38 from Miller Field on Staten Island in New York. He was an outstanding pilot and officer.

Readers might like to know that General Castle was to be inducted posthumously into the Aviation Hall of Fame and Museum on May 17, 1988.

Mr. Frisbee's article brought great tribute to General Castle.

Col. Louis R. Vocino, NJANG (Ret.) Hamilton Square, N. J.

The Retention Solution

Retention—it's simple! When will you ever learn?

The Air Force, like every other large organization, will never learn one basic fact—leaders and supervisors are born with this talent. You can't make a leader out of every up-and-coming officer or NCO. If the person is the best technician, pilot, or whatever, leave him be. Pay him for his talents. Let him do what he's best at. Don't try to make him into something he was never intended to be.

The attitude for promotion that we have now only perpetuates the "Peter Principle." This leads to incompetent leaders who force the best technicians, pilots, etc., out of the service. Wake up! . . .

Pay people for their talents, and you'll have a stable situation. You'll also reduce the ridiculous number of generals that we now have. Oops! I did it. Now all those ridiculous generals will never understand this simple solution. . . .

Art Caldwell Aurora, Colo.

Loss List

I am compiling a list of every US Air Force, Navy, and Marine Corps aircraft lost between January 1, 1946, and January 1, 1988. Rotorcraft and engineless aircraft are excluded from this list.

I have been involved with this ambitious project for quite some time, and although I already have more than 1,000 aircraft listed, the list is far from complete. (Air National Guard, Air Force Reserve, and Naval Reserve aircraft are included in the list.)

If any readers have any information regarding an aircraft lost during this time period, their assistance would be deeply appreciated. I will note any assistance when I publish this list in an abbreviated form for each of the services. Any material sent would be returned.

The listing is compiled according to the type of aircraft involved, the date, the location, the cause, pilot's name, and any fatalities.

Matt S. Johnes 415 Crooked Creek Rd. Hendersonville, N. C. 28739

350th Fighter Group

Were you with the 350th Fighter Group in Italy during the fall of 1944? Can you provide any first-person details or photos of the activities of the Brazilian Air Force P-47 squadron (1st Grupo de Caca) that was attached to the 350th from October 1944 to May 1945?

I am an aviation writer who would like to gather information on this Bra-

zilian outfit. I am especially looking for photos of aircraft markings and personnel.

If you can help, please drop a line to me at the address below.

Mike Minnich 39 Airdrie Rd. Toronto Ontario M4G 1L8 Canada

USAFE Units

I am preparing a book about USAFE and am looking for photos and information from personnel who worked on Martin B-57s with the 38th Bomb Wing at Laon AB, France, from 1955 to 1958 and who served with the 10th Tactical Reconnaissance Wing at Spangdahlem AB, Germany, from 1954 to 1957.

All material loaned will be treated with care and returned.

R. M. Robinson 37 Home Farm Rd. Houghton, Huntingdon Cambridgeshire PE17 2BN United Kingdom

Westover Jeeps

I am trying to locate any pictures from 1942–45 showing the vehicle markings on any Jeeps that were assigned to Westover Field at Chicopee, Mass. I have a restored 1945-model Jeep that would be used for open houses and reunions at Westover AFB.

All pictures will be returned. Please contact me at the address below.

CMSgt. Robert C. Adams III, USAFR 42d APS

Westover AFB, Mass. 01022-5000 Phone: (413) 527-5788

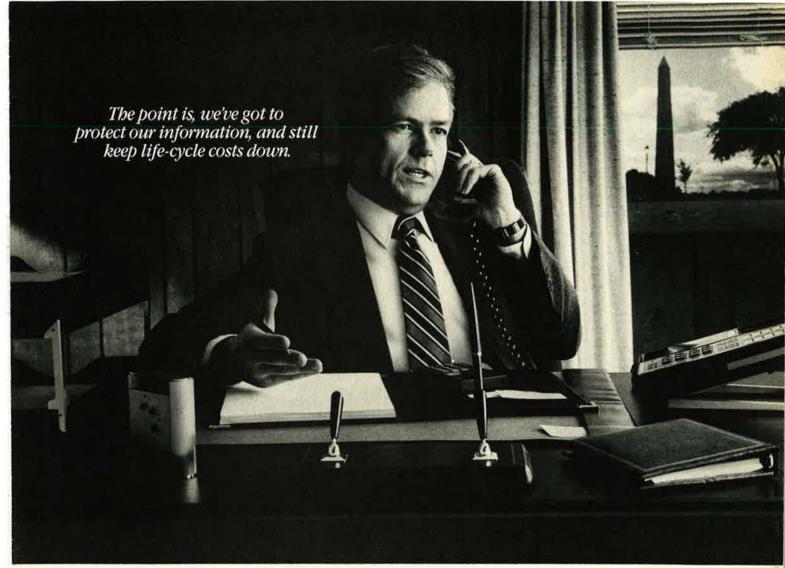
48th TFW

I am the RAF Lakenheath Project Warrior officer, responsible for bettering the understanding of our base by cultivating an awareness of our military past. My purpose in writing is to contact former members of the 48th Tactical Fighter Wing who served either in France after World War II or here in England after the wing moved to RAF Lakenheath.

I would be grateful for any information readers might provide on our wing history. Although I haven't anything specific in mind, I was hoping to obtain photos or patches for a permanent display for the base.

Please contact me at the address below.

Capt. Charles G. Wenko, USAF Project Warrior Officer Hq. 48th CSG APO New York 09179-5000



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For more information, call AT&T at 1 800 262-3787. (NC residents call collect: 919 279-3411.) © 1988 AT&T





Airmail

Air Traffic Controllers

I hope to compile a record of the outstanding work done by air traffic controllers and other personnel who manned Airways and Air Communications Service facilities from Army Air Corps days through MATS service command days on to major command status and to the present day.

Of particular interest are air traffic control "saves" (pilot descriptions welcome), unusual anecdotes, and personal remembrances that would appeal to all readers. Input received will not be returned.

Please contact me at the address below.

Lt. Col. John R. Reynolds, USAF (Ret.) 1128 291st St., S. Roy, Wash. 98580

Russian Aviation

I am currently working on a project for a four-volume survey of Russian and Soviet aviation. I am in need of photographs, data, and historical items on Russian and Soviet aircraft (all types) from 1914 to the present. I have exhausted all public sources, so I must turn to private sources.

Any loaned items will be copied and the original returned. Please indicate if a credit line is necessary. Readers can contact me at the address below.

> Capt. Geo. John Geiger, USAF (Ret.) P. O. Box 11616 Capitol Station Columbia, S. C. 29211

Phone: (803) 256-1041

Collectors' Corner

I am a former F-105 engine technician who is seeking flight suit patches from Thailand-based Thud units for the period 1967–70. I am especially interested in wing, squadron, River Rat, Yankee Air Pirate, SAM Slayer, and "100 Missions, North Vietnam, F-105" patches.

Anyone who can help is asked to contact me at the address below.

MSgt. James B. Walker, Jr., USAF (Ret.) 888 Woodhill Rd. Dayton, Ohio 45431 c: (513) 253-0498

Phone: (513) 253-0498 AUTOVON: 986-6513

I recently acquired a collection of thirty different aeronautical charts dated from June 1943 through June 1945. Most are sectional or regional charts of the southwestern and southcentral US. All are in very fine condition.

I would like to trade these maps for



solid-wood scale model aircraft kits or World War II ID materials.

Raymond W. Scheetz 1007 N. 30th Ave. Hattiesburg, Miss. 39401

I would be interested in hearing from anyone who collects aircraft/ missile/space photographs concerning current and historical projects. In addition, I would like to hear from anyone involved with the building and launching of model rockets.

Please contact me at the address below.

Herb Desind 9605 Armistead Rd. Silver Spring, Md. 20903

I am a security policeman assigned to the 3d Law Enforcement Squadron, Clark AB, Philippines. I am starting a collection of patches of security police units assigned to active-duty, Guard, and Reserve units.

I would appreciate the donation of



Airmail

any such patches that readers might have.

TSgt. Robert J. Thomas, USAF PSC 1, Box 6039 APO San Francisco 96286

I am a World War II veteran who served with the 13th Air Force in the South Pacific during 1943 and 1944. I am in need of a 13th Air Force shoulder patch.

Anyone knowing where I might locate such a patch is asked to contact me at the address below.

> Ottis C. Berry P. O. Box 718 Cherry Hill, N. J. 08003

Phone: (609) 784-6220

Roll Call

I am trying to locate Capt. Charles C. Candelaria, who was with the 22d Fighter-Bomber Squadron, 36th Fighter-Bomber Wing, at Fürstenfeldbruck AB, Germany, in 1950–51. He pulled duty as a supply officer.

He was later assigned to the headquarters squadron of the 31st SFW at Turner AFB, Ga., in 1956.

Any aid from readers in helping me to locate my friend would be appreciated.

John J. Schurman 5 Roosevelt St. Maynard, Mass. 01754

Phone: (617) 897-4718

I am anxious to learn if anyone out there can tell me the whereabouts of the other members of my crew. We flew in a B-17 named Hells Belle, sister ship to the Memphis Belle (so we were told), and were stationed at Bassingbourn, England, in 1943 as part of the 401st Bomb Squadron, 91st Bomb Group.

My crew members include Charles Guinn, Kenneth Fallek, Robert Hornbeck, Sidney Edelstein, Harold Wingate, Bert Stieler, William Rasmussen, Charles Dyer, and John Hinda.

If anyone can help me, I can be reached at the address below.

Gerald McDowell 1122 Vilsmeier Rd. Lansdale, Pa. 19446

I am attempting to find a Maj. Bernard A. Bergman, who served during World War II in the Personal Narrative Office of the Army Air Forces.

Major Bergman was sent to Memphis during the war to meet with William Faulkner, later a Nobel Laureate. They were to discuss the possibility of Faulkner writing a book on Air Force operations overseas. The meeting, AFA's
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held April 20, 1945, was "inconclusive," according to Faulkner anthologist Joseph Blotner.

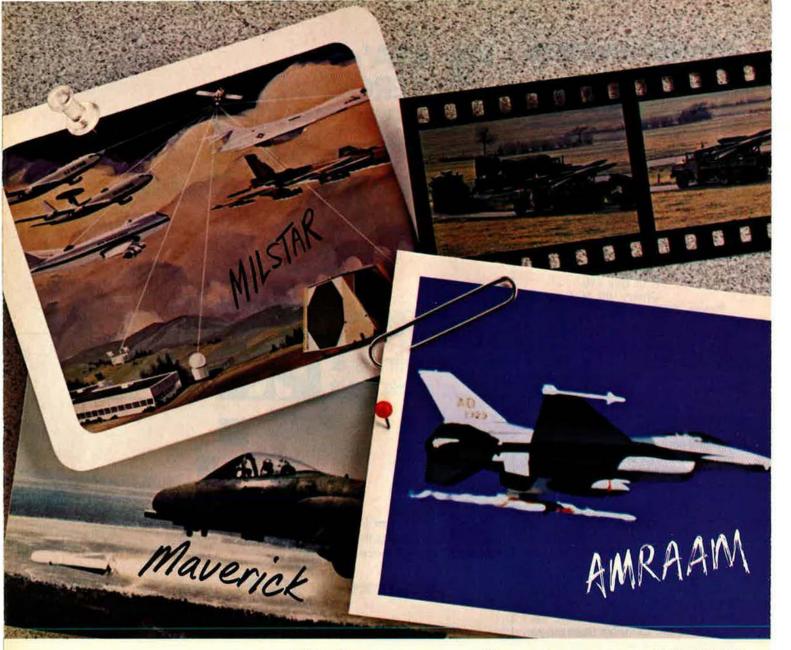
Anyone who knows anything about this meeting or about the present-day whereabouts of Major Bergman is asked to contact me at the address below.

Lt. Col. Jesse R. Core III, USAFR (Ret.) 1315 Milan St.

New Orleans, La. 70115 Phone: (504) 897-1920 I am trying to locate anyone who knew my father, Preston McKart, a B-24 navigator at Manduria, Italy, with the 720th Bomb Squadron, 450th Bomb Group, in April 1944.

He died of injuries on May 1, 1944, on a liferaft in the Mediterranean Sea. I would especially like to establish contact with any of the nine surviving crew members.

Jack McKart 737 Ridge Ave. Evanston, III. 60202



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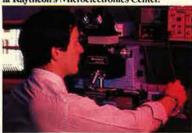


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For more information, write: Raytheon Company, Government Marketing, 141 Spring Street, Lexington, MA 02173.

A technician works with automatic equipment at Raytheon's Microelectronics Center.



Raytheon

Washington Watch

The Uncertain Lifeline

By John T. Correll, EDITOR IN CHIEF

The defense industrial base issue is hot again. The US has no real capacity for wartime mobilization or surge—and is increasingly reliant on foreign suppliers for critical systems components.



Washington, D. C. After many years of neglect and abuse, the defense industrial base has finally sunk to the point that the Administration and Congress can no longer ignore the problem. It

emerged as a major issue recently when the realization set in that other countries are overtaking us in high-technology manufacturing, that domestic industry is losing defense business, and that the US is rapidly becoming dependent on foreign suppliers for critical military items.

"There is no doubt that we are today more dependent on foreign sources for critical components in our weapon systems than we have ever been before," says Sen. Jeff Bingaman (D-N. M.), whose Senate Armed Services subcommittee is investigating the defense industrial base and related trade policies. "That is largely the result of the increasing internationalization of high-technology and other defense-related industries over the past forty years."

In his FY '89 report to Congress, Secretary of Defense Frank C. Carlucci said that "we are continuously assessing our vulnerability to foreign dependency for critical items. Through these efforts, we have identified problems in the machine tool and electronic areas and are highly concerned with the situations developing in the precision optics and bearings industries."

The Pentagon admits that the US advantage in military trade is dropping, but says that sales are still

ahead of purchases. "Our declining defense trade balance is not attributable to increased defense imports but rather to a loss of international market share," Dr. Robert B. Costello, Under Secretary of Defense for Acquisition, told Congress March 29.

Senator Bingaman says that "foreign military sales by American companies have been halved from 1980 to 1986, going from \$14.8 billion to \$7.1 billion. Our defense trade balance with NATO has gone from a high of 4.8:1 down to 1.6:1 during the last five years, and those figures do not take into account nondefense offsets to which our firms must agree to gain market access."

The net export value of military sales is often negated by such "off-set" agreements. These are side arrangements—perhaps unrelated to the main sale—that require some industrial or commercial compensation as part of the package deal.

"Offsets have increased in the last decade from fifty to 160 percent of the value of the sale," says Sen. Alan J. Dixon (D-III.). "I believe that setting up a marketing system for hams or foreign cars or promoting tourism for a foreign country has no place in the sale of weapons."

Far more serious, Senator Dixon says, is that "US firms have transferred technology to foreign governments used to develop critical defense systems as part of offset arrangements." Thus fortified, foreign suppliers are better able to compete against US companies in the world market.

"A number of our allies are now competing against us using technology developed in the US," Senator Dixon says.

Surge Capability Slim

These new aspects of the problem come on top of older ones that have worried the defense community for a long time. A steady parade of Pentagon reports, confirmed in 1980 by congressional inquiry, warned that US industry could not expand its production to meet a wartime mobilization in less than eighteen months. It is

not possible to surge the output of even the most important weapons and war materiel much faster than that.

Gen. Robert T. Marsh, USAF (Ret.), Chairman of AFA's Science and Technology Committee, has participated in numerous surge studies conducted by the Air Force. In most cases, he says, the finding was "that all you could really do by way of surge was sort of empty the pipeline. You could push a little faster, up your rates a little bit for things that were already in the pipeline. Then came the big dip, twelve to twenty-four months while the lower-tier [supplier and subcontractor] surging took effect."

Moreover, General Marsh says, the surge studies typically have a built-in weakness. They examine only one weapon system at a time. "We never could figure the intersections," he says. "If you're surging AWACS radars and surging Phoenix missiles, we don't know the extent to which they're depending on the same guys for the same critical components."

The shortage of such suppliers has long been recognized as a major industrial-base deficiency. Half of the small specialty firms that once supplied high-technology parts to the prime systems contractors have either disappeared or left defense work. The chain of suppliers often reaches down for four or five levels. Neither the Defense Department nor the prime contractor know who all of the suppliers are—or how many of them are foreign.

According to a March 24 report by Tim Carrington in *The Wall Street Journal*, "Pentagon strategists recently discovered that if war broke out, Soviet bombers could gravely wound the [United States] simply by attacking a small German plant thirty miles west of the Czechoslovakian border.

"The plant makes all of the highpurity silicon the US buys for chips in thousands of missile guidance systems. Destruction of the plant would stall US missile production for months, crippling the West's capacity to resupply its forces with missiles."

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Paler, Business Development, Defense Systems
Division-Akron, 1210 Massillon Road, Akron,
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Loral has developed Weapons Systems Trainers for the sophisticated F-15E fighter.





Loral's F-15 training system represents state-of-the-art technology for tactical aircraft simulation.

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Loral's F-15E development facility allows testing of hardware and software for mission simulation into the '90s and beyond.

In response to a query from AIR FORCE Magazine, the Defense Department confirmed Mr. Carrington's report, but said that steps are being taken now to correct the situation.

A task force of the Defense Science Board concluded last year that the next generation of advanced semiconductor chips will probably be made by Japan, not the US. If so, the United States in the 1990s will either buy foreign semiconductors or settle for second best in its weapon systems.

Thus the armed forces are not only unable to count on domestic industry for mobilization but are also becoming increasingly dependent on overseas sources to meet their needs in peacetime.

"Buy American" Lawsuit

In a lawsuit filed April 8, the National Council for Industrial Defense accuses the Pentagon of granting blanket waivers to the Buy American Act without fully considering the consequences. It says that in pushing offshore procurements, a "staff of international advocates" in the Defense Department not only hurts domestic

manufacturing and technological leadership but also leaves the US dependent on plants and facilities that are "within easy bombing range of the Soviet Air Force."

This newly formed lobbying organization claims a membership of 5,200,000, mostly drawn from defense supplier and subcontractor firms and several AFL-CIO labor unions, but says it is "not anxious to reveal the names of member companies" for fear that reprisals might be taken against them.

In its aggressive and rather flamboyant attack, the Council charges that a "buy foreign" policy causes "a dangerous weakening of the US defense industrial base, particularly at the second- and third-tier subcontractor levels."

These are the levels that most frequently lose business because of offset concessions.

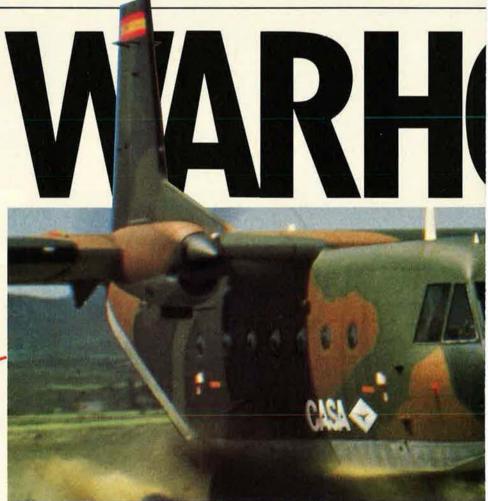
The main objective of the lawsuit is "to compel the Department of Defense to comply with those laws that are intended to preserve our industrial base by giving a preference to the procurement of American-made defense products."

How Much Independence?

Opinions differ about the extent to which the United States can or should aspire to independence in its defense industrial base. The question is one of degree. Virtually no one who has studied the problem thinks the US could afford to rebuild a World War II style "Arsenal of Democracy." Another consideration is allied cooperation.

A recurring complaint of the allies about arms standardization is that, traditionally, the US has always sold weapons to the Europeans but never bought anything much from them. They called for the establishment of a "two-way street" in military sales. Congress and the Defense Department have put special emphasis on cooperative research and development the past few years.

"Our national security needs cannot readily be met with US resources alone," Dr. Costello said in his statement to Congress. "We must cooperate with our allies to reduce wasteful duplication of development efforts, to promote commonality and interoperability among US and allied forces, and to achieve urgently needed econ-



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omies of scale throughout the acquisition and logistics cycles. Our domestic industrial base is critically important, but we must not allow ourselves to use this issue as a shroud for protectionism."

Secretary Carlucci testified that "national weapons programs have led to the deployment of six types of main battle tanks, six types of fighter aircraft, and a plethora of antitank missiles and armored vehicles within NATO." He added that "we project our investment in cooperative programs will increase from the current three percent of research, development, test, and evaluation [RDT&E] resources to twenty-five percent by the year 2000."

Senator Bingaman acknowledges the value of allied cooperation and has supported collaborative development and production. He says, though, that "while such programs help us in making the best use of the Alliance's limited resources for defense, they inevitably increase our foreign dependency." He further points out that allied governments practice protectionism regularly.

The United States, Senator Bingaman contends, has not been "as vigorous in pursuing US economic interests as our allies have been in pursu-

ing their own. Our allies seem better able to recognize that while we are political and military allies, we are also economic rivals."

How We Got Here

As the issue heats up, questions arise about how the US defense industrial base could have deteriorated to its present state. There is no single or simple answer. And the trouble has been developing for a long time.

First, there have been big changes in the makeup of industry, both in the United States and internationally. Heavy "smokestack" industries have declined in economic importance as high technology has moved to the forefront. The United States is no longer so dominant as it once was in the global business arena. More and more, commercial interests and interdependencies cross national boundaries. Technological advancement, especially in electronics, has created an enormous demand for high-technology consumer products. For example, the US armed forces, once the primary customers of the semiconductor industry, currently buy just three percent of the total quantity produced.

Commercial and consumer sales now drive the technical product mar-

ket. Suppliers have followed the shift in the market. They also found that their commercial lines gave them better profits, more stability, and less trouble than defense work. Meanwhile, ironically, these widget makers were becoming more important to defense. Between 1950 and 1980, the share of defense work sublet by prime contractors increased from nine percent to forty-one percent. One of the most intense areas of subcontracting is electronics—which is also the main pillar of technical superiority in modern weapon systems.

According to the Defense Science Board, the growing Japanese advantage in semiconductors is chiefly a result of their better ability to produce these chips in large quantities at very low cost.

A number of people, General Marsh among them, believe that stunted productivity may be the most fundamental problem of all with the US defense industrial base. Defense contractors have not invested in capital improvements that would have made them more productive and efficient.

"The defense industry suffers from insufficient capital investment, resulting in excessive touch labor and hence less than desired quality and productivity," General Marsh said in

DRSE



After a million hours' operation, the C-212 M today is more than ever what a tough military machine needs to be.

The C-212 is operated by 19 different Armed Forces. The US Drug Enforcement Agency chose it to fight drug traffic in the toughest jungle conditions. For maritime patrols, antisubmarine missions or commando transport,

it is battle-tested to perform the toughest tasks under the toughest conditions.

Its unique ability to operate

with its rear cargo-ramp door open means it can transport longer loads. Or carry out LAPES missions.

The new C-212 M hauls a bigger payload, has improved electric and hydraulic systems and a longer range.

It's the born-tough transport that's got what it takes. When you really need it.

Technical Characteristics:

Max. takeoff weight: 8,000 Kg. (17,637 lb.).
Max. landing weight: 7,450 Kg. (16,424 lb.).
Max. zero fuel weight: 7,100 Kg. (15,653 lb.).
Max. payload: 2,820 Kg. (6,217 lb.).
Max. range: 1,582 Km. (854 MN).
Armament capacity: 500 Kg. (1,100 lb.).



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Everything it will take to get his budget passed through the top brass. Well, you'd have thought he'd been given a Presidential Citation or something..."

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testimony to a Senate subcommittee on March 30. "This in turn leads to unduly high costs and reduced international competitiveness. These weaknesses exist throughout the prime and lower tiers of the industry. A perplexing characteristic of the defense industrial base is an overcapacity in a number of areas at the prime supplier level but a shortage of qualified suppliers for many critical materials and components in the lower tiers."

Failure of defense industry to modernize is a problem with multiple roots of its own. Economists have been lecturing for years about the proclivity of American business in general to emphasize short-term profits over long-range development. In the semiconductor industry, stock is traded at a breakneck pace, the volume of turnover being equal to a complete exchange in ownership every six to nine months. Management is under pressure from investors who want their earnings quickly.

Harsh Policies Hurt

Part of the fault, however, lies in the way the government has structured incentives and disincentives for business. The defense industry-unpopular with the public and perceived widely as a threatening "military-industrial complex"-has been treated more harshly than most.

A February 1988 study published on behalf of the Aerospace Industries Association, the Electronic Industries Association, and the National Security Industrial Association examines the effect of policy changes from 1984 to 1987 on capital formation in defense industry.

"Business is fundamentally about risks and returns," the study says. "As essentially the only purchaser of highly specialized defense equipment, DoD controls both sides of the risk/return balance (at least for major systems procurement). In the period we have examined, DoD and Congress decided to adjust what was viewed as an imbalanced risk-return relationship. Unfortunately, it reduced rewards and increased risks simultaneously, with not one but multiple uncoordinated adjustments. At the same time, Congress significantly increased the industry's capital requirements (by reducing progress payments and deferred tax financing).

"While some in DoD now claim industry is much more like commercial industry, Wall Street is saying it will not provide it with capital at the same rate as commercial industry. Wall

Street might provide the capital if it saw the opportunity for high returns (as it does for biotechnical companies, for example); the industry might live with the low profits if the government provided more of the financing and did away with cost-sharing, fixedprice development, and other unreasonable risks. But, as matters currently stand, the government has stepped out, Wall Street is unwilling to step in, and the industry is unable to.

It is not only the large prime contractors who feel the government has been clumsy in its use of carrots and sticks. Dennis M. Biety testified to the Senate Armed Services Committee on March 30 for Pneumo Abex Corp., a first-tier supplier of hydraulic subsystems. He said that his firm, which does about half of its business in military sales, is typical of the subcontractor base.

Mr. Biety said that suppliers and contractors see DoD as chasing short-term savings with policies that would be counterproductive in the long run. He said that firms at his tier are finding it "increasingly inadvisable to invest in the development of advanced technology or manufacturing capability for defense systems."

Proposals and Solutions

The Pentagon, Congress, and industry are all hacking away at parts of the problem.

Centerpiece of the effort to regain US competitiveness in semiconductors is Sematech, an industry consortium that just opened its permanent headquarters in Austin, Tex. It will work on improved equipment, materials, and techniques for semiconductor manufacturing, not on the design of chips. It was production ability that enabled Japan to overtake the United States in the semiconductor market in the early 1980s.

Sematech will not emphasize military applications in its research, pointing out that defense consumption of semiconductors is a small share of the total. The Defense Department says that its role in Sematech has not been decided yet. The guiding idea at Sematech seems to be that the proper way to help defense is to restore the domestic semiconductor industry to a strong position in the commercial market.

Target financing for Sematech is \$1.5 billion over six years, with \$600 million of that coming from the federal government and member companies paying most of the remainder.

The Pentagon's own Manufacturing

Technology (ManTech) and Industrial Modernization Incentives Program (IMIP) are older and broader initiatives that share with industry the cost of upgrading the defense production base. There have been some successes, notably in assembly, castings, forgings, and factory automation. The Air Force is the only service that has shown real interest in ManTech, though. Funding has been modest. and industry has been reluctant to make capital investments to improve productivity.

Legislative actions are also pending. Senators Bingaman and Dixon. along with Sen. Phil Gramm (R-Tex.) and Sen. Timothy Wirth (D-Colo.), are sponsoring the Defense Industry and Technology Act of 1988. It would reweight the balance among risk, reward, and profit in defense procurement in a way that is more favorable to

industry

The Defense Department has already backed away from the use of fixed-priced contracts on development programs for which the outcome is but dimly foreseen. Acquisition officials have also seen their error in forcing contractors to pay big portions of the R&D cost on high-risk developments even though the production award might go to a different contractor or the product might never be built. Part of this was a realization that the policy was unfair. Perhaps more motivating, though, was the discovery that contractors were refusing to bid on losing propositions.

In April, Senator Dixon introduced an amended version of his Defense Industrial Base Preservation Act. which he says "would eventually eliminate the growing number of offset arrangements." He concedes that "earlier drafts were protectionist in nature," but claims the revision "does not close the door to our friends and

allies overseas.'

At best, these measures might ameliorate the defense industrial base problem. They would not solve it. Even if all of the proposals were adopted immediately, the United States would still lack the capacity for wartime mobilization and surge. It would still depend—to an unknown extent-on foreign suppliers. Commercial demand would continue to drive the high-technology market.

The most encouraging sign is that concern about the defense industrial base is spreading. If the public, Congress, and Administration officials stay worried enough for long enough, the United States may slowly work out of the hole it has dug itself into.

The Chart Page

Defense Posture at a Glance

Edited by Colleen A. Bollard, STAFF EDITOR

The Pentagon defines military capability as consisting of four "pillars"—force structure, modernization, readiness, and sustainability. By all of these measures, the defense posture of the United States improved steadily in the 1980s,

filling in the gaps and shortfalls of the 1970s. Now, though, defense budgets are being cut back severely. The services are faced with holding onto as much capability as they can with declining resources.

	Maj	or Strategic	Systems			
	FY '80	FY '84	FY '86	FY '87	FY '88	FY '89
Land-Based ICBMs						
Titan	52	32	7	-	_	-
Minuteman	1,000	1,000	998	973	954	950
Peacekeeper	_	-	2	27	46	50
Strategic Bombers						
B-52D	75	11.00 mg/11.00	_	_	_	_
B-52G/H	241	241	241	234	234	234
B-1B		- 1 T	18	58	90	90
FB-111A	56	56	56	52	48	48
Fleet Ballistic Launchers (SLBMs	s)					
Polaris	80		_	_	_	-
Poseidon (C3 and C4)	336	384	320	336	368	400
Trident	= =	72	144	192	192	192
Strategic Defense Interceptors						
Active Duty	127	90	76	54	36	36
Air National Guard	165	162	198	195	216	216
Primary Aircraft Authorized						

Airlift and Sealift Assets						
	FY '80	FY '84	FY '86	FY '87	FY '88	FY '8
Intertheater Airlift						
C-5A	70	70	66	66	66	6
C-5B	_	_	5	14	32	4
C-141	234	234	234	234	234	23
KC-10A	, -	25	48	57	57	5
C-17	-	3	_	-	- "	4
Intratheater Airlift						
Air Force						
C-130	482	520	504	559	521	51
C-123	64			-		1 -1 -
C-7A	48	1 - A - A - A - A - A - A - A - A - A -		T	W 7 - I	- 1
Navy and Marine Corps						
Tactical Support	97	85	88	88	92	9
Sealift Ships, Active						
Tankers	21	21	24	20	20	2
Cargo	23	30	40	41	41	4
Reserve**	26	106	122	135	144	15



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Several generations of DMSP spacecraft have passed through our design and manufacturing facilities — each generation building on experience and increasing system effectiveness through inclusion of fail-safe modes in redundant on-board processing units, increased autonomy

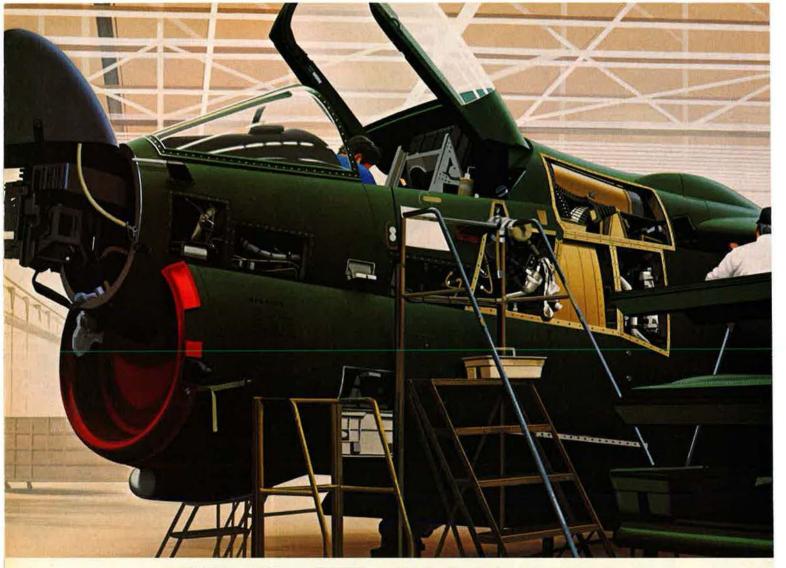
and pointing accuracy and improved survivability. With sophisticated system engineering and management skills we have crafted an exceptionally flexible configuration which effectively houses varying sets of payloads from mission to mission.

Through the production of 25 launched DMSP satellites, our DMSP team has met all budget, schedule and mission demands. These achievements have enabled an on-orbit performance record for which we are justifiably proud. The DMSP program demonstrates the dynamic, dependable results of contractor commitment and responsiveness to customer.

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years of experience as one of the nation's leading aircraft manufacturers.

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Aircraft Products Group

Aircraft Modernization and Support Division

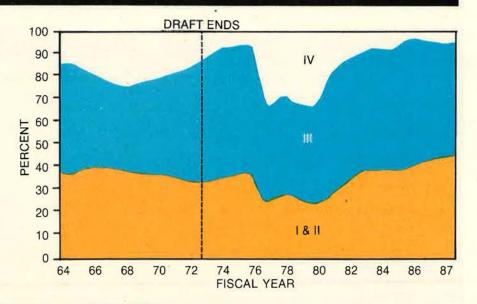
	The Ev	The Evolution of Tactical Forces					
	FY '80	FY '84	FY '86	FY '87	FY '88	FY '89	
Army Divisions							
Active Reserve	16 8	16 8	18 10	18 10	18 10	18 10	
Marine Corps Divisions							
Active	3	3	3	3	3	3	
Reserve	1	1	1	1	1	3 1	
Air Force Attack/Fighter Aircraft							
Active	1,608	1,734	1,764	1,812	1,762	1,746	
Reserve	758	852	876	900	894	876	
Navy Attack/Fighter Aircraft							
Active	696	616	758	752	758	792	
Reserve	120	75	107	101	120	118	
Marine Corps Attack/Fighter Aircraf	t						
Active	329	256	333	331	334	341	
Reserve	84	90	94	96	94	96	
Naval Forces							
Strategic Forces Ships	48	41	45	43	42	42	
Battle Forces Ships	384	425	437	445	439	443	
Support Forces Ships	41	46	55	58	61	65	
Reserve Forces Ships	6	12	18	22	28	30	
Total Deployable Battle Forces	479	524	555	568	570	580	
Other Reserve Forces Ships	44	24	21	21	20	18	

Mission-Capable Rates									
	FY '80	FY '82	FY '84	FY '86	FY '87	GOAL			
Army (FMC)									
Aircraft	66	68	71	75	76	75			
Fire Support Artillery	88	90	89	92	92	90			
Fire Support Missile Systems	91	96	94	96	97	90			
Tanks	86	87	87	85	85	90			
Combat/Combat Support									
Vehicles	88	85	88	89	90	90			
Navy and Marine Corps Aircraft (MC)								
Total Aircraft	59	63	70	74	73	73			
Fighter/Attack Aircraft	53	57	63	70	70	70			
Air Force (MC)									
Total Aircraft	66	67	71	78	80	75			
Fighter/Attack Aircraft	62	66	73	77	79	74			
Marine Corps (FMC)									
Artillery	88	86	89	84	94	85			
Missile Systems	94	93	92	88	89	85			
Tanks	86	88	87	86	83	85			
Combat Vehicles	84	82	82	81	89	85			

Equipment is rated "mission-capable" (MC) if it can perform one of its primary missions and "fully mission-capable" (FMC) when it can perform all of them. For single-mission ground force systems, only FMC is measured. The averages obscure the peak readiness of first-line combat units. USAF fighter squadrons, for example, often achieve FMC rates in the range of eighty-five to ninety percent.

Brighter Recruits

Only five percent of the recruits joining the armed forces today are in mental Category IV (the lowest) as measured by the Armed Forces Qualification Test. They are brighter than enlistees and draftees of the past—and also ahead of the general US youth population, thirty-one percent of which falls into Category IV. Last year, forty-one percent of the recruits scored in one of the two top mental categories.

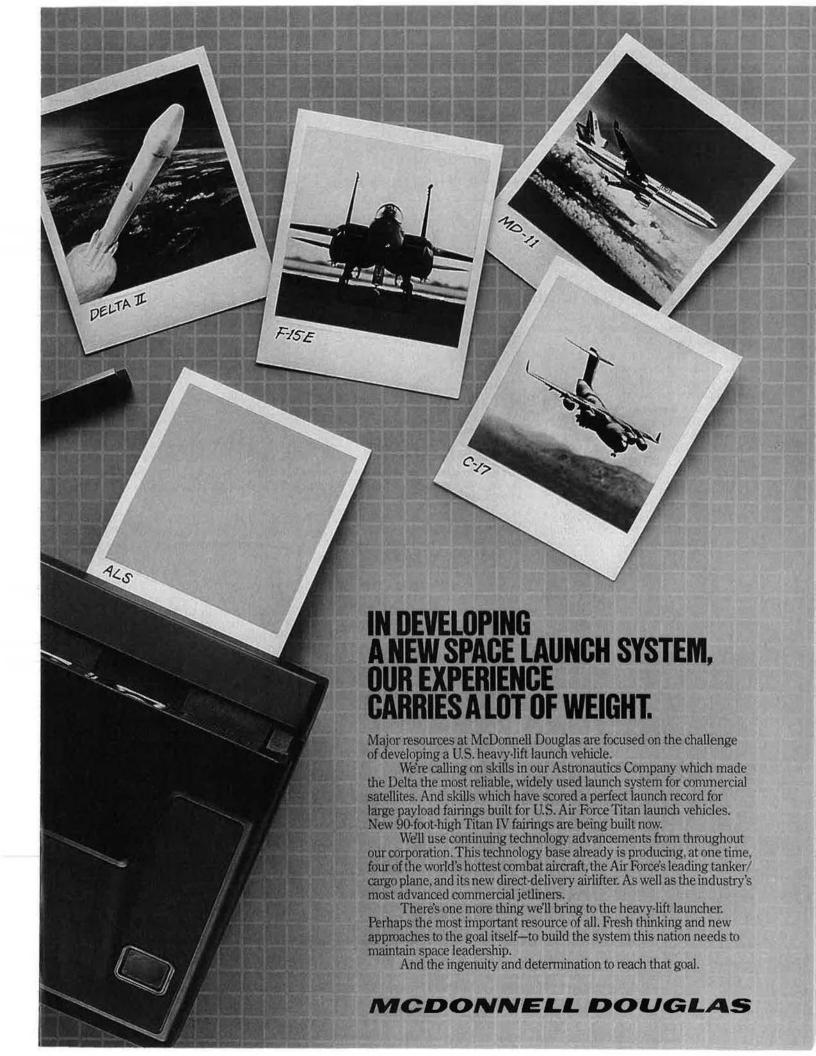


Lower Manpower Levels (Fiscal year end-strength in thousands)						
	FY '88	FY '89				
Military Active Duty						
Level originally planned Army reduction Navy reduction Marine Corps reduction Air Force reduction	2,172 -9 0 -2 -23	2,184 - 9 - 9 - 3 - 28				
Total Active-Duty Reductions	-34	- 46				
Level Now Planned	2,138	2,138				
Selected Reserves						
Original Plan Reductions	1,190 - 18	1,213 - 40				
Plan Now	1,172	1,173				
Civilians						
Original Plan Reductions	1,123 - 11	1,125 - 23				
Plan Now	1,112	1,102				

The wave of budget reductions last winter forced the Defense Department to cut back the manpower levels planned for in its original budget submission. At the end of FY '89, the active-duty military will be down 35,917 people since 1987. Civilian strength will be 30,884 below 1987. Planned growth in the Guard and Reserve has been slowed, but these forces will achieve a net gain of 22,045 over 1987.

	1110	.cpc c	f Training	9			
	ACTUAL					PROJECTED	
	FY '80	FY '84	FY '85	FY '86	FY '87	FY '88	FY '8
Flying Hours per Crew per Month							
Army Tactical	N/A	13.5	13.1	13.6	15.1	14.5	15.
Navy/Marine TacAir/ASW	24.5	25.0	24.9	25.0	24.9	24.9	24.
Air Force TacAir	15.6	19.1	19.0	18.8	19.5	18.2	19.
Air Force Strategic	18.1	18.2	18.2	17.3	18.2	17.1	17.
Steaming Days/Quarter							
Deployed Fleets	56.6	60.0	53.6	50.5	53.2	50.5	50.
Nondeployed Fleets	28.6	28.2	27.4	26.9	27.0	29.0	29
Army Tank Mileage per Tank per Year	_		850	830	800	725	85

In FY '89, the Defense Department will make sacrifices in other budget accounts to restore the operational tempo of training lost in the recent cuts. Army tank mileage figures for years before 1985 were not available.



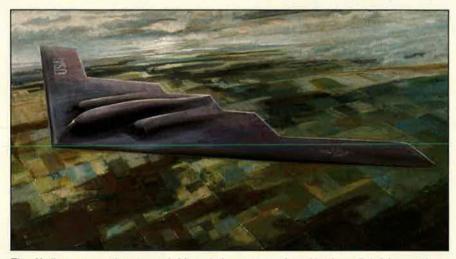
Aerospace World

By Jeffrey P. Rhodes, AERONAUTICS EDITOR

Washington, D. C. ★ After keeping it highly classified for many years, the Air Force has finally shed some light on its B-2 Advanced Technology Bomber (ATB) program. While revealing information on three major areas, the Air Force released few specifics about the Stealth bomber program in its April 20 announcement.

The first B-2 aircraft is apparently nearing the final assembly and checkout stage and is scheduled for a first flight sometime this fall. The aircraft will take off from Air Force Plant 42 in Palmdale, Calif., where Northrop (the plane's prime contractor) is building it, and fly to the Air Force Flight Test Center at Edwards AFB, Calif., where testing will be conducted.

It also appears that the B-2As will cost more than expected. The Air Force said that "[w]hile the acquisition of 132 B-2 bombers was originally estimated to cost \$36.6 billion (in FY '81 dollars), [the service] is reevaluating cost estimates for the program as a result of current and expected fiscal restraints. When that process is completed . . . [it] will release those figures." Estimates for the



The Air Force recently released this artist's concept of the Northrop B-2 Advanced Technology Bomber after keeping the program classified for many years. Few of the plane's details are discernible in this illustration.

program from outside sources now range to as high as \$50 billion.

The biggest revelation was an artist's concept of what the plane looks like. As long suspected, the B-2 is a flying wing. This shape is one of the major ways to reduce the plane's radar cross section (RCS), which will

allow the B-2 to penetrate Soviet airspace while avoiding detection. Its configuration also proves there is nothing new under the sun.

Northrop built both the XB-35 (a four-engine flying wing driven by counterrotating propellers) and the YB/YRB-49 (a wing powered by eight, and then six, jet engines) that flew in 1946 and 1947 respectively. The flying wing design was seen as being ahead of its time then, and the XB-35 and YB-49 both encountered many problems in flight. Only a handful of these airplanes was ever built. Both YB-49 prototypes eventually crashed.

The stability and control problems encountered in the earlier wings should be alleviated in the B-2 by the use of engines that have sufficient power (General Electric is building the B-2's engines, which are thought to be derivatives of the F101-GE-102 powerplants used in the B-1B) and through such advanced systems as fly-by-wire controls and high-speed computers. Similar systems are used in the F-16 (which, by design, is inherently unstable) to keep it flying correctly. This control stability is critical, because the B-2 (like the XB-35) does not have any vertical tail surfaces.

As can be seen in the accompanying illustration, the artist's concept reveals little about the B-2 other than its



Under a company-funded program, McDonnell Douglas Helicopter Co. has worked up a design for a naval variant of its AH-64 Apache attack helicopter. The basic Apache design will have to be changed significantly for this seagoing mission.

shape. Not shown are any control surfaces or engine exhaust ports, and such details as crew complement, bomb load, or size were not in the announcement.

The B-2's ability to evade radar also leads to another advantage. As Sen. Sam Nunn (D-Ga.), Chairman of the Senate Armed Services Committee, said, "When fielded, [the B-2] will provide a significant increase in our ability to place targets in the Soviet Union at risk. At the same time, it will render obsolete billions of dollars of Soviet investment in their current air defenses."

★ Under a proposal recently released by McDonnell Douglas Helicopter Co., the Army's AH-64 Apache attack helicopter could be given sea legs in order to perform several missions in support of the Navy's Surface Action Groups (SAGs).

The company claims that a modified Apache could significantly extend the area of surveillance for the SAG by loitering up to six hours at distances out to 200 nautical miles from the ships. It could also improve the SAG's targeting for over-the-horizon engagements. Closer to shore, the AH-64 crew could accurately spot for naval gunfire.

On the defensive side, detecting submarine or surface-launched cruise missile shots would provide *Ticonderoga*-class Aegis cruisers the opportunity to launch their defensive missiles on warning.

Since the helicopters would be armed, the naval AH-64s could alleviate some of the need for aircraft carriers to provide combat air patrol (CAP), they could provide escort for other helicopters in amphibious landing operations, and they could also provide outer air defense. Armed with antiship missiles, the Apaches could also go hunting up to 360 nm from the SAG.

The naval Apaches will differ significantly from their Army brethren. The naval AH-64s will have a wide-track retractable landing gear, the active-search APG-65 radar found on the F/A-18 Hornet, an infrared search and track (IRST) installation, passive electronic support measures (ESM), a retractable in-flight refueling probe, and provisions for carrying AGM-84 Harpoon or AGM-119 Penguin antiship missiles. Air-to-air capability could be provided by AIM-9 Sidewinder, AIM-7 Sparrow, or AIM-120 AMRAAM missiles.

The naval Apache would also have provisions for power folding of the main rotor blades and a folding tail boom. This would reduce the width of

the helicopter to eleven feet, allowing two AH-64s to be fitted into the hangar on a *Ticonderoga*-class cruiser. New "glass" cockpit instrumentation, saltwater and electromagnetic interference protection, and more comfortable crew seats would also be installed.

The Navy has expressed interest in this proposal, but under the current budget crunch, any follow-up developments will likely be delayed. McDonnell Douglas Helicopter reports that a naval Apache demonstrator aircraft could be readied by late 1989.

★ In recent testimony before the House Armed Services Committee, Lt. Gen. (Dr.) Murphy A. Chesney, the Air Force's Surgeon General, said that the Air Force's Medical Readiness Program (MRP) has come a long way

hospitals and civilian hospitals aligned with the National Disaster Medical System (NDMS) will provide hospital beds for 20,000 returning Air Force casualties unable to return to duty within sixty days of their injuries.

By prepositioning contingency hospitals, Dr. Chesney said that "the Air Force will have medical facilities available . . . for . . . the level of expected casualties, [and] we will conserve critical airlift resources . . . required to support combat operations." In 1978, cumulative investment in medical war reserve material (WRM) was \$17 million, but the value of those assets is expected to grow to more than \$450 million in the next few years.

Dr. Chesney reported that a portion of the Civil Reserve Air Fleet (CRAF) will be dedicated to medical airlift operations, and such rapid response



In late February, a fifty-two-knot wind gust destroyed a storage warehouse at Woensdrecht AB, the Netherlands. Members of the 486th Tactical Missile Wing, a ground-launched cruise missile unit, immediately pitched in to save more than \$1.5 million worth of security police supplies that were left exposed to the weather. Cleanup took the better part of a day.

since its inception in 1979, but there is still work to be done.

Dr. Chesney said that the state of the Air Force's medical readiness in 1979 was "grossly inadequate to meet the needs of existing operational plans." A major review of the MRP led to the foundation of the current program, which includes the availability of operational medical support to deploying combat forces, prepositioning of the larger contingency assets, and a medical concept of operations.

The Air Force adopted NATO's four echelon (4E) medical-care system for its concept of operations, in which patients are cared for and returned to duty or evacuated to the next level of care, where the process repeats. Stateside, Veterans Administration

teams as the USAFE Flying Ambulance Surgical Trauma Team (FAST) and the SAC Urgent Treatment Utility Response Element (SUTURE) have been established to respond to acts of terrorism, natural disasters, and other mass casualty situations.

"We forecast a requirement for more than 86,000 medical personnel," said Dr. Chesney. "With expected heavy combat casualties very early in the war, more than 55,000, or sixty-five percent, of those medical personnel must be available in active units, with the reserve providing the balance of our requirements.... [And] during wartime, medical personnel from the Air Force Reserve and Air National Guard will be mobilized and deployed to provide more

SAF photo by Sgt. R. H. Rosell

than ninety-seven percent of the US's worldwide aeromedical evacuation capability."

Dr. Chesney predicts that by the end of 1989, a manpower shortfall of just over 13,000 people, or seventeen percent of requirements, will exist. This shortfall has been reduced from the FY '80 level of nearly 31,000 people.

In conclusion, Dr. Chesney stated that "a workable concept of operations has been developed, and medical personnel are receiving good training for their wartime roles."

★ Some members of the 109th Tactical Airlift Group, an Air National Guard unit in Schenectady, N. Y., can literally say they have gone from one end of the world to the other.

Near the end of the "summer" season in late February, two of the unit's ski-equipped LC-130Hs were flown to McMurdo Sound in Antarctica, where the Navy and the National Science Foundation operate a facility. There the Guardsmen met up and flew missions with their counterparts from the Navy's LC-130H squadron, VXE-6, based at Point Mugu, Calif.

Antarctica from New Zealand, will be in for major overhauls then. The Guard aircraft and crews will be called in to fill the gap.

Once back from way down under, the 109th TAG was called in for a most unusual airlift to their usual stomping grounds up near the Arctic Circle.

Since the end of January, distemper, a disease that affects the central nervous system, has killed more than 700 dogs (about ninety percent of the canine population) near Thule AB. The Greenlanders depend on their dogs to get to and from hunting areas, so the canine shortage was critical.

On April 19 and 20, the 109th TAG's LC-130Hs were used to airlift 220 replacement dogs, 4,400 pounds of dog food, and seven Greenlandic dog handlers from Disko Bay in southern Greenland to Thule. The aircraft have also been used to airlift humanitarian food packages and snowmobiles for use by the villagers who had lost dogs to the epidemic.

★ The Air Force has ordered an offthe-shelf business jet to be used for tablish new ground navigational and air traffic control systems.

The \$70 million production contract was issued on April 8 by Air Force Systems Command's Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio, to LTV Missiles and Electronics Group's Sierra Research Division, Sierra Research will manufacture and integrate the computerized flight inspection consoles into the C-29s at its facility near Buffalo, N. Y. The C-29 airframe will be the British Aerospace 125-800 turbofan-powered jet, which is also one of the contenders for Air Training Command's Tanker, Transport Training System (TTTS) aircraft.

A \$400,000 contract was also issued for Contractor Logistics Support (CLS) for the aircraft. Garrett General Aviation Services Co. will provide the logistics support. The contract includes options until 1997.

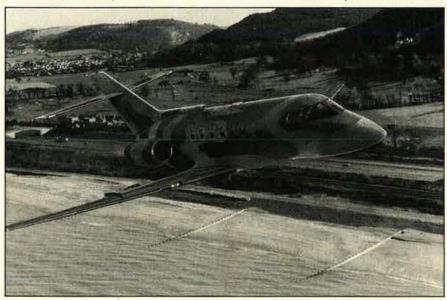
The first C-29A is expected to be delivered in June, and all deliveries are to be completed by March 1990. The six C-29As will replace two Rockwell CT-39 Sabreliners and four Lockheed C-140 JetStars in the C-FIN mission. The new aircraft will be assigned to Scott AFB, III., Rhein-Main AB, West Germany, and Yakota AB, Japan.

★ A lot of things have been happening in the world of missiles lately, and most are unrelated to each other. Here is a short rundown of what's been going on:

The first test launch of an AIM-120A Advanced Medium-Range Air-to-Air Missile (AMRAAM) using a live warhead was carried out on March 25. An F-16 from Air Force Systems Command's Armament Division at Eglin AFB, Fla., launched the AIM-120, which destroyed a QF-100 drone. This was the sixteenth direct hit in the test program and the forty-sixth success in fifty-five attempts overall. Hughes and Raytheon are building the AIM-120s.

On April 1, the Air Force cut \$999 million from seven full-scale development contracts for the Small Intercontinental Ballistic Missile (SICBM) program. The contracts totaled more than \$2 billion before the cuts.

Companies affected by the cuts and what they are under contract for are: Martin Marietta Astronautics, post-boost vehicle, shroud, and assembly and testing (\$100 million reduction) and system support (\$47 million); Aerojet Nevada Rocket Operations, second-stage rocket motor



The Air Force's Combat Flight Inspection and Navigation (C-FIN) mission will be taken over by six of these British Aerospace 125-800 business jets equipped with a 900-pound computerized flight-control panel made by LTV's Sierra Research Div. The new jets will be designated C-29A.

The Guardsmen, who have the job of hauling fuel and supplies to Distant Early Warning (DEW) line radar sites in Greenland, were at the bottom of the world for the first of a series of training missions to prepare the 109th TAG crews for search and rescue during the 1990–91 Antarctic winter season. Several of the Navy's LC-130s, which are used to airlift supplies into

checking and calibrating ground navigational systems at military bases.

The Combat Flight Inspection and Navigation (C-FIN) mission will be taken over by the new jets, which are to be designated C-29A. In addition to ensuring the ground systems are working properly, the flight inspection aircraft are used during crises and quick-reaction situations to es-

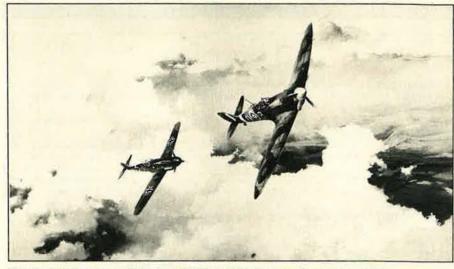
(\$72 million); Hercules Aerospace Production Group, third-stage rocket motor (\$72 million); Morton Thiokol's Strategic Operations Division, first-stage rocket motor (\$51 million); Boeing Aerospace, hard-mobile launcher (\$278 million); and Rockwell's Autonetics Division, guidance and control integration (a \$374 million reduction).

The Department of Defense has recommended terminating the SICBM program, but requested \$200 million in the FY '89 budget as a compromise to keep the program going until its fate can be decided by the next administration.

The lead-acid batteries used for backup electrical power in LGM-30 Minuteman ICBM silos will be replaced with longer-lasting lithium batteries. Twelve of the batteries (each of which has a shelf life of ten years) are needed in each launch facility. The change will affect 150 sites around Grand Forks AFB, N. D., fifty sites around Malmstrom AFB, Mont., and a number of sites around F. E. Warren AFB, Wyo.

Responsibility for two more aspects of the LGM-118A Peacekeeper ICBM—missile transportation and handling equipment—has been transferred to the Ogden Air Logistics Center at Hill AFB, Utah. Transfer of launch canister responsibility to Ogden ALC is expected soon. Eventually all responsibility for the Peacekeepers will be divided among several center directorates.

The Northrop AGM-136A Tacit Rainbow loitering antiradar missile



The works of British artist Robert Taylor are the feature of a one-man show, "Horizons," at the Smithsonian's National Air and Space Museum. This piece, entitled "Duel of Eagles," depicts a 1940 aerial combat scene between Luftwaffe ace Adolf Galland and RAF ace Sir Douglas Bader. The show lasts until April 1989.

successfully destroyed an active radar emitter on April 12. After the test missile was launched from a Navy A-6E Intruder, it followed a preprogrammed flight path, automatically loitered for an unspecified period of time, identified, and then attacked the emitter. The test was the first of three flights to certify that Northrop's quality control problems with the missile have been solved. After further test launches from A-6s and Air Force B-52s, a low-rate initial production decision is expected in FY '89.

The Navy's Lockheed UGM-133A Trident II, or D5, missile program recorded its ninth success in ten attempts on April 7. The sea-launched ballistic missile was launched from a flat pad at Cape Canaveral AFS, Fla., and impacted on the Eastern Test Range in the Atlantic. The January 21 test failure has been attributed to an electrical problem. The Navy also announced that all future D5 tests would be conducted with eight or fewer reentry vehicles so that the missile will be counted at that number of warheads under the provisions of the unratified SALT II Treaty.

After two successive failures, the Navy successfully launched a Lockheed UGM-96A **Trident I** SLBM from the USS *Stonewall Jackson* (SSBN-634) on February 27. This demonstration and shakedown launch took place underwater off Cape Canaveral AFS.

Two inert BGM-109 Tomahawk nuclear land attack missiles (TLAM-N) were successfully tested on March 27 and 28. Both missiles were launched from an undisclosed destroyer in the Gulf of Mexico—the first from the ship's vertical launch system (VLS) and the second from an armored box launcher. Each missile flew 800 miles to the target area on the Eglin AFB reservation. There each deployed a parachute and was recovered.

A TLAM-D (a Tomahawk with a submunitions dispenser) was successfully tested on April 9. The missile was VLS-launched from a cruiser roughly 500 miles off the California coast and engaged three targets with inert bomblets before performing a terminal dive on a fourth target at the Naval Weapons Center at China Lake, Calif. General Dynamics and McDonnell Douglas build the Tomahawks.



Crew members from the 55th Special Operations Squadron at Eglin AFB, Fla., flew two MH-60 helicopters from Eglin to Peterson AFB, Colo., on February 26 to set a nonstop record for the aircraft type. HC-130 crews from the 9th SOS refueled the MH-60s in midair during the 1,200-mile, ten-hour trip.

June Anniversaries

 June 5, 1783: First captive flight in public of a Montgolfier balloon takes place in Ammonay, France. The thirty-five-foot-diameter balloon attains a height of greater than one mile.

June 20, 1913: The first Naval aviator is killed when Ens. W. D. Billingsley is

thrown from a seaplane.

 June 21, 1913: Eighteen-year-old Georgia ("Tiny") Broadwick becomes the first woman to make a parachute jump in the US. Her 1,000-foot leap takes place over Los Angeles.

 June 12, 1918: The 96th Aero Squadron bombs the Dommary-Baroncourt railway yards in France in the first daylight bombing raid carried out by the AEF.

June 9, 1928: For the third consecutive year, Army Air Corps Lt. Earle E.
 Partridge wins the distinguished gunnery badge at the Air Corps Machine Gunning Matches at Langley Field, Va.

 June 15, 1928: Lt. Karl S. Axtater and Lt. Edward H. White, flying in an Air Corps blimp directly over an Illinois Central train, dip down and hand a mailbag to the postal clerk on the train, thus completing the first airplane-to-train transfer.

 June 15, 1943: The 58th Bombardment Wing, the Army Air Forces' first B-29 unit, is established at Marietta, Ga. Also on this day, the world's first operational jet

bomber, the German Arado Ar-234 V-1 "Blitz," makes its first flight.

• June 26, 1948: "Operation Vittles," the Berlin Airlift, begins with Douglas C-47s bringing eighty tons of supplies into the city the first day. Also on this date, the first Consolidated B-36 Peacemaker is delivered to the 7th Bombardment Wing at Carswell AFB, Tex. The airplane doesn't have to travel far, though, because the base and the plant share a common runway in Fort Worth.

• June 16, 1953: North American delivers the 1,000th T-28 Trojan tandem-seat

trainer to the Air Force.

 June 17, 1958: Boeing and Martin are named as the prime contractors to develop competitive designs for the Air Force's X-20 Dyna-Soar boost-glide space vehicle. This project, although later canceled, was the first step to the Space Shuttle.

• June 16, 1963: Cosmonaut Valentina Tereshkova, a cotton mill worker, becomes the first woman to go into space. Tereshkova's Vostok-6 flight lasts nearly three days. The first American woman to go into space, Dr. Sally Ride, would fly aboard Challenger on the seventh Space Shuttle mission (STS-7), which took off on June 18, 1983.

June 17,1983: The first LGM-118A Peacekeeper intercontinental ballistic missile is test-launched from Vandenberg AFB, Calif., into the Western Test Range in the Pacific.

Finally, two contracts were recently awarded for the Army's Air-to-Air Stinger (ATAS) program. This program will integrate the FIM-92 Stinger shoulder-fired surface-to-air missile into the Army's AH-64 Apache, AH-1 Cobra, OH-58 Kiowa, and UH-60 Black Hawk helicopters for self-defense. The team of Thomson-CSF and Hamilton Standard will build fifty-six head-up displays (HUDs) that will be used for stores management and navigation in the OH-58. Deliveries are to start in 1989. The Flight Systems Division of Western Gear has been given a contract to build the launch structural assembly for the ATAS program. Delivery of the assemblies is expected to start this summer.

★ APPOINTED—William L. Ball III was formally sworn in by President Reagan as the sixty-seventh Secretary of the Navy in ceremonies on March 30. Mr. Ball, a native of Belton, S. C., served as Assistant to the President for Legislative Affairs for the past

two years. A regular Navy officer, he served three years aboard the destroyer USS Sellars (DDG-11) and three years in Washington with the Navy Department. He then served ten years as a legislative aide and a staff member on the Senate Armed Services Committee.

James B. Odom was recently appointed as the head of the National Aeronautics and Space Administration's space station development program. He previously served as the director of science and engineering at the George C. Marshall Space Flight Center at Huntsville, Ala. Other assignments at the Marshall Center included managing the Space Telescope project, developing the second stage of the Saturn V moon rocket, and developing the external tank for the Space Shuttle.

★ AWARDED—The 57th Fighter Interceptor Squadron, assigned to NAS Keflavik, Iceland, was named as the winner of the Hughes Achievement

Trophy for 1987. The Hughes Trophy is presented annually to the top USAF squadron with an air defense mission. Selection is based on operational performance, readiness status, and significant achievements. This is the third time (1970 and 1976 were the other years) the squadron has won the prestigious award. Since 1953, three units (317th, 32d, and 57th FISs) have won three times, while three other units (43d and 67th TFSs and 318th FIS) have claimed the trophy twice.

The 1987 MacKay Trophy, given for the most meritorious flight(s) of the year, has been awarded to the Air Force Contract Management Division's Plant Representative Office at Rockwell International in Palmdale, Calif., and to the B-1B System Program Office (SPO) at AFSC's Aeronautical Systems Division at Wright-Patterson AFB, Ohio, for their involvment in two B-1B flights that established thirty-six class records. The record missions, conducted last July and September, set records for speed, distance, and payload.

The maintenance complex of the 416th Bombardment Wing at Griffiss AFB, N. Y., has been named as the Daedalian Maintenance Award winner for 1987. The award recognizes the outstanding Air Force maintenance organization for the previous fiscal year. The 416th BMW, which has won the award two of the last three years, is now a finalist for the Secretary of Defense Maintenance Award. The award has been presented since 1974 by the Order of the Daedalians, an organization founded by World War I pilots.

★ MILESTONES—The 445th Military Airlift Wing at Norton AFB, Calif., the first wing established as a Reserve Associate unit, marked its twentieth anniversary on March 25. In addition to their "routine" assignments during that span, the Norton Reservists have used active-duty C-141s to perform such varied missions as transporting moon rocks to the Johnson Space Center in Houston, Tex., after the Apollo-12 mission in 1969, airlifting ex-prisoners of war to the US during Operation Homecoming in 1973, and delivering relief supplies to hurricane and earthquake victims in several

The General Electric F404-GE-400 engine passed the 1,000,000-flight-hour mark in late March. The engines, which are in the 16,000-pound static thrust class, are used mainly to power the McDonnell Douglas F/A-18

Hornet. Versions of the engine are used in the Grumman X-29 Forward Swept Wing Demonstrator, the Dassault-Breguet Rafale, Singapore Aircraft Industries's reengined A-4 Skyhawks, and SAAB's JAS-39 Gripen. A variant of the F404 will go into the Navy's new A-12 and also the X-31 Enhanced Fighter Maneuverability aircraft.

★ PURCHASES—In late March, the Fairchild Metro III commuter aircraft was picked as the winner of the Air National Guard Operational Support Transport Aircraft (ANGOSTA) competition. As a result, Fairchild was given a contract worth approximately \$50 million for six aircraft (to be designated C-26A) and logistics support. Deliveries are to begin in March 1989

and are to be completed in August 1989. The contract also has options for seven more aircraft. The C-26As can also be converted to a cargo or litter-carrying configuration.

The United Kingdom's Ministry of Defence has placed an order with British Aerospace for an additional thirty-four Harrier II GR Mk 5 V/STOL attack aircraft. The total value of the

Senior Staff Changes

PROMOTIONS: To be Lieutenant General: Anthony J. Burshnick; Donald L. Cromer; Ralph E. Havens; John M. Loh; Clifford H. Rees, Jr.

RETIREMENTS: B/G Charles R. Cabell; M/G Chris O. Divich; M/G James P. Smothermon.

CHANGES: B/G Malcolm B. Armstrong, from Cmdr., 831st AD, TAC, George AFB, Calif., to Dep. Dir., Plans & Interoperability, J-7, OJCS, Washington, D. C. . . . B/G (M/G selectee) Billy J. Boles, from Dir. of Personnel Prgms., DCS/Personnel, Hq. USAF, Washington, D. C., to Cmdr., Hq. AFMPC, and Ass't DCS/Personnel for Mil. Personnel, Randolph AFB, Tex., replacing M/G (L/G selectee) Ralph E. Havens . . . B/G John L. Borling, from Cmdr., 57th AD, SAC, Minot AFB, N. D., to Ass't DCS/Ops., Hq. SAC, Offutt AFB, Neb., replacing B/G James W. Meier . . . M/G (L/G selectee) Anthony J. Burshnick, from Ass't DCS/P&O, Hq. USAF, Washington, D. C., to Vice CINC, Hq. MAC, Scott AFB, Ill., replacing retiring L/G Robert D. Springer . . Col. (B/G selectee) Frank Cardile, from Cmdr., 374th TAW, MAC, Clark AB, Philippines, to DCS/Product Assurance and Acquisition Log., Hq. AFSC, Andrews AFB, Md., replacing M/G David J. Teal.

B/G Jimmy L. Cash, from Command Dir., NORAD Combat Ops. Staff, J-31, Hq. NORAD, Cheyenne Mt. Complex, Colo., to Vice Dir., NORAD Combat Ops. Staff, J-31, Hq. NORAD, Cheyenne Mt. Complex, Colo., replacing B/G David C. Reed . . . M/G (L/G selectee) Donald L. Cromer, from Cmdr., SAMTO, and Dep. Cmdr. for Launch Ops., AFSC, Vandenberg AFB, Calif., to Cmdr., SD, AFSC, Los Angeles AFB, Calif., replacing retiring L/G Aloysius G. Casey . . Col. (B/G selectee) Albert J. Edmonds, from Cmdr., Tactical Comm. Div., and DCS/Communications-Computer Sys. (TAC), AFCC, Langley AFB, Va., to Dir. of C³, J-6, Hq. USCENTCOM, MacDill AFB, Fla., replacing B/G Wayne E. Schramm . . . Col. (B/G selectee) Marvin S. Ervin, from Spec. Ass't to CINC, Hq. MAC, Scott AFB, III., to Ass't DCS/Plans, Hq. MAC, Scott AFB, III., replacing B/G Paul E. Landers, Jr. . . . B/G (M/G selectee) Thomas R. Ferguson, Jr., from Sys. Prgm. Dir. for AIM-120 AMRAAM, AD, AFSC, Eglin AFB, Fla., to DCS/T&P, Hq. AFSC, Andrews AFB, Md., replacing retiring B/G Charles F. Stebbins.

Col. (B/G selectee) Charles E. Franklin, from Cmdr., RADC, AFSC, Griffiss AFB, N. Y., to Sys. Prgm. Dir. for AIM-120 AMRAAM, AD, AFSC, Eglin AFB, Fla., replacing B/G (M/G selectee) Thomas R. Ferguson, Jr. . . . Col. (B/G selectee) Milton L. Haines, from Dep. Comptroller for Cost and Economics, and Cmdr., USAF Cost Center, Ass't SAF/Acquisition, OSAF, Washington, D. C., to DCS/ Comptroller, Hq. AFLC, Wright-Patterson AFB, Ohio, replacing M/G Charles D. Metcalf . . . M/G Elbert E. Harbour, from Prgm. Dir. for B-1B, ASD, AFSC, Wright-Patterson AFB, Ohio, to Vice Cmdr., ASD, AFSC, Wright-Patterson AFB, Ohio, replacing M/G (L/G selectee) John M. Loh . . . M/G Paul A. Harvey, from Cmdr., 322d Airlift Div., MAC, and DCS/Airlift, Hg. USAFE, Ramstein AB, Germany, to Cmdr., Keesler TTC, ATC, Keesler AFB, Miss., replacing retiring M/G James G. Jones ... M/G (L/G selectee) Ralph E. Havens, from Cmdr., Hq. AFMPC, and Ass't DCS/Personnel for Mil. Personnel, Randolph AFB, Tex., to Cmdr., Hq. AU, Maxwell AFB, Ala., replacing retiring L/G Truman Spangrud.

Col. (B/G selectee) Larry L. Henry, from Cmdr., 37th TFW, TAC,

B/G James W. Meier, from Ass't DCS/Ops., Hq. SAC, Offutt AFB, Neb., to Dep. Dir. of Ops., NMCS, J-3, OJCS, Washington, D. C. . . . M/G Charles D. Metcalf, from DCS/Comptroller, Hq. AFLC, Wright-Patterson AFB, Ohio, to Cmdr., Hq. AFAFC, and Ass't Comptroller for Accounting & Finance, Lowry AFB, Colo., replacing retiring B/G Mark J. Worrick . . . Col. (B/G selectee) Robert W. Parker, from USAF Member, CJCS Staff Gp., OJCS, Washington, D. C., to Sr. Mil. Advisor to Dir., ACDA, Washington, D. C., replacing B/G Jay W. Kelley . . . B/G David C. Reed, from Vice Dir., NORAD Combat Ops. Staff, J-31, Hq. NORAD, Cheyenne Mt. Complex, Colo., to Cmdt., ACSC, Hq. AU, Maxwell AFB, Ala., replacing B/G Frank E. Willis . . M/G (L/G selectee) Clifford H. Rees, Jr., from Cmdr., USAF ADWC, TAC, Tyndall AFB, Fla., to Vice CINC, Hq. USAFE, Ramstein AB, Germany, replacing L/G Thomas G. McInerney.

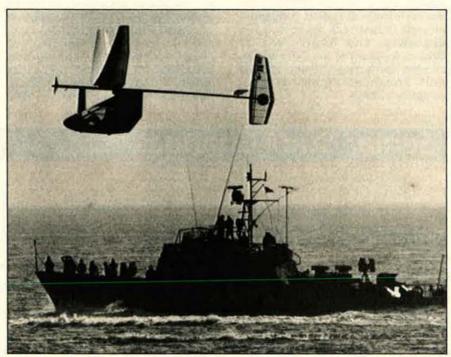
Col. (B/G selectee) Ronald L. Running, from Dep. Dir. for Int'l Prgms., DCS/P&R, Hq. USAF, Washington, D. C., to Ass't Dep. Dir. for Int'l Negotiations, J-5, OJCS, Washington, D. C. . . . B/G (M/G selectee) John P. Schoeppner, Jr., from DCS/Systems, Hq. AFSC, Andrews AFB, Md., to Cmdr., AFFTC, AFSC, Edwards AFB, Calif., replacing retiring M/G William T. Twinting . . B/G Wayne E. Schramm, from Dir. of C³, J-6, Hq. USCENTCOM, MacDill AFB, Fla., to Vice Cmdr., Hq. AFCC, Scott AFB, Ill., replacing retiring B/G Charles W. Bartholomew.

Col. (B/G selectee) Graham E. Shirley, from Cmdr., 20th TFW, USAFE, RAF Upper Heyford, UK, to Dep. Cmdr., AFCOS; Dep. Dir. of Ops., DCS/P&O, Hq. USAF; and Dep. Dir., Office of Mil. Support, Hq. DAMO/ODZ (Army), Washington, D. C., replacing retiring B/G Richard L. Craft . . . B/G (M/G selectee) William H. Sistrunk, from Vice Cmdr., 22d AF, MAC, Travis AFB, Calif., to Cmdr., 32d Airlift Div., MAC, and DCS/Airlift, Hq. USAFE, Ramstein AB, Germany, replacing M/G Paul A. Harvey.

Col. (B/G selectee) Nolan Sklute, from Dir. of Civil Law, Office of the JAG, Hq. USAF, Washington, D. C., to Staff Judge Advocate, Hq. AFLC, and Cmdr., AFCLC, Wright-Patterson AFB, Ohio, replacing retiring B/G Norman R. Thorpe ... M/G David J. Teal, from DCS/Product Assurance and Acquisition Log., Hq. AFSC, Andrews AFB, Md., to DCS/Systems, Hq. AFSC, Andrews AFB, Md., replacing B/G (M/G selectee) John P. Schoeppner, Jr. ... Col. (B/G selectee) Lester J. Weber, from Cmdr., 2d Space Wing, AFSPACE-COM, Falcon AFB, Colo., to DCS/Ops., Hq. AFSPACE-COM, Falcon AFB, Colo., replacing retiring B/G Earl S. Van Inwegen ... B/G Frank E. Willis, from Cmdt., ACSC, Hq. AU, Maxwell AFB, Ala., to Vice Cmdr., 22d AF, MAC, Travis AFB, Calif., replacing B/G (M/G selectee) William H. Sistrunk.

contract is more than \$665 million. The GR Mk 5 is a virtual twin to the McDonnell Douglas AV-8B used by the US Marine Corps and is a joint British Aerospace/McDonnell Douglas effort. BAe acts as the prime contractor for the GR Mk 5, and McDonnell Douglas acts as the prime for the AV-8B. Orders and requirements for the Harrier II currently stand at 436 aircraft, with 328 required by the Marine Corps, twelve on order for the Spanish Navy, and ninety-six on order for the Royal Air Force.

★ NEWS NOTES—The percentage of Air Force contracts open to competition increased for the third consecutive year in FY '87. Air Force competition advocate general Anthony DeLuca reports that more than fifty-six percent of the Air Force's procurement dollars and 91.6 percent of contract actions were competed last year. Thirty-one percent of procurement dollars were awarded as follow-on contracts to those originally competed. Only eleven percent of the procurement dollars were awarded to a sole source without competition. The percentage of competition has risen



A world record for human-powered flight was set on April 23 when Greek cycling champion Kanellos Kanellopoulos pedaled the spindly Daedalus '88 aircraft between the Islands of Crete and Santorini in the Aegean Sea. The seventy-four-mile flight took three hours and fifty-four minutes to complete. The aircraft was sponsored in part by MIT and United Technologies Corp.

YOUR CRITICAL NEEDS

on y liv



Effective air defense must depend on proven capabilities in the development and manufacture of weapon systems, and military solutions must conform to strict national defense budgets. For many decades Rafael has dealt successfully with the operational and economic demands of Israel's tough, active military. Rafael can put this battleborn expertise to work for you – in joint ventures or turn-key projects.

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steadily since the thirty-one percent competed in FY '84.

Secretary of Defense Frank Carlucci has approved the Armed Forces Expeditionary Medal for people participating in Persian Gulf operations since July 24, 1987. The medal may be awarded to people in the armed forces who meet the requirements for participation and support of an operation in which armed opposition or the threat of hostile action is encountered.

In early April, President Reagan signed an Executive Order removing references to the gender-specific "American fighting man" in the Armed Forces Code of Conduct. The change deletes the word "man" from Articles I, II, and VI of the six-paragraph Code that provides guidelines for members of the armed forces who may become prisoners of war. The Code, written in 1955 and amended in 1977, contained language describing a service member: "I am an American fighting man. . . . I will never surrender my men . . . and I will never



In 1965, while a cadet at the Air Force Academy, Dale S. Elliot (right) got the opportunity to fly with NASA pilot Bill Dana on an X-15 chase mission. Just before retiring earlier this year, Lieutenant Colonel Elliot flew Mr. Dana on a flight in one of the space agency's two-seat F-104 Starfighters.

forget I am an American fighting man." The new language reads: "I am an American. . . . I will never surrender the members of my command . . . and I will never forget I am an American."

Becent flight tests have validated

Recent flight tests have validated the high-speed data transmission rate of the improved P-4A airborne telemetry pod used on Air Combat Maneuvering Instrumentation (ACMI) ranges. The Navy, which also procures the pods for the Air Force, has exercised an option with the pod's maker, Kollsman, for thirty-two of the improved pods plus spares.

Have you ever wondered what became of the Army's canceled Sgt. York Division Air Defense (DIVAD) mobile antiaircraft gun? The sixty-ton gun has found a home at the Navy's Pacific Missile Test Center at Point Mugu, Calif., where it is used to track drones, aircraft, and other airborne targets used in electronic warfare operations at the center. It is not used to shoot at anything, though. The PMTC is so pleased with its Sgt. York that it has ordered two more from the Army and enough spares to last ten years.

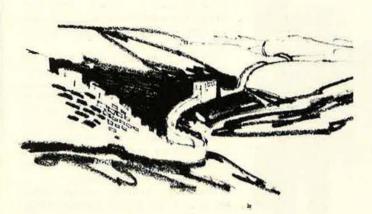
★ DIED—Retired Rear Adm. Frank Akers, the first aviator to make an instrument landing on an aircraft carrier, of cancer on March 22. He was eighty-six.

Born in Nashville, Tenn., Admiral Akers made his "blind" flight from San Diego to the USS Langley (CV-1) out in the Pacific in 1935, an action for which he would later receive the Distinguished Flying Cross. He was the navigation officer aboard the USS Hornet (CV-8) when it launched the Doolittle raid on Tokyo on April 18, 1942. He later worked as head of the Bureau of Aeronautics aircraft radio and electrical branch, and he served as the skipper of the USS Saratoga (CV-3). He commanded three carrier divisions before retiring in 1963. At one time he was designated the Gray Eagle, an honor reserved for the oldest Naval aviator on active duty.

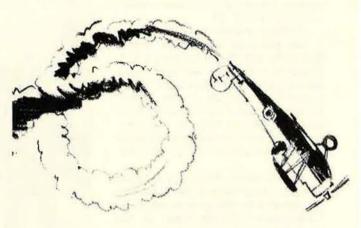
Two deaths overlooked earlier were Kenneth Lee Porter and Robert Todd, two of the last World War I aces. Mr. Porter died February 3 at age ninety-one at his home in Jackson Heights, N. Y., while Mr. Todd died January 21 at age ninety at a Veterans Administration hospital in La Jolla, Calif. Mr. Porter shot down six enemy aircraft and had three unconfirmed victories with the 147th Aero Squadron over France in 1918. Mr. Todd shot down eight German aircraft and an observation balloon as a member of the 17th Aero Squadron.

Index to Advertisers

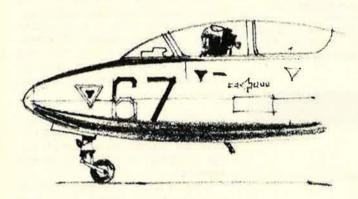
Allied-Signal Aerospace Co	
AT&T Technologies, Inc.	
Avis Rent A Car System, Inc.	
CASA Aircraft Inc.	22 and 23
Custom Electroplating	115
Data General Corp	14
Dayton International Airshow and Trade Exposition	115
EDO Corp., Government Systems Div	15
Ford Aerospace Corp	Cover III
Fusion Plus	11
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Jesse Jones Industries	
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TRW Electronics and Defense, DSG	contract and contr
Vitro Corp.	
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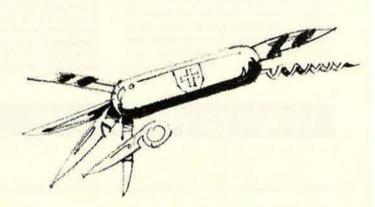
What's the name of the Director of Civil Aviation, the Chinese Peoples' Republic?



Who's the Dean of Instruction for the Alabama Aviation & Technical College?



What's the telephone number for the Mexican Airforce?



How do you contact the Swiss Armament Technology and Procurement Group?

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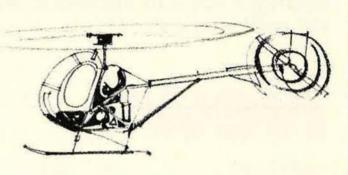
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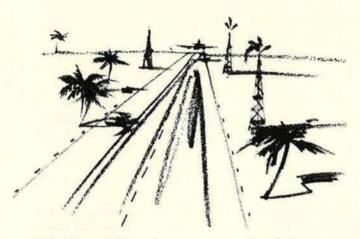
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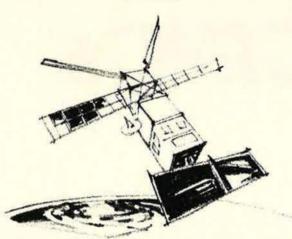
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The 1986 reorganization gave the warfighting commanders a much stronger voice in decisions affecting US military posture.

New Clout for the CINCs

BY JAMES W. CANAN SENIOR EDITOR

Robert T. Herres, Vice Chairman of the Joint Chiefs of Staff, summed up "the essence of the intent of Congress" in the Goldwater-Nichols Department of Defense Reorganization Act of 1986.

The purpose of that Act, said General Herres, "can be focused sharply into one sentence: Increase the clout of the CINCs and the Chairman."

That has happened. The Chairman of the Joint Chiefs of Staff is still charged with representing the service Chiefs, heeding their views, and building consensus among them. But he has become much more his own man as the top decision-maker and strongest voice of the increasingly "purple-suited" US military.

So have the Commanders in Chief of the operational, warfighting commands—the unified and specified commands.

The legislation enables the CINCs to keep their distance from their respective service Chiefs. The Chairman is their official spokes-

man, and they now take straight to him their cases for what they believe they must have and must do to prepare for the combat that their commands would wage.

Over time, this will almost certainly diminish the sway of the individual services over the disposition of defense resources and the formulation of requirements, roles, and missions.

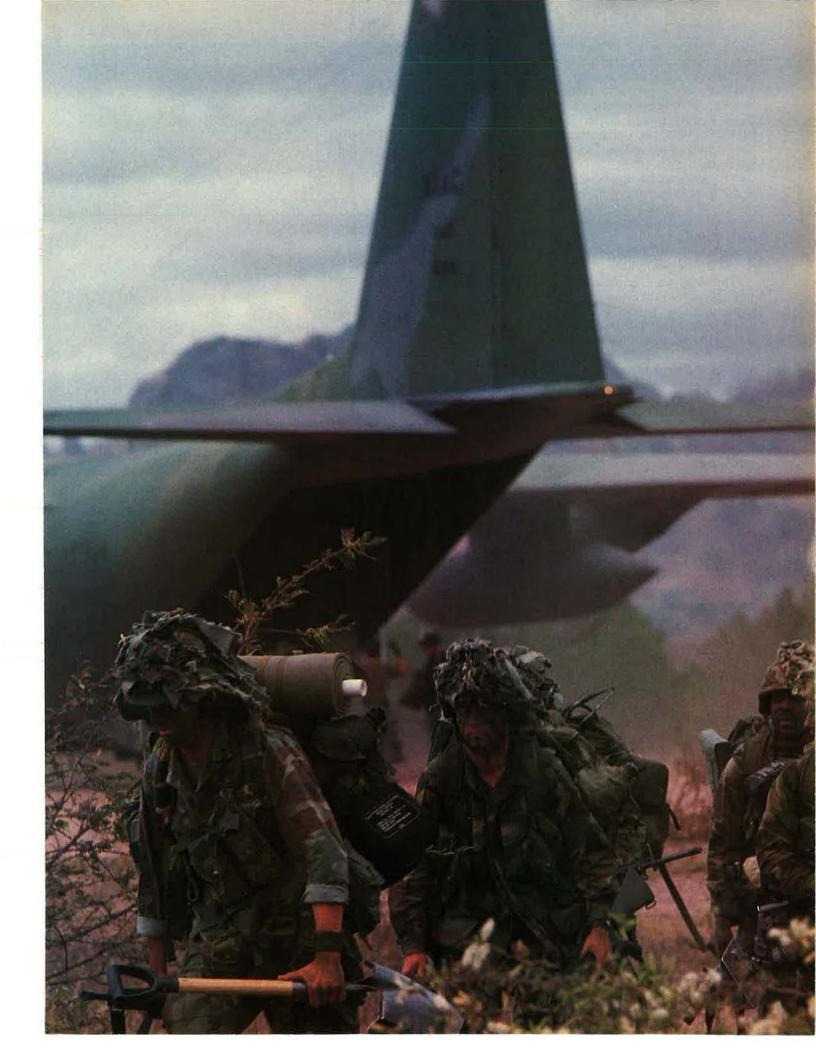
Decisions about such matters are and will be all the more meaningful in this time of scarcer resources and leaner force structures—and of the greater military risks for the US that will inevitably ensue.

In such context, it stands to reason that preparing to fight today's war will take precedence over gearing up for tomorrow's. This is already evident in the priority that the Pentagon has given to combat readiness and sustainability—at the expense of major program starts in the name of modernization—in the harder times at hand.

In the Catbird Seat

And when it comes to decisions

With the current unsettled situation in Central America. joint-service training exercises take on a little more urgency for the US Southern Command. An American presence, such as that provided by these members of the Army's 7th Light Infantry disembarking from an Air Force C-130 In Honduras, is seen as being vital to the security of the region.



about whether or not to go for big new systems, the joint-arms users are clearly in the catbird seat.

Accurate or not, said General Herres, "a strong perception of the framers of the reorganization legislation was that the Department of Defense was emphasizing functions rather than missions.

"The resource managers were believed to hold too much influence at the expense of the warfighters, and the acquisition process was producing equipment with insufficient thought as to effective joint integration and interoperability. . . .

"The American people and Congress have told us in no uncertain terms that they expect more functional and technical interoperability among the services—the capability to mesh systems and forces into an integrated defense team."

As Vice Chairman of the JCS, a post that the defense reorganization act created to help the Chairman handle his many new responsibilities, General Herres also emphasized that "the services are functional, and . . . the unified and specified commanders are the only military leaders with true operational missions—the business of force employment.

"The services must orient on force structure, training, and logistics in order to provide trained and equipped forces to the CINCs for the pursuit of their missions.

"There must be less talk of socalled roles and missions of the services and more meaningful, aggressive action to support the combatant commanders."

The main responsibility for evoking such action now rests with the Chairman of the JCS, Adm. William J. Crowe, Jr., who began his second two-year term in the post last October 1.

Admiral Crowe has the wherewithal for doing so. As General Herres put it: "One of the farsighted results of the reorganization is that the Chairman has not only been given a number of new responsibilities, he also has been given the tools necessary to carry them out."

For one, the Chairman now has at his personal disposal the entire Joint Staff, a 1,500-member purple-suited group of officers who are accountable to him alone and no longer to the Joint Chiefs as a whole.



Everything from detecting missile launches to controlling satellites is the job of one of the newest unified commands—US Space Command. Here, 1st Lt. Michael T. Morrell (seated) and 1st Lt. Stephen W. Linhart monitor the Tactical Operations Room console for the Pave Paws radar at Cape Cod AFS, Mass.

As General Herres explained it, "This distinction is, in practice, particularly important," because it means that "the Joint Staff may be guided by one voice," just as "the priorities of the CINCs can be represented by one voice.

"The Chairman has always had the responsibility to ensure that the services' programs were in line with national strategy. But now he has a specific role in the planning, programming, and budgeting system that he did not have before.

"He is charged with providing the Secretary of Defense advice on the extent to which the services and the [defense] agencies' program and budget submissions conform to the CINCs' warfighting priorities."

Admiral Crowe's second two-year term as Chairman will expire on September 30, 1989. The betting is that General Herres will succeed him, it being the turn of an Air Force four-star to head the JCS next time around.

New Clout?

Before becoming the first Vice

Chairman of the JCS about a year ago, General Herres served as the first CINC of the unified US Space Command. He was succeeded in that slot by Air Force Gen. John L. Piotrowski, whose efforts in behalf of greater warfighting capabilities for his multiservice operational command may well have been given a boost by the new clout accorded the CINCs.

Among other things, General Piotrowski wants the US to develop and deploy radar systems in space to look downward for enemy bombers and cruise missiles. He also covets new radars or other sorts of sensors on land or in space to enhance his command's somewhat deficient capability for surveillance of Soviet deep-space satellites.

The corporate Air Force is leery of such systems. Their costs would be burdensome in present conditions, and the Air Force budget would probably have to bear those costs.

But General Piotrowski is now in a position to make his pitch for them directly to the JCS Chairman, circumventing the Air Force leadership.

Whether he would make a point of doing this or would succeed at it is another matter. But at least he and all CINCs who want other things that their individual services shy away from are now free to take their best shots.

Space gets its share of attention, but does not stand out among the many major concerns expressed in Admiral Crowe's recent testimony on Capitol Hill and in the Joint Staff's "United States Military Posture" document presented to Congress earlier this year.

The budgetary downsizing of the space-oriented Strategic Defense Initiative is rued, as is the termination of USAF's antisatellite (ASAT) weapon development program, which fell prey to the budget and to the refusal of Congress to let the fighter-launched rocket weapon be tested against target satellites in space.

Much is said about the need for an ASAT weapon to redress the "serious asymmetry" between US and Soviet capabilities for controlling space and defending US space as-

sets. There is also considerable emphasis on the need to bring US spacelaunch capabilities up to snuff—which is yet another of General Piotrowski's prime goals.

But as to the need for such new systems as space-based radars and other space-surveillance sensors, little or nothing is said. Perhaps later on.

Given the JCS Chairman's bigger stick, his views are even more important and noteworthy nowadays. He embodies the great bulk of those views in his "net assessment"—an analysis of US and allied capabilities vis-à-vis those of the Soviet Union and other adversarial nations—that the reorganization legislation now requires of him annually.

As Admiral Crowe told Congress earlier this year: "Last year, I summarized my own net assessment. This year, as a result of the Goldwater-Nichols Act, the Joint Staff has completed its first in-depth net assessment."

The US Military Posture document is representative of that. It covers all the ground—strategic and tactical nuclear forces, strategic mobility, maritime defense, NATO and Warsaw Pact forces in Europe, Southwest Asia, the Pacific theater, Western Hemisphere, Special Operations Forces, space, Africa, and much, much more.

Good News-And a Warning

Taking it altogether, Admiral Crowe had good news and a warning for Congress, declaring: "In summary, it is clear that the investments made in the last few years have materially improved the net assessment from the US standpoint.

"It is equally obvious that the picture is a dynamic one, that the Soviets are working diligently to improve their position across the board, and that there are still a number of serious gaps in our own posture. On balance, we need a number of years' growth before we can face the future with confidence.

"And now," as he put it pointedly, "to the defense budget."

The Chairman's message here: It was extremely difficult to shape the Fiscal Year 1989 budget constrained to no real growth, and "we can do this for one or two years, but not as a long-term proposition.

"Moreover, we are depending

Unified and Specified Commanders in Chief

A unified command is composed of US combat forces from two or more services, has a broad and continuing mission, and is normally organized on a geographical basis. There are eight unifiled commands.



Adm. Lee Baggett, Jr., USN US Atlantic Command



Gen. Duane H. Cassidy, USAF US Transportation Command



Gen. George B. Crist, USMC US Central Command



Gen. John R. Galvin, USA US European Command



Adm. Ronald J. Hays, USN US Pacific Command



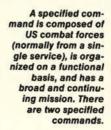
Gen. James J. Lindsay, USA US Special Operations Command



Gen. John L. Piotrowski, USAF US Space Command



Gen. Frederick F. Woemer, Jr., USA US Southern Command





Gen. John T. Chain, Jr., USAF Strategic Air Command



Gen. Joseph T. Palastra, Jr., USA Forces Command

heavily on Congress to approve the overall shape and content of this budget. Substantial changes in the fundamentals or even at the margin may very well increase the risks we have tried hard to avoid. . . .

"We are engaged in a security marathon, and it would be folly to conclude otherwise. Thus, the Joint Chiefs of Staff strongly concur with Secretary [of Defense] Carlucci's conclusion that we should aim for two percent real growth in the biennial Fiscal Years 1990–91 budget submission."

Tying his net assessment to his position on the defense budget, Admiral Crowe said that "the global military balance has not changed appreciably since my testimony last year," but made it plain that the balance will swing against the US if Congress fetters or refashions the budget even further.

The Chairman dealt extensively in his testimony with risks, commitments, and people, saying in part:

"It is important to understand that this may be only the beginning of greater risks in the defense planning and programming process. . . . Several years of negative growth in defense spending will inevitably lead to dangerously reduced capabilities and force structure.

"We should learn from our history. Four times in the last one hundred years we cut back precipitously in peacetime and then entered a major conflict unprepared. In each instance, we paid a needlessly high cost in treasure, lives, and stability.

"Of particular concern is the impact of cost-avoidance measures on our people. We are not cutting back on commitments. Yet we are asking our military personnel to take up the slack resulting from modest but nonetheless real cuts in force structure.

"Congress can do a great deal to ease this transition by ensuring that our military personnel remain confident in laws governing military compensation—including the benefits of active duty and the integrity of our military retirement system."

The Dominant Threat

The JCS Chairman gave Congress a balanced but unrelenting assessment of the rise of Soviet mili-

tary power—a reminder that, despite changes in Kremlin policies, "the Soviet Union remains the dominant threat to our national security and to a more secure and stable international environment.

"World power is still the name of the game in the Kremlin, and Communist Party leaders will do what is necessary to play that game."

Over the last two decades, he said, the USSR has built the world's largest nuclear and conventional forces supported by "a huge arms production program and a steady research and development program. Power projection capabilities are increasing at a steady pace, not only on and around Eurasia but also in space.

"The free world has accommodated to the Soviet penchant for numbers, but—even more worrisome—we are now seeing our traditional qualitative edge erode."

On the other hand, said Admiral Crowe, the Soviet military machine is flawed on several counts. Among these are "pervasive personnel problems," many undermanned units that would have to be filled out in war with "personnel far less com-



Peter Turnley/Black Star

The most tension-filled area of the world right now is the Persian Gulf, an area of responsibility for the US Central Command. This photo shows the USS Crommelin (FFG-37) escorting the SS Sea Isle City, a reflagged oil tanker, after the big ship struck an Iranian mine in the Gulf last summer.

petent" than those in today's frontline units, deficient training of conscripts who serve too briefly to do much good, "persistent ethnic problems" in the ranks, the "lack of a regular core of career NCOs," major logistical problems, unreliable equipment, poor maintenance, and "highly centralized," inflexible command and control.

"On a more fundamental level," Admiral Crowe testified, "there may be even more important forces at work. General Secretary Gorbachev and his Party colleagues seem to have concluded that the Soviet Union cannot remain a first-rate world power with a second-rate industry.

"Unquestionably, he wants to reshape the economy. It is not clear whether he will succeed."

Noting that "Gorbachev reportedly has suggested that the Soviet General Staff move from a war-winning posture to something called 'reasonable sufficiency,'" the Chairman added:

"We still do not know what that means in terms of military spending or force structure. We do know that the Soviet military and the Russian people have little stomach for unilateral disarmament. And we have yet to see any tangible cutbacks in military spending or production.

"Thus, if Gorbachev is going to reduce the burden of military expenditures, he must do so in the broader context of his arms-control agenda."

What it comes down to, said Admiral Crowe, is that "the Kremlin remains as firmly committed as ever to a long-term military competition with the West and to the support of so-called 'wars of national liberation' in the Third World."

Increasing Importance of SOFs

In this regard, the military posture statement puts much emphasis on the need of the US to be prepared to wage low-intensity conflict (LIC) in support of friendly nations facing military encroachment.

It states flatly: "LIC is the most likely and dangerous form of international conflict the United States will face for the foreseeable future and is the form of conflict totalitarian forces have chosen to wage against the West in pursuit of expansionist goals."



The unified command receiving the most attention these days is the newly created US Special Operations Command, headquartered at MacDill AFB, Fla. In areas such as Central America, where all-out war is unlikely, the possible need for special operations grows. These members of the Army's 82d Airborne Division are in Honduras.

The Joint Staff document also dwells at some length on the increasing importance of US Special Operations Forces (SOF), which now operate under a relatively new unified command and are making out like gangbusters when it comes to funding and political support.

"SOF," says the document, "are especially effective in resolving crises and terminating conflicts that are still at relatively low levels of violence."

Such forces are also tailored to counter international terrorism, whether state-sponsored or fomented by independent groups.

Declares the military posture statement: "The threat of international terrorism against the United States and other nations continues to pose formidable challenges. Targeting of US interests in Europe and the Middle East continues. These areas, along with Latin America, will probably remain the scenes of the greatest number of terrorist activities against US interests."

The unified Special Operations Command (SOCOM), said Admiral Crowe, "is receiving a great deal of top-level attention while continuing to demonstrate its unique value in both low-intensity conflict and conventional conflict."

SOCOM was established at Mac-Dill AFB, Fla., on April 16, 1986. Last year, in July, two other commands came into being—the specified US Forces Command (FORS-COM) at Fort McPherson, Ga., and the unified US Transportation Command (USTRANSCOM) at Scott AFB, Ill.

They exemplify the steady trend toward jointness and interoperability of forces and toward more power for the CINCs and the Chairman of the JCS that the Department of Defense Reorganization Act aimed at bringing about.

"As a result of the Act," Admiral Crowe told Congress, "I am much better positioned to solicit, integrate, and weigh the views of the Joint Chiefs of Staff, commanders of the unified and specified commands, and directors of the defense agencies—and to guide the work of the Joint Staff. . . .



Nowhere is the Soviet presence felt more directly than in Europe. US European Command's job is to be ready for a war where the Soviets hold a commanding numerical advantage. Offsetting that advantage are such modern weapons as this F-16C from the 50th Tactical Fighter Wing at Hahn AB, Germany, and the KC-135R tanker it is escorting.

"Real progress has been made in the areas of resource analysis and net assessments. Overall, we are steadily improving our ability to integrate defense resources and warfighting capabilities."

Joint Doctrine Master Plan

Fundamental to such integration is a Joint Chiefs of Staff document now being prepared for publication later this year—one that will greatly advance the everyday practicality of "jointness" in the US military.

It is called the "Joint Doctrine Master Plan," a blending of the doctrines of the individual services into amalgamated warfighting plans, the concerted likes of which the Pentagon has never seen.

As the US military posture statement explained it:

"Military doctrine provides the fundamental principles by which forces of two or more services are employed in coordinated action toward a common objective.

"Joint doctrine is promulgated by the Joint Chiefs of Staff and provides a framework for developing solutions to enhance the warfighting capabilities of the CINCs....

"The Joint Doctrine Master Plan will spearhead the development of CINC warfighting doctrine and enable the Chairman, JCS, to meet his responsibility for 'developing doctrine for the joint employment of the Armed Forces.'"

The major aims of the master plan are to identify and fill voids in and among joint doctrines now more narrowly in effect, such as Air Force-Army doctrines for joint attack and joint suppression of air defenses, and to "bring all joint doctrine previously approved by all four services under the JCS publication system."

The ultimate goal is to organize everything "into a systematic hierarchy that clearly links doctrine to procedures under a single capstone [JCS] manual."

Such an endeavor would not be possible, of course, without influential inputs from the individual services. And so, despite the inexorable flow of power to the JCS Chairman and the CINCs, the service Chiefs are by no means being stripped of say-so in operational military matters.

As General Herres noted: "The natural assumption is that the new prerogatives of the Chairman and the CINCs have emasculated the roles of the service Chiefs. But I don't believe this is the case. . . .

"The law requires the Chiefs to continue to advise the Chairman and provide him the benefit of their experience, the expertise of their respective operating domains, and their service viewpoints."

Moreover, General Herres continued, the service Chiefs remain responsible for force development and management, and each "can—and must—dissent from any position that the Chairman adopts that he feels is wrong."

That having been said, however, General Herres got to the heart of what is going on, declaring:

"No one can intelligently argue any longer that jointness is not the most effective way to operate our military."

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The Pentagon thinks that defense budget cuts have put national security at risk. Many in Congress disagree. The stage is set for a showdown debate on US defense posture.

The Disputed Issue of Risk

BY ROBERT S. DUDNEY, SENIOR EDITOR

CONVERGENCE of budgetary and strategic factors is kindling debate over Washington's most critical defense question in years. Has the nation begun sliding into a time of greater military risk?

There is wide agreement in the US defense establishment that security risks can never be eliminated. But the Pentagon and Congress are far from accord on whether today's situation is acceptable.

Among congressional Democrats and some Republicans, there is consensus that the global military balance has been stabilized over the years by a \$2 trillion rearmament of US armed forces.

Pentagon leaders, however, insist that new factors threaten to undo the security gains underwritten by this major defense spending effort. The trends, they maintain, point to danger. To quote Defense Secretary Frank C. Carlucci: "The degree of risk is getting to the point where we as a nation have to worry about it."

The upshot, in the year to come, could be the start of a contentious US military reevaluation of the type

not seen since the heated debates of the late 1970s and early 1980s.

Already, controversy is building about the possible future course of the Soviet military threat under Mikhail Gorbachev's regime. Compounding the uncertainty are arguments about the military effects of potential nuclear-arms reductions by the superpowers.

However, what most fuels concern about the nation's military risks is the budget crunch. There is a sharp decline in Pentagon expectations that it will get the money that it says it needs to man and equip its forces.

In producing a \$299.5 billion 1989 spending blueprint, now under congressional review, the Pentagon was obliged to chop \$33 billion from a budget plan it already considered minimal.

This will bring about, in the year ahead: smaller forces, via elimination of fighter wings, Army units, and warships; fewer new arms, from strategic nuclear missiles down to Navy carrier bombers and Army artillery shells; and lower technology,

What most fuels concern about the nation's military risks is the budget crunch.



stemming from flat investment in basic weapons research and fewer new weapons starts.

The spending crunch appears to be long-term. Even in the most optimistic view, the Pentagon will be forced over a five-year period starting in 1990 to make do with some \$230 billion less than it had expected as the nation struggles to cope with enormous federal deficits.

The long-term result of this squeeze, senior Pentagon officials maintain, is that American security will be at "significantly greater risk."

The Pentagon's conclusions are debatable. Even new Defense Secretary Carlucci concedes that the defense planning process is not a "precise calculus." The military's most comprehensive public estimate of the balance—with American strengths and weaknesses—is put forth in the Secretary's "Annual Report" to Congress. What follows is a distillation of that 325-page Pentagon world view.

The Strategic Competition

No aspect of US defense commands greater Pentagon attention than dissuasion of Soviet resort to nuclear arms. This policy of deterrence is backed, first and foremost, by a vast strategic nuclear arsenal—a triad of land-based, air-breathing, and sea-based firepower. At this level of competition in arms, the Pentagon appears distinctly upbeat about the future.

Today, says Secretary Carlucci, "our assessment is that [the] overall strategic balance is essentially stable." What's more, he says, the situation may well improve somewhat in years to come.

With the introduction of new weapons—up to fifty Peacekeeper missiles based in silos, a fleet of B-1 bombers, better cruise missiles, and quieter strategic submarines loaded with more accurate ballistic missiles—the assessment is that "US offensive forces are becoming increasingly effective and survivable."

Moreover, says Secretary Carlucci, such future weapons as the Air Force's B-2 Advanced Technology Bomber "will reduce Soviet advantages in some areas" without creating new American vulnerabilities.

It is the modernization of the land-based leg of the triad that poses the greatest problems and risks and shows the greatest effect of the intensifying domestic budget crunch.

Shortage of funds has made competitors of two ICBM programs that were supposed to be complementary—the mobile, ten-warhead Peacekeeper and the mobile, single-warhead Midgetman. While both are expensive, the costs of the small missile greatly exceed those of the Peacekeeper and its rail-garrison basing system.

Thus, Secretary Carlucci felt obliged to try to scrap the Midgetman, for an overall savings of some \$40 billion in the years ahead. The budget included \$200 million to keep the missile on life support, should the next administration wish to revive it.

The original plan had been to go forward with both missiles. "What I am saying to Congress," notes the Secretary, "is I don't see how that can happen. I don't think, given the top line and given our estimates in the outyears, that that's a realistic assessment."

Instead, the Pentagon opted for mobile deployment of the Peace-keeper alone to provide a secure land-based force for the 1990s. It had sought \$837 million to develop the rail-garrison basing mode for the supermissile.

It is thought that this system will be somewhat less secure and provide less flexibility than would the two-missile program.

Even Peacekeeper is being slowed. Rather than buying the twenty-one ICBMs that were originally planned, the Pentagon sought procurement in 1989 of only twelve because of the reluctance of Congress in years past to fund more than that number.

Survival of the Carlucci proposal is not assured. There is sentiment in Congress, especially in the House, to resuscitate the Midgetman program and curb or kill mobile Peace-keeper. Pentagon concern is that a bout of political fratricide could in time undermine ICBM modernization altogther.

On the Russian side, the Pentagon finds a mixed strategic picture. The Soviets, the Carlucci report maintains, "no longer speak openly of winning a nuclear war" as

they did throughout the 1970s.

Even so, the Soviet force is still structured to conduct a "warfighting" campaign. And there are several troubling weapons developments.

Soviet deployment of mobile SS-24 and SS-25 ICBMs may "significantly alter the Soviet target base" and make it more difficult for the US to attack these assets with its own atomic strike. Moreover, the Pentagon finds much to worry about with regard to Soviet efforts to develop the means to assemble a rudimentary antiballistic-missile defense system that could blunt a weakened US retaliatory strike.

Whatever the concerns, however, the Pentagon report makes this much clear: "The United States has, and will retain for the foreseeable future, the capability to deter a direct [Soviet] nuclear attack."

The Conventional Imbalance

The billions being poured into defense are aimed at doing more than protecting US territory. Beyond this primary duty for the 2,100,000-strong force is the task of protecting US allies and US economic interests abroad.

American theater forces are called on to help prevent Soviet political domination of West European allies, bullying of Japan and other friendly Pacific nations, or disruption of Western access to critical Persian Gulf oil supplies.

How is the US strategy faring? In Secretary Carlucci's words:

- Western Europe. Though the Warsaw Pact holds some advantages, "we assess that the combination of Soviet uncertainty in the nuclear and conventional realm is currently enough to deter them from starting a war in Europe."
- East Asia. "Although the Soviet Union and its clients retain advantages in some of the regional military balances, several theater-wide factors favor the United States and its allies."
- Middle East. "The Soviet Union's proximity to the Persian Gulf region provides it with a significant military advantage," although it is offset somewhat by logistics problems and the hostility of local defense forces.

Pentagon planners emphasize that these assessments, highly equivocal in and of themselves, pertain only to peacetime deterrence of Russia's power. Should deterrence fail and war ensue, they say, the outcome for Washington's thinly stretched forces would be grimmer.

Cited as a prime case in point is the situation in Western Europe, where the US and its NATO allies face the brunt of Soviet power.

There, in the view of the Carlucci report, the preponderance of Soviet and Warsaw Pact forces "leads us to conclude that in the event of war in Europe, NATO could face the difficult choice of early escalation to the use of nuclear weapons or suffering a conventional defeat."

Secretary Carlucci's concern stems from a number of factors. One development that Washington finds "particularly worrisome" is the further growth of the East bloc's advantage in armor, artillery, and other ground forces on the Continent. This is backed up by a "decided advantage" in modern stocks of chemical weapons.

The Pentagon argues that, in the 1980s, deployments of new American helicopters, main battle tanks, fighting vehicles, and other systems permitted the West to keep pace with the Soviet Union. But now, it claims, the situation is on the verge of a new deterioration.

In the air, the Pact is judged to have a far narrower advantage over Western forces. Soviet-led forces surpass the West in numbers of combat aircraft. But US analyses show that, after thirty days' mobilization on both sides, NATO would be able to improve the balance sharply.

Finally, when it comes to combat sustainability—provision of missiles, bullets, and other war consumables—NATO improvements are seen as having been outstripped by Soviet efforts.

The Soviet Union's presumed conventional supremacy in Europe is counterbalanced in part by the fact that the Kremlin must reckon on the danger of a second-front war against China and on doubtful reliability of its East European allies. And the West is still judged to hold a technological edge in important weapons categories.

The import of these factors, says Secretary Carlucci, is that "at the conventional level, the Soviets may



Leaner military budgets may exacerbate the conventional shortfall in Europe.

not be confident that their forces are sufficient to guarantee them a high probability of success." Thus, he concludes, they remain deterred from contemplating initiation of war.

Consequences of Cutting Back

What worries US planners is that the effects of leaner military budgets may be changing that situation and changing it to Washington's disadvantage.

They note that an already overcommitted Army and Air Force structure is being reduced even further. The Air Force has abandoned a long-standing goal of building forty tactical fighter wings and will even back down from the thirty-eight it fields today to thirty-five by 1991.

Placed on the chopping block are the seventy-two-plane 474th Tactical Fighter Wing, based at Nellis AFB, Nev., and the 401st TFW based at Torrejon in Spain, which Madrid has ordered removed. If the US finds an alternative European base for the 401st TFW, as seems likely, Washington will deactivate another US-based unit. Further, plans call for reducing the Air Force's reserve squadrons by the equivalent of one wing.

For its part, the Army will lose one brigade from its 9th Light Infantry Division, delay the activation of the 6th Light Infantry Division, deactivate its Roland air defense unit, and lay up 450 of its Vietnam-era utility helicopters.

The Defense Secretary points out that these reductions, in the main, do not touch US forward-deployed forces, such as heavy tank units, that now confront Soviet power. What it does reduce, he notes, is the nation's strategic reserve of conventional combat forces.

For example, the Army is required to deploy ten divisions to Europe in ten days. The Air Force works under similar pressures.

Adding to the concern is the budget squeeze on new weapons, which Washington wants in order to bolster its units and keep them in action

against a numerically superior foe.

Thus far, program cancellations and deferrals have remained confined to relatively marginal systems—the Army's Aquila drone, Copperhead laser-guided artillery projectile, and Anti-Tactical Missile system plus the Air Force's AGM-130 standoff weapon and Sensor-Fuzed Weapon tank-hunter munition, to name a few.

The concern is that a prolonged period of austerity will cut deeper, affecting critical programs. This year's request for the Air Force F-15E multirole aircraft, for example, was reduced from forty-two to thirty-six and may face even greater pressure. The Army wonders where

it is to find money to build modern helicopter gunships to support its ground forces in combat.

Compounding this problem is the limited capability of US defense industry to mobilize. If the US were compelled to convert its peacetime industry to all-out military production, the Soviet Union would likely hold an edge in the early going.

That point was made clear in a recent study conducted by the Joint Chiefs of Staff. It concluded that America's emphasis on high-technology manufacturing—heavily reliant on offshore sources for its components—would impose severe limitations. It would take industry a full eighteen months before achieving significant gains in production of major weapons to contribute to a war in Europe.

Judging from the Carlucci presentation, the strategic outlook in the other major military theaters of the world shapes up as being less bleak than that in Europe.

The prime example is the increasingly important East Asian rim, where the US at present maintains relatively small ground and air contingents to support its interests in Japan, South Korea, and other nations in that vast region.

To be sure, the Pentagon notes that there is a Soviet preponderance of ground forces and airpower in the immediate region, one that focuses principally on the border with China.

Also of "great concern" to US planners is the military balance on the Korean peninsula, where a huge, heavily armed North Korean force poses the danger of surprise attack against Washington's South Korean ally.

Serving to counterbalance this risk to US interests, in the Pentagon's view, are economic trends that run strongly in Washington's favor. China's economic development, it is pointed out, will "pave the way" for "significant improvements in combat capabilities" during the 1990s. The South Korean economy, four times that of its northern antagonist, is underwriting a major military expansion that Pyongyang will find difficult to match. Finally, Japan's economic vitality is seen as leading to increased strength for that pivotal nation.

Cutbacks in force structure are decimating the strategic reserve of conventional forces.



In sum, says the Carlucci assessment, these factors "make the longterm regional trends in the military balance appear favorable."

In the oil-rich Middle East, the assessment is only slightly less upbeat. There, Secretary Carlucci maintains, "the military balance favors the Soviets, but the combination of our [military and security] efforts and those of countries in the region create significant risks and uncertainties for Soviet planners."

Bolstering the Pentagon's position, in the Carlucci view, are major strides in developing faster airlift and sealift to rush American forces to the distant Persian Gulf.

"On balance," he concludes, "our improved capability to project significant [armed] forces rapidly to the region helps to deter Soviet aggression. Should deterrence fail, we can successfully defend the region with substantially fewer ground forces than the Soviets require to seize and occupy it, provided our forces are strongly supported by tactical air."

The Edge in Seapower

The military situation in the major theaters would be cause for greater concern, the Secretary suggests, were it not for the strategic counterweight provided by superior US naval and Marine forces.

Any regional or superpower conflict involving this nation's forces—in the Far East and Mideast, in particular, but in the European theater as well—would require heavy commitment of the Navy to protect the movement of US troops and supplies by sea. It would first be called on to take control of the sea. The Navy's other mission would be to project its air and amphibious power against enemy shores.

At present, the Secretary makes plain, the United States enjoys a clear-cut edge in seapower: "Although the Soviets have improved their naval force's capabilities . . . we are maintaining a maritime balance favorable to the United States."

This represents a marked change from the tone of the early 1980s, when senior admirals openly fretted that Washington had lost its superiority at sea and successfully pushed for a major naval buildup.

It is in its force projection capa-

bilities that the US Navy's superiority becomes most strikingly apparent. For intervention in Third World hotspots or even in major regional conflicts, the Soviet Navy has nothing to compare with the US fleet's fourteen big-deck aircraft carriers and 190,000-strong Marine Corps. And in the Secretary's view, the Navy is in no jeopardy of losing this edge anytime soon.

"The United States Navy," he contends, "will retain significant advantages over the Soviets in tactical airpower [and] long-range

power projection."

When it comes to fighting a major war at sea against the Soviets, however, the issue becomes somewhat murkier. The Secretary identifies the Soviet Navy's prime wartime mission to be defense of sensitive waters near the Russian homeland from intrusion by US carriers, cruise-missile-carrying surface warships, and nuclear attack submarines. A secondary mission is to try to use its submarines to cut US sea lines of communication to Western Europe and Asia.

In this warfare area, the superpower balance is undergoing important change. "The Soviets' continual upgrading of the quality of their attack and cruise missile submarines," says the Pentagon report, "combined with continued improvements in Soviet naval aviation, has permitted Moscow to begin extending 'sea-denial areas' into the southern Norwegian Sea and the northwest Pacific."

In these circumstances, many admirals maintain, any reduction of the Navy's capabilities shapes up as being shortsighted and perilous. Even so, budget pressures appear to be dictating a painful reassessment of some important Navy and Marine Corps goals.

The latest Pentagon budget preparation, for example, defers the achievement of the Navy's plan for a fleet of 600 ships by 1989. There will be 580 instead. Sixteen older frigates are to be retired ahead of schedule. In addition, the Navy has been ordered to stand down one of its active carrier air wings, leaving it with only thirteen.

Also sacrificed in the budget crunch was the Navy's plan to build the A-6F carrier-based attack aircraft. The fleet will make do with less potent models of the A-6 as well as F/A-18 strike fighters until the arrival of the stealthy A-12 Advanced Tactical Aircraft in the mid-1990s.

There are slowdowns of other Navy projects. The Pentagon, in reviewing the Navy's shipbuilding plan, lopped off an LSD-41, a major amphibious vessel, thereby deferring achievement of a marine amphibious shipping goal. The budget funds only three DDG-51 Aegis destroyers, two fewer than the Navy wanted to buy this year to replace ships due for retirement.

It is the fate of the US aircraft carrier fleet, however, that is fueling most concern in the Navy.

The Defense Secretary insists that there has been no change in the goal to achieve and maintain a force of fifteen deployable carriers.

Still, some Navy officers express conviction that the budget situation will inevitably lead to calls for the Defense Department to modify the plan. The Navy currently has fourteen carriers and expects to hit fifteen in 1990, with the activation of the USS Abraham Lincoln.

Already, however, there are suggestions that the Pentagon can achieve major savings by deactivating its two oldest carriers—the USS *Midway* and USS *Coral Sea*, both World War II vintage ships. That would take the carrier fleet back down to thirteen decks until at least 1992, when another new carrier is to enter service.

A recent study by the Congressional Budget Office estimates that the move would produce five-year savings of some \$4.2 billion.

The Navy maintains that such savings would carry a high cost in terms of additional risks to the nation. Far from being an overambitious goal, its supporters claim, the proposed fifteen-carrier fleet falls well below the JCS wartime "requirement" for more than twenty carriers.

In short, there clearly is no quick fix for the crucial problem of maintaining American strength in the face of a continuing Soviet challenge and the rise of such indigenous Third-World threats as Iran.

The debate over American security risks has just begun. It is bound to intensify as the battle over defense budgets heats up.

Budget cuts threaten to wipe out the gain USAF has made in force effectiveness. The immediate concerns are about people, readiness, and sustainability.

An Air Force for the Lean Years

BY JOHN T. CORRELL EDITOR IN CHIEF

WHEN the defense budget demolition exercises ended last winter, the Air Force found itself \$18 billion shy of the funding it had counted on for this fiscal year and next. Reductions of the same—or even greater—magnitude will be in effect through 1993.

"Let me assure you that the American people need and deserve a better Air Force than this budget will provide," Air Force Secretary Edward C. Aldridge, Jr., said at a Pentagon news conference. He also said "the budget levels for FY '89 are such that future capability will be reduced and past gains will, in some cases, be reversed."

The scaled-down force that enters the 1990s will have fewer combat wings and fewer people. Some modernization programs will have been delayed and others canceled. Unless military compensation improves, personnel shortages in critical specialties are almost certain. Force-structure turbulence has already led to widespread apprehension among military people and civilian employees about the security

of their careers. To save money, USAF will recruit one-third fewer airmen this year than it had planned. Military personnel vacancies are not being filled until unit manning drops below ninety percent overseas and below eighty-five percent in the continental United States.

Air Force leaders are also worried about a lack of wartime sustainability. Flying units today are living off spare parts ordered two and three years ago. The supply will begin drying up soon. The FY '88 and FY '89 budgets fund less than half the requirement for aircraft spares. All of those purchased will be consumed in regular peacetime operations.

No wartime reserve stocks are being bought, and new aircraft joining the inventory in 1990 and 1991 will not have wartime readiness spares kits. Gen. Alfred G. Hansen, Commander of Air Force Logistics Command, predicts that these decisions will come back to haunt us.

"While we remain ready to respond to contingency operations,

Deep budget cuts are making it more difficult to keep first-line tactical fighters, like the F-16 shown here, reloaded and ready.



we may not have the staying power to sustain," General Hansen told the Senate in testimony March 25. "We are, in fact, a peacetime Air Force and must accept the risk to our national security that that entails."

The outlook would be even worse except for gains in capability achieved between 1980 and 1987. The Air Force now has newer aircraft that perform better and go longer between breakdowns. The airlift and aerial refueling fleets have been beefed up considerably. By the end of the decade, strategic airlift capacity will have nearly doubled over its 1980 level. Fuel offload capability of tankers will be up by fifty percent.

Some of the most spectacular improvements are not yet out of the development pipeline. An example is the Advanced Medium-Range Air-to-Air Missile (AMRAAM), which is to begin service in 1990. In aerial combat, it will double the effectiveness of the F-15 and increase that of the F-16 by six times.

Force Posture Today

Pentagon budgets have been tailing off since 1985, when the Reagan Administration's rearmament program hit its peak. Despite that, the Air Force had been funded reasonably well up to six months ago when the wholesale round of budget reductions began.

Precise details of force posture are classified, but the generalized "mission capability indicators" announced by the Defense Department in March show the results of the good budget years.

Aggregate US "nuclear kill potential" against various targets, ranging from very hard silos to easily damaged industrial facilities, was about seventy-five percent better in 1987 than it had been in 1980. The improvement was best against hardened ICBM silos, the class of targets that is most difficult to damage, Deputy Defense Secretary William H. Taft IV told the Senate Armed Services Committee.

Between 1980 and 1987, tactical air forces doubled their "relative kill capabilities" for air-to-air engagements. Their capability to destroy ground targets increased by 240 percent. These measures take into account such variables as number and quality of aircraft, their probability

of survival in combat, sortie-generation rates, and weapons effectiveness, Secretary Taft said.

The Defense Department had been projecting that these measures of mission capability would improve significantly more by 1992. That is no longer likely. In fact, a shortfall in readiness and sustainability funding could make the numbers drop quickly. Cannibalization of aircraft for parts is already increasing, and USAF says that the number of aircraft grounded as not mission-capable could climb by ten to fifteen percent. Comparative effectiveness would decline further over time if tactical force modernization fails to keep abreast of changes in Soviet and Warsaw Pact forces.

Secretary Taft also cited a substantial increase in munitions sustainability between 1980 and 1987. Stocks of air-to-air munitions grew from thirty-three percent to nearly sixty percent of the desired levels. Air-to-ground munitions were up from fifty-five percent of the requirement to seventy-five percent. (USAF says it could fly 100 percent of its air-to-ground sorties with full weapons loads, but that many sorties would go with less than the best choice of munitions.)

The Air Force has absorbed the

brunt of the budget damage so far by reducing force structure and weapons acquisition. Major procurement cuts have been concentrated in the termination of about twenty programs. Acquisition of other systems has been slowed—which will lead to higher unit cost for these weapons if production cannot be maintained at the most efficient rate.

For the immediate future, though, the main areas of concern are personnel, readiness, and sustainability.

Tough Times for People

Both the Defense Department and the Air Force insist that they regard their people as their most important asset. They have shielded them as best they could from the budget turbulence, but total protection has not been possible.

For the past several years, Congress has treated the defense payroll as a convenient place to save money. As a consequence, military pay has dropped behind that in the private sector by eleven percent. The gap for Defense Department civilians is even worse at twenty-four percent. Personnel retention rates are still good in the overall count, but losses have begun in critical specialties.



One of the actions announced to achieve the target reduction in force structure is deactivation of the 474th Tactical Fighter Wing at Nellis AFB, Nev. The Air Force of the next five years will have fewer people, fewer combat units, and less flexibility.

The biggest problem is pilots. Current projections show that the Air Force will be short 2,499 pilots by 1993. That is equivalent to the loss of more than ten flying wings of pilots, Lt. Gen. Thomas J. Hickey, USAF Deputy Chief of Staff for Personnel, told Congress in March.

"Air Force pilots are increasingly opting to leave active duty because of dissatisfaction with military life and because lucrative airline flying opportunities make the career transition much safer than in past years," General Hickey said.

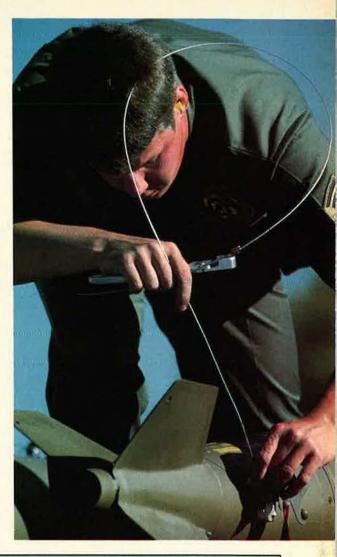
Retention of military engineering officers is down by eighteen percent from three years ago. The loss rate for civilian engineers has increased twenty-one percent since 1983. In both cases, the Air Force is outbid by private industry for the limited pool of technical manpower.

Even before the deep budget cuts started, Congress had ordered the Defense Department to reduce its officer strength by six percent by 1990. The Air Force cut 1,255 officers last year and must come down another 2,255 this year. Personnel officials expect to achieve this by encouraging voluntary separations and limiting the number of new lieutenants commissioned. They warn, however, that the reductions coming in FY '89 and FY '90 may compel the Air Force to discharge officers it needs to keep and who want to stay in service.

The threat of involuntary furloughs has hung over the heads of Air Force civilians for months. These people are paid with Operations and Maintenance (O&M) money, the same account that funds flying hours, readiness, and sustainability. After inflation, the Air Force O&M budget dropped 10.5 percent in FY '88. This would have been a heavy hit under any circumstances, but was made heavier still because Congress did not set the budget until December 22.

By the time the reduction was allocated among operating commands, they were committed to their second-quarter fiscal plans. The Air Force says "severe actions" in civilian manpower management cannot be ruled out this year, but hopes to avoid anything drastic by juggling its money. Next year will be better if the full request for O&M is approved, but even that would be

The Air Force says that it could fly all of its assigned attack sorties today with full weapons loads, but that many sorties would carry less than the best choice of munitions. Precisionguided "smart" weapons are—and will continue to be-in short supply. The familiar Mark 82 bomb, shown here, is still a mainstay of tactical operations.



The Second Wave of Cuts

Congress was three months late in deciding on the FY '88 defense budget. Thus, the first quarter of the fiscal year had already passed when the Air Force was confronted with an \$8 billion cut—to be achieved in the nine months remaining. This played havoc with operations and led USAF to such wrenching actions as requesting authority to furlough civilian employees to save money. Sixteen members of Congress wrote to the Secretary of the Air Force to complain about possible furloughs in their districts. Fourteen of them had voted for the budget cut that set up the problem.

That, however, was just the beginning. The armed forces were told to reduce their spending plans by ten to twelve percent for each of the next five years. The amended defense budget sent to Congress in February cut the Air Force's original funding request for FY '89 by \$10 billion. Here are some of the consequences.

• Force Structure. Deactivation of two tactical fighter wings; reduction of the number of aircraft assigned to twelve Air Guard and Reserve squadrons, which is the equivalent of losing a third fighter wing; phaseout of the SR-71 strategic reconnaissance fleet; deactivation of two tactical air support helicopter squadrons; conversion of an Air Guard RF-4C squadron to other purposes; and mothballing of the spacelaunch facility at Vandenberg AFB, Calif.

• Manpower. The Air Force takes a nominal reduction of 25,000 military people, but the actuality is worse. It will close out this fiscal year with military strength 31,000 lower than in 1987.

• Systems. Cancellation of the antisatellite (ASAT) missile, the AGM-130 standoff weapon, Minuteman III penetration aids, the C-27 light aircraft, and the replacement for the Airborne Command Post. The Midgetman Small ICBM is also on the list for termination, but that is a popular program with Congress, which is insisting on at least enough funding to keep the development alive. Other acquisition programs will be delayed or deferred. The Research, Development, Test, and Evaluation (RDT&E) account has been cut by sixteen percent.



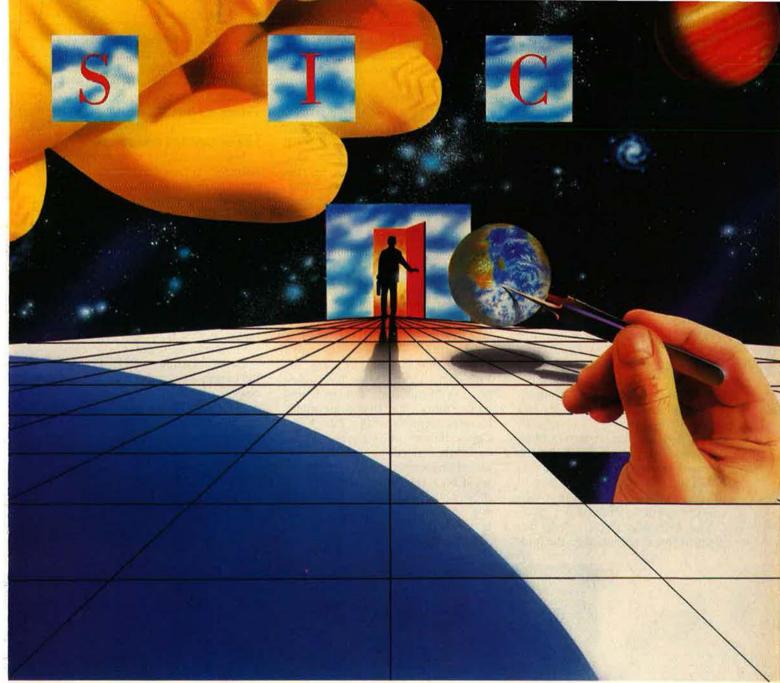
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The enlisted force is in good shape. Ninety-nine percent of last year's recruits were high school graduates, and 48.5 percent of them were in the two top mental categories as measured by the Armed Forces Qualification Test. Only 0.2 percent were in the lowest mental grouping, Category IV. In 1980, first-termers were fifty-two percent of the total USAF enlisted strength; today they are forty-three percent. This higher mix of career airmen adds experience and maturity, but creates a new problem when more fully qualified people must compete for a limited number of NCO promotions.

USAF leads all of the services in the percentage of its members who are women, 12.6 percent as of last December. In the first quarter of FY '88, about twenty percent of its recruits were women. Congress has directed the Air Force to recruit twenty-two percent women in 1989. Service officials are trying to get the quota lifted, asking that they be allowed to recruit to "market levels" of interested and qualified applicants, regardless of gender.

The Defense Department has pledged that it will manage the bud-

get reductions in such a way that readiness and sustainability do not suffer. There is obvious sincerity in this promise, and the Pentagon may be able to bring it off over time with its redrafted five-year defense plan.

At present, however, the major commands are struggling with shortfalls in operating money as a result in the sudden drop in this year's budget. In a March 30 memo, Secretary Aldridge said that "to operate within depot maintenance funding constraints, we are holding the repair level of exchangeables to sixty-five percent of the requirement, maintaining engines at a fifty percent service level, and deferring all but safety-of-flight and minimum corrosion control during aircraft and missile overhauls."

Lt. Gen. Michael J. Dugan, USAF Deputy Chief of Staff for Plans and Operations, told Congress in March that "it is becoming increasingly clear that some major training exercises like Red Flag, Cope Thunder, and Checkered Flag deployments will be drastically reduced or canceled. Also, unless the Air Force gets reprogramming authority, the tactical air forces may not be able to fly out their flying hour program."

Other forces are affected, too.

Strategic Air Command, for example, will not hold a munitions loading competition in 1988. It has parked about twenty-five percent of its motor vehicles and stopped purchases of all base-level equipment.

Lower Level of Readiness

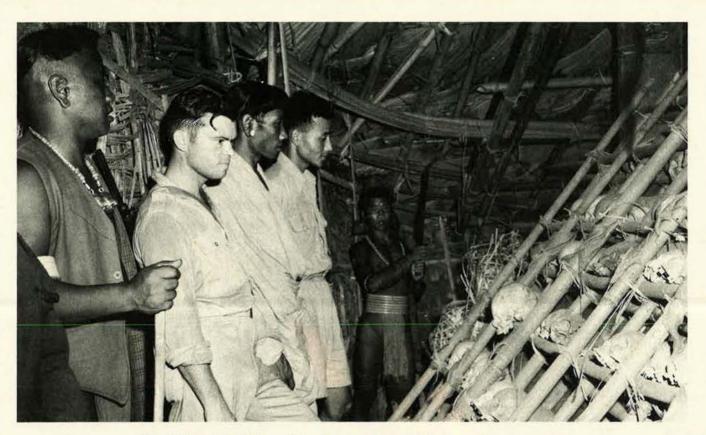
Military Airlift Command announced April 9 that it is going to a lower level of operational readiness to avoid furloughing its civilian employees and making deep cuts in its personnel programs. "We have decided to accept a short-term reduction in our overall mission capability rather than to take a long-term reduction in our ability to perform our mission through demoralization of our dedicated civilians," said Gen. Duane H. Cassidy, MAC's Commander in Chief.

General Cassidy said that most of the money to carry out his plan will come from a thirty-five percent reduction in local training flying hours during the rest of this fiscal year, which will affect training by C-5, C-141, and C-130 crews. He said that "this action will reduce the command's capability to respond to such short-notice taskings as the recent Honduras operation and major humanitarian relief efforts." MAC has canceled its Airlift Rodeo com-



The C-130 at right won't be repeating this appearance at Airlift Rodeo this year. It's canceled, along with other aspects of training and operations in Military Airlift Command. MAC says it will accept a temporary drop in operational readiness to avoid furloughing civilian employees and making deep cuts in personnel programs.

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In World War II, Japanese invaders ran into an additional enemy in Burma—Naga tribesmen whose methods of warfare included ambush and decapitation.

AMERICA'S HEADHUNTER ALLIES

petition and will conduct no operational readiness inspections this year.

The Air Force will cancel nine overseas deployments planned for tactical units this year. Airfield pavement repairs will be delayed in some commands. Long-haul communications have been reduced by twelve percent. Almost 50,000 tons of vehicles and munitions are in temporary storage for want of money to ship them.

Tactical Forces

The size of the fighter force is headed in the wrong direction. The original plan for the defense recovery program called for forty tactical wings by 1986. The Air Force still says this is the minimum number of wings it needs to carry out its operational responsibilities. The present lineup consists of thirty-eight fighter and attack wings—and is headed downward toward thirty-five because budgets will not support more.

The good news is that combat capability of the tactical fleet has never been better. F-15 and F-16 fighters now predominate in the active forces and are replacing F-4s in the Guard and Reserve. The F-15, in Air Force service since the mid-1970s, is more reliable and easier to maintain than the 1960s-vintage F-4. And the F-16, introduced in 1979, is hardier than either of them.

Compared to the F-4, the F-16's mission-capable rate is twenty-five percent higher, the break rate is twenty-eight percent lower, and it requires seventy percent fewer maintenance hours per flying hour. In Tactical Air Command's Coronet Warrior exercise last year, F-15s persisted under surge conditions four times better than a computer model had predicted. Upgrades of the F-15s and F-16s promise to make their impressive performance statistics even better.

Continued modernization of the fighter fleet with additional F-15s and F-16s is one of the four priorities USAF has declared critical for tactical forces. The other three requirements on that list are the Advanced Tactical Fighter (ATF), the Advanced Medium-Range Air-to-Air Missile (AMRAAM), and sufficient operational support resources

The shark-mouthed F-4E Phantom, seen here representing Osan AB, Korea, in Exercise Team Spirit, is among the last of its line in the active forces. F-15s and F-16s now predominate. The F-4 has a tremendous combat heritage and loval advocates who still swear by it, but the newer fighters are more reliable and mission-capable.



to keep the fighting commands from falling into the "hollow forces" trap that bagged them in the 1970s.

Some opposition to these plans has surfaced. In late 1987, Assistant Secretary of Defense David Chu argued for killing the F-15E, the dualrole variant of the basic fighter, so that its funding could be applied instead to more advanced systems now in development. He was unsuccessful, but he didn't miss by much.

A faction of Defense Department bureaucrats and Army officers is also trying to thwart Air Force intentions to adapt an existing fighter, probably the F-16, for close air support. These people want an all-new aircraft built specifically for that mission. Its enthusiasts envision a heavily armored, slower-moving airplane that bristles with guns and has long loiter time. The Air Force terms this notion "The Mudfighter" and says it could not survive on the battlefield of the future. It also says that single-mission airplanes limit flexibility.

In testimony to the Senate, USAF's Director of Plans, Maj. Gen. Albert L. Logan, said that twenty-eight percent of the thirty-eight-wing tactical force is committed to close air support and battlefield air interdiction today. Another fifty percent, flying multirole aircraft, can be tasked to perform close air support if necessary.

"The Air Force maintains less than three fighter wing equivalents for deep interdiction, and only seven wings are designated for air superiority," General Logan said. "The bulk of the fighter force is essentially multirole because we lack the ability to perform all the potential tactical air missions simultaneously. . . There is not enough tacair to go around; thus we depend on the flexibility of multirole aircraft to focus on missions as dictated by the circumstances of war."

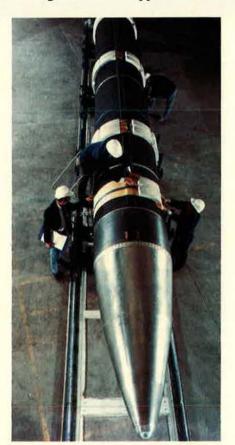
Strategic Forces

The biggest single line-item reduction offered up in the revised five-year defense plan is the cancellation of the Midgetman Small ICBM. In the original strategic modernization package, Midgetman and the MX Peacekeeper were supposed to be complementary, mutually reinforcing systems. Instead, budget pressures have now set up a political confrontation that effectively transforms the two missiles into competitors for the same funding.

More than twenty Peacekeepers are already on alert in old Minuteman silos. The schedule calls for a total of fifty to be operational in this basing mode by December. The Air Force wants a second fifty for "railgarrison" deployment. These missiles would move out on railroad tracks in time of crisis.

Peacekeeper is a multiple-warhead missile. Each Midgetman carries only one warhead. For equivalent firepower, the Small ICBM costs three times as much and takes twice the manpower to operate. Consequently, the Air Force and the Defense Department concluded that they cannot afford Midgetman when budgets are being cut so radically.

The hooker is that Midgetman has a great deal of support in Con-





Armchair experts may think otherwise, but Strategic Air Command says the B-1B bomber (above) is doing fine. By the end of the decade, it will have taken over the primary strategic penetration role from the B-52. The biggest single cut in the Pentagon's revised financial plan is cancellation of the Midgetman (below left).

gress. If the small missile is restored and budget ceilings remain as projected, the Air Force would have to find \$36.4 billion in cuts elsewhere.

By the time this article appears in print, the Air Force should have taken delivery of its one-hundredth and final B-1B bomber. Strategic Air Command continues to express satisfaction with the B-1B bomber and says it performed fantastically well in the last Global Shield exercise. Gen. John T. Chain, Jr., SAC's Commander in Chief, doesn't think much of the incessant criticism of the airplane that he reads in the newspapers.

General Chain recently rebutted "one so-called military analyst" who claimed the bomber can't fly higher than 20,000 feet. "Well, that's interesting," General Chain said. "I've personally flown it well over 30,000 feet." He acknowledges that the electronic countermeasures system "doesn't work as well as I'd like," but says that the B-1B can still penetrate hostile airspace because it's hard to detect on radar and

scoots along in all weather at 200 feet and a speed better than 600 mph.

SAC's older generation of strategic weapons, the B-52 bomber and the Minuteman ICBM, have been modified and upgraded steadily. These systems still have considerable military usefulness remaining, although their roles are changing as new systems come on line.

By the end of the decade, the B-1B will be the primary penetrating bomber. The B-52 will then function mainly as a cruise missile carrier and assume an additional conventional work load in support of theater commands. In the 1990s, the B-1 will yield the toughest penetration jobs to the B-2 Stealth bomber.

Live launch tests of the improved short-range attack missile, SRAM II, begin next year. Both the B-1B and the B-2 will carry this weapon when it is operational in the 1990s. Work also continues on the Advanced Cruise Missile, and USAF says development is proceeding at "the fastest prudent rate."

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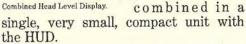
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THE BRAINPOWER.

THE WILLPOWER. THE WINPOWER.

USAF's top enlisted man describes for Congress the five issues of greatest concern to Air Force people and their families.

What's Bugging the Troops

ONTINUING budget cuts and military strength reductions are causing enlisted people to question the advantages of a military career, Chief Master Sergeant of the Air Force James C. Binnicker said recently in appearances before various congressional committees.

Chief Binnicker said that in the past year he has visited eighty-nine bases and talked with thousands of Air Force members and their families. He also hears regularly from senior enlisted advisors in the field, who are in even closer contact with the troops. The warning signals are easy enough to read.

Today's enlisted force is generally regarded as the best that USAF has ever had. It was built with a substantial investment of effort and money after the low pay and shabby conditions of the 1970s had driven experienced veterans out of the force in large numbers. Now, Chief Binnicker said, underfunding of "quality-of-life" programs is laying the ground anew for retention problems in the near future.

Five major issues dominate the concerns of the enlisted force: pay and allowances, promotions, housing, the household goods weight al-

lowance, and medical and dental care.

The number-one problem is military pay, which has fallen behind private-sector compensation by eleven percent. Military pay raises, which have been capped year after year, have also begun to trail behind the rate of inflation. "This is a significant point," Chief Binnicker told Congress. "I believe one reason we have had such favorable recruiting and retention with a growing pay gap has been that relative purchasing power has not eroded. Our pay increases have pretty well matched inflation. That is no longer the case."

This is the combination that led to trouble in the 1970s, when military compensation not only failed to keep pace with the civilian world but when runaway inflation also decreased the value of GI paychecks. Chief Binnicker called for a pay raise of at least 4.3 percent.

The cap just imposed on Variable Housing Allowances (VHA) means reductions in that area for sixty-five percent of Air Force people. "These reductions were deep enough that more than 30,000 Air Force people actually got a pay cut on January 1,

1988," the Chief said. "Their two percent pay raise was wiped out by lower VHA rates—and their housing costs didn't go down one dime."

NCO Force Is a Bargain

Promotion rates for five of the nine USAF enlisted grades are at their lowest points in ten years. A major reason is that the Military Personnel Appropriation is based on limiting the number of people in NCO grades to an arbitrary percentage of the force. In 1980, 43.5 percent of the Air Force's enlisted strength was in the top five grades. Because of better retention and a drop in force size, forty-six percent of the troops are now in those grades. The net result is a slowdown in promotion opportunity.

This does not mean the force is top-heavy with NCOs. "The Air Force is evolving to a less-labor-intensive force structure," Chief Binnicker said. "Modern equipment is more compatible with a smaller, more experienced force." In addition, "Air Force NCOs are the best bargain in the Department of Defense. An NCO with ten years of experience in the Army, Navy, or Marine Corps is typically an E-6; in

the Air Force, he or she is typically an E-5 and therefore costs less. . . . We should not penalize Air Force NCOs by letting favorable retention patterns and differing needs for experience produce gross inequities."

With VHA rates deteriorating, more married members would prefer to live on base, but quarters are scarce. Approximately 43,000 Air Force families are on the waiting list for base housing. When they do get quarters, they often find them insufficient for their needs.

"Family housing units that are too small, with too few bathrooms, inadequate kitchens, outdated appliances, chaotic utility systems, and no carpeting are the most common complaints," Chief Binnicker said. "The average house is between thirty and thirty-five years old. Single junior enlisted members who are forced to live on base are faced with equally inadequate dormitories. Current space and occupancy standards require sharing of small rooms, with little storage and communal bathrooms for many members. These inadequacies compound the frustration and dissatisfaction of many enlisted members."

The Cost of Moving

Many Air Force people lose money each time they are reassigned. The government does not fully cover their travel, temporary lodging, and house-hunting costs. The most recent Air Force survey shows that members are reimbursed for only a third of their actual moving costs. Median out-of-pocket expenses ranged from \$1,300 for middlegrade enlisted personnel to more than \$2,700 for field-grade officers. When their household goods exceed their weight allowance for shipping, members must pay for the difference, and that can be a major expense.

"The current weight allowances are antiquated," Chief Binnicker said. "Fifteen percent of the enlisted force and nineteen percent of the officer corps who moved in Fiscal Years 1985 and 1986 paid overweight charges. Ninety-six percent of those who paid charges were members with dependents, and the mean overweight charges averaged sixty-two percent of monthly basic pay. The Air Force supports the congressionally directed DoD household goods weight allowance report, April 1987, which recommends an 18,000-pound ceiling for senior members and graduated entitlements for lower grades. These allowances would meet ninety-five percent of the shipment weight needs of service members in grades below O-6. However, Congress must also provide the funding needed to implement this change."

Medical care has always been

recognized as a major benefit of military service. "The wartime readiness mission and the delivery of peacetime health care are stretching medical resources to the limit," Chief Binnicker said. "Dependents are particularly aggravated by the lack of access to the health-care system. Active-duty members are given priority, but in many areas, dependents are frustrated by long waits for appointments or the unavailability of appointments in military facilities."

He said USAF has established a Health Care Finder program to assist dependents and retirees seeking doctors and facilities that accept payment from CHAMPUS. Also, four contract primary care clinics will open this year. But even with these programs, he said, "there is grave concern about the ability to continue to deliver adequate health care to our dependent and retiree population through FY '88 because of underfunding of medical programs by \$65 million."

Chief Binnicker thanked Congress for the quality-of-life programs it has provided, but added that personnel and budget cuts have created a difficult situation at present. "We simply will not have the resources to meet the needs of our military members and families without congressional support," he said.

—J.T.C.



In his various appearances before Congress, CMSAF James C. Binnicker, shown here at far right, stresses the issues that affect today's enlisted force. Five major issues dominate the concerns of the enlisted force: pay and allowances, promotions, housing, the household-goods weight allowance, and medical and dental care. Chief Binnicker says that the number-one problem is military pay.

-USAF photo by TSgt. Ken Hammond

Special Operations forces, rebuilt in the aftermath of "Desert One," are learning to function together in their new unified command.

BY JEFFREY P. RHODES AERONAUTICS EDITOR

T was the "Desert One" fiasco more than anything else that led to the revitalization of US Special Forces. That hastily mounted operation in April 1980 not only failed to rescue American hostages held in Iran but also turned into a disaster of even wider dimensions.

Eight US servicemen died when a mission helicopter collided with a tanker aircraft. Several other helicopters malfunctioned, with the result that some were ditched and some turned back. Evacuation of the disaster site was so hurried that the raiding force left behind the bodies of the servicemen who were killed, and information found in the wreckage helped the Iranians track down people who had been secretly aiding the US in preparing for the assault.

Congress and the nation demanded better preparation than this for low-intensity conflict and action against terrorism. A year ago this month, US Special Operations Command (USSOCOM) was activated to carry on in the tradition of the famed Office of Strategic Services in World War II and the counterinsurgency forces in the Vietnam War.

The Air Force component of USSOCOM is Twenty-third Air Force, and its cutting edge is the 1st

Quite a bit of what the 1st Special Operations Wing does is classified, but one element that is highly visible is the unit's Lockheed AC-130H Spectre gunships. With a combination of sensors and the plane's one 40-mm and two 20-mm guns, and, as shown here, one 105-mm cannon, the gunships can lay devastating firepower on ground targets with surgical precision, even in the dark.





Special Operations Wing (SOW). Both are located at Hurlburt Field, Fla.

"Before Desert One, we were on the tail end of the equipment dog," said Col. Carl Anderson, the wing's Deputy Commander for Operations. "Now we're up near the snout so far as new equipment goes, and that's important." Indeed, the 1st SOW's three flying squadrons are to get a huge expansion of major assets.

The 1st SOW was heavily involved in Vietnam and has been part of almost every special operation undertaken since—the assault on the Son Tay prison in North Vietnam, the aborted Iranian hostage rescue, and the Grenada operation.

Today, using stock aircraft equipped with not-so-stock avionics and systems, Twenty-third Air Force crews have the ability to penetrate long distances behind enemy lines at night and at low altitudes, arrive precisely anywhere in the world within seconds of a target time, and airdrop, airland, recover, hover, or shoot with their MC-130E, MH-53H, and AC-130H aircraft. "We train to the hardest mission," said Col. Byron R. Hooten, the 1st SOW Vice Commander. "If we can do the hardest thing, everything else becomes relatively easy."

The SOFs, and especially 1st SOW, have to be good at what they do. In anything short of an all-out war, the 1st SOW has to be perfect, with no casualties to themselves. "If we lose an AC-130 in wartime, it is a tragedy," said Brig. Gen. Hanson L. Scott, Vice Commander of Twenty-third Air Force. "But if we lose one in a peacetime operation, it is front-page news."

"There is a lot more of the Air Force involved in special ops than 1st SOW," said Col. Dale Stovall, 1st SOW Commander. "Other units use their capability to augment us and help us get where we are going. We have to work closely with other MAC units all the time. SAC tankers are invaluable to us."

New and Improved

The possibility of a second Iranian rescue attempt brought the assignment of long-range MH-53 Pave Low helicopters in 1980 to 1st SOW. Also since Desert One, incremental improvements in equipment—secure voice transmission and electronic countermeasures, for example—have been added to the fixedwing aircraft on a continuing basis.

The 20th Special Operations Squadron (the "Green Hornets") flies the MH-53s on missions that last more than eight hours, using terrain-following radar at night and in bad weather. The helicopters, used for troop infiltration/exfiltration and resupply behind enemy lines, also have the capability to hover and descend automatically to two feet above the ground. Present plans call for forty-one HH-53B/C aircraft (and the eight MH-53H Pave Low IIs currently at Hurlburt) to be reengined, modified, and brought up to the much improved MH-53J Pave Low III standard by 1992, although not all of these aircraft will be assigned to Hurlburt.

The 8th SOS (the "Black Birds") does basically the same mission as the 20th SOS, except that the squadron's MC-130E Combat Talons have much longer range and greater payload, can refuel the helicopters in midair, and can't hover. The fourteen MC-130Es worldwide are heavily tasked. They will be augmented by up to twenty-four improved MC-130H Combat Talon IIs currently being funded.

The only active-duty squadron in MAC to use guns and bullets as part of its job description is the 16th SOS. The squadron flies the AC-130H Spectre, which has two 20-mm M61 Vulcan cannons, a Bofors 40-mm cannon, and a 105-mm howitzer firing from the aircraft's port side. The gunships, which first gained public attention in Vietnam, are used for close air



The business end of the AC-130H's 105mm cannon. The standard that the load crews strive for is to have one of the gun's fifty-five-pound shells striking the target, one on the way, and one in the breech at any given time. When this gun is fired, the entire AC-130 fishtails to the right from the recoil.

-Staff photo by Guy Aceto

support, interdiction, armed reconnaissance, air base defense, and other missions. Twelve new AC-130U gunships are currently being procured, and the first aircraft is expected at Hurlburt in 1991.

When the new aircraft arrive, so will more people. From a base population of 3,700 in FY '86, the authorization takes a huge leap to 6,025 people by the end of FY '91. This population explosion brings its own set of problems.

Parking places will have to be made for the nearly fifty aircraft expected at Hurlburt by FY '92. Of the twenty-five construction projects planned through FY '91, twenty of them are solely for the special operations mission.

"We don't have one square foot of empty space," said Lt. Col. Carl Tickel, the base's civil engineer. "We are also probably already two years behind in getting what is needed. When the new aircraft start arriving, those facilities have to be in place, or we'll really be behind."

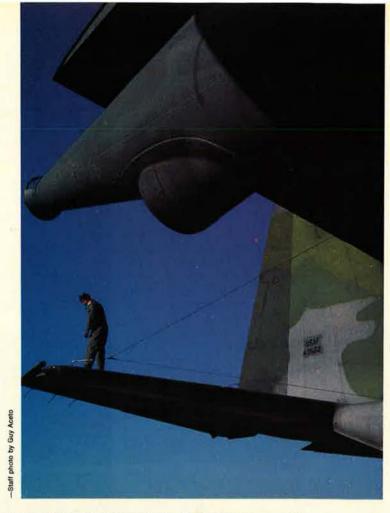
Busy All the Time

"We work in almost every JCS [Joint Chiefs of Staff] exercise around," said Colonel Stovall. "'Joint operations' is not just a buzzword with us. We work continuously with Navy SEALs and Army Rangers and Special Forces. We always have a customer."

Between February 18 and October 18 this year, for example, 1st SOW assets and crews will be involved in forty-eight deployments ranging for periods of from one day to five weeks. These trips involve anywhere from one to eleven aircraft going to places like Panama, Korea, the Middle East, Europe, and points all over the continental US.

"We are on the road quite a bit," said Capt. Dennis Jones, a pilot on one of the 20th SOS's MH-53Hs. "It varies from year to year, but on average, we are away from Hurlburt about four months a year."

It's not just the aircrews who travel, either. At any one time, up to 100 people are off base. "With every aircraft launched off station, a minimum of two crew chiefs go, too. And depending on the amount of time away, a number of avionics technicians also go along," said Lt. Col. David Rauhecker, the 834th





The 1st SOW's aircraft are outfitted with some very specialized systems, and proper function of all the aircraft's equipment is essential. Above, an MC-130E Combat Talon I loadmaster readies his plane for a twilight takeoff. The 1st SOW is never lacking for a customer to take somewhere. These sinister-looking characters are part of a Marine Force Recon team (left).

Component Repair Squadron Commander.

The large amount of time that the planes and crews are off base creates certain problems. Along with the burgeoning number of aircraft coming to Hurlburt, there will have to be an increased number of flight and maintenance crews trained to operate and work on the aircraft. However, with aircraft away so often and thus unavailable to train on, finding the opportunity to train is tough.

"We're getting a lot of new crews, and we've got to train them," said Colonel Hooten. "We're not getting any new aircraft right now, and we've got to hit the ones we have pretty hard to get the crews trained. Otherwise, we're going to have the new aircraft and nobody to fly them." Added Lt. Col. Fred Martin, the wing's Assistant Deputy Commander for Maintenance, "It's tough to fix aircraft and train at the same time. It takes a lot of manpower and resources to do that."

The handful of aircraft assigned to 1st SOW is pushed hard. On average, the AC-130s are flown fifty hours per month per airplane, and the MC-130s are airborne roughly sixty hours per month per plane—

totals that pass those of the average "slick" (unmodified) C-130 unit, which has many more aircraft, by ten to twenty hours per month. The MH-53s are flown upwards of thirty-five hours per month. That's higher than the rate at which the helicopters were flown in Vietnam.

And flown in Vietnam they were. All of the 1st SOW's aircraft are combat veterans, and that's why modernization of the SOF fleet is so critical.

Not only will the aircraft be on the leading edge of technology so far as sensors and radar systems go, but those systems and the aircraft themselves will be far more reliable mid-1960s," said Maj. Emmett "Otis" Redding, an AC-130 Fire Control Officer (FCO) evaluator. "As they were modified, they'd pull one box out and put another one in, so now there is a whole mishmash of systems. It drives maintenance crazy—they hurt themselves working so hard."

Not all of the aircraft have even had the same modifications. Several of the MC-130s have undergone a special operations enhancement program, and the first gunship recently left the base for a one-year-plus avionics modernization effort, with more AC-130s to follow.

With three different types of air-

which there is an aircraft generation squadron, an equipment maintenance squadron, and a component repair squadron. This organization makes it simpler for the wing to deploy, but the combination of old aircraft and eclectic systems doesn't help. As with most flying units, a War Readiness Spares Kit (WRSK) also has to deploy with the 1st SOW in most cases. A WRSK means that an outside airlift capability is needed, too.

An average large deployment requires ten to twenty pallets of transport space, and ammunition for the gunships requires even more pallet space. "We try to go lean and mean.



The 1st SOW's specialized rotary-wing assets are the Sikorsky MH-53H Pave Low II helicopters. The Pave Low Ils tend to operate closer to the ground more often than their fixed-wing brethren, so the helicopters are beefed up with 1,000 pounds of armor plate and are able to hover automatically. The helicopter in the background is a transient CH-53B.

-Staff photo by Guy Aceto

and easier to maintain. Many of those systems will be digital and in the form of line-replaceable units, and the aircraft will be new-build or completely reworked.

"It is expensive and time-consuming to keep the aircraft flying," said Colonel Rauhecker. "There have been constant changes made in the basic technologies to keep up with the threat."

Conglomeration of Systems

Those changes have produced a whole conglomeration of systems in the same aircraft. "All of the hardware on the gunships was built in the

craft all equipped with systems of a broad technological age, the 834th Component Repair Squadron has to be ready for just about anything. "We have to fix everything from vacuum tubes to lasers, and fiber optics are coming [on the MH-53J Pave Low IIIs]," said Colonel Rauhecker.

A case in point can be found on the MC-130Es, where the Morse code key sits just beneath the space where the satellite communications gear will go.

The 1st SOW is organized under the Combat Oriented Maintenance Organization (COMO) concept, in We can't take one of each part, so we look at failure data [for the parts] and take only some of them," said Colonel Martin. "They are all tailor-made packages. Maintenance, supply, and operations get together and decide what is needed and build a package from there."

Getting parts that are available for the aircraft and the WRSK is not a considerable problem for the maintenance troops. The unit's twenty-four-hour-a-day readiness posture—the 1st SOW's motto is "Any Time, Any Place"—entitles it to a Force Activity Designator 1 classification. That designator gives

the unit first priority for parts. "We rarely see an airplane down [inoperative] because of parts," said Col. Wayne Smith, the wing's Deputy Commander for Resource Management.

Getting the Job Done

Despite all of the advanced systems, the MC- and AC-130s and the helicopters still make inviting targets. Consequently, most of the 1st SOW's training is done at night since that would be the expected pattern in actual operations.

"We set up the flights, so we sure aren't going to take off at Oh-Dark-Thirty," said Major Redding. "But the maintenance troops have to be there whenever we land, and they

get the job done."

While the 13,000 hours flown by the three squadrons last year demonstrate that maintenance does get its "real" job done, the fact that 834th CRS technicians added 4,000 square feet to their building themselves also says something about motivation. The squadron, which has grown from 245 to 400 people in the last year, is also remodeling the interior of the building themselves.

Self-help activities are not limited to the 834th CRS, either. All the squadrons are doing self-help of some kind. For instance, the 1st SOW does not have an aerial port squadron on base. So supplies from a C-141 on Monday get unloaded by the same people who work in personnel and finance the rest of the week. Four or five people in every one of the load crews who work on a weekly basis also work daily in some other functional area. The base budget planner got the job of planning cargo loads

because he was familiar with the computer program.

Innovation thrives among the 1st SOW's people. The ball that contains the Low-Light-Level Television (LLLTV) camera for the AC-130s is not a standard piece of equipment for most of the Air Force, so there is no standard ground-handling equipment when the camera has to be fixed. Taking a screwjack type of car jack and a safing pin, one member of the 834th CRS went to the base's welding shop and had a custom lift made. It was promptly approved for use.

Innovation also extends to operational exercises. Overseas recently, there were specialized SOF assets and some C-12 operational support aircraft present. One day, all of the SOF assets were committed, but some special operations teams still had to be delivered. The teams were stuffed into the King Airs, and the crews went on to accomplish the mission. "It looked just like the movie Goldfinger," said Colonel Stiles.

Other instances of innovation abound. For example, the fire-control system in the AC-130 uses most of the components from the A-7 attack plane, and the AC-130's first-generation fire-control computers were breaking down. MSgt. Rick



The AC-130s carry a crew of fourteen, and it takes a team effort to find targets and destroy them. The pilot (above) uses the gunsight from an A-7 to find the targets the Fire Control Officer locates for him. After the boss gives the word, the load crews (at left loading the 40-mm cannon) go to work.



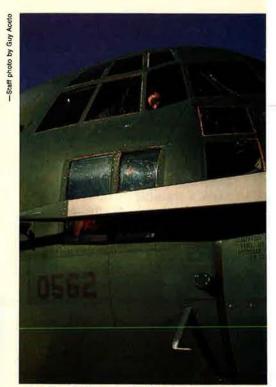
AIR FORCE Magazine / June 1988

Fields, a member of the 834th CRS, knew that the A-7s were getting new computers, so he had the computers that were removed from the aircraft tested and approved for use in the gunships. This action provided a bonanza of spare parts at a time when it looked as though the computers would have to be completely replaced with another model.

"There is not a lot of bureaucracy between the guy driving the airplane and the President," said Colonel Anderson. "The people here are aware of what's going on in the world and are concerned about it. They know they could be involved tonight." Two groups of people essential to the 1st SOW mission are found in the 1723d Combat Control Squadron assigned to the base and the Special Operations Weather Teams (SOWT).

The 1723d CCS's teams, like all combat controllers, are airdropped into an area to set up and operate either a drop zone or a landing strip. These small, commando-type units are also invaluable for such things as performing forward air guide services, positioning navigational aids and target designation equipment, and, when called on, providing air base defense.

Wartime special operations are



The MC-130Es have a unique way of picking up people and packages from the ground—the Fulton STAR (Surface-to-Air Recovery) system mounted on the airplane's nose.

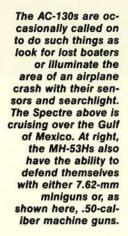
usually conducted far behind enemy lines. Pinpoint delivery (to the top of a mountain, for instance) is essential, which is why having a meteorologist along to give accurate readings of wind, temperature, and pressure is so critical. "It is vitally important to have accurate data," said Lt. Col. Tom Utley, the 6th Weather Squadron commander. "We are just as much a part of the team."

The four-man SOWTs have the capability to do clandestine entry, data gathering, and transmittal of data. The special weathermen have to go through parachute, small arms, mountain, and SCUBA training, and they carry a Belt Weather Kit (BWK) that contains a complete but miniaturized set of weather observing equipment.

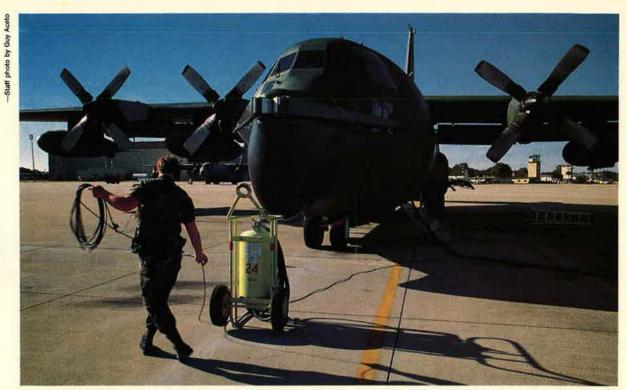
Tough Training

Interestingly, a high percentage of the current operational crews have been flying special operations since Vietnam, while, conversely, a large majority of the members of the 834th Combat Support Group are recent tech school graduates led by senior NCOs. But the system seems to be working well, and retention of









The Combat Talons fill a unique role. They can deliver or pick up after traveling long distances at low altitude, and they can refuel the MH-53s in midair. The ramp at Hurlburt is always this empty, because 1st SOW is called on for nearly every exercise.

pilots (up to eighty or eighty-five percent for all squadrons) and ground crews as well is very high.

"We have to bring the maintenance people up to speed pretty fast," noted Colonel Martin. "We try to recruit experienced people, but it's not always possible."

Many people are needed to fly the 1st SOW's aircraft, but few of the pilots or navigators come to the 1st SOW's squadrons right out of school. The newer pilots coming into the squadrons have a minimum of 1,000 or 1,500 hours in "slicks" and must be volunteers. The line of volunteers is pretty long.

Once the crews take shape at Hurlburt, most of what they learn about their new aircraft and its peculiar systems comes from on-thejob training.

In addition, the nature of the mission necessarily shrinks the envelope of safety that the crews must work in. Flying at night, at low level, and at high gross weights for long ranges in hostile environments calls for a higher level of expertise. The margin for error is small, and experience is needed to help keep the margin of safety as wide as possible.

There are no simulators to dupli-

cate terrain-following or to practice midair retrieval with the Fulton STAR (Surface-to-Air Recovery) system. Those things have to be learned by flying in an MC-130. It takes up to two years to season an MH-53 pilot fully because of the highly complex cockpit operation.

Once fully trained, the crew members are valuable resources for operations and for future leadership roles. "There are much greater opportunities for special operators now," said Capt. Curt Ross, a pilot with the 8th SOS. "Special operations needs warm bodies now for operations, and later on, we can move to staff jobs in MAC, SO-COM, or Twenty-third Air Force—all of which didn't exist in 1980. Now there is a career path for special ops."

But getting trained and staying finely tuned are crucial.

In an ideal world, the 1st SOW would be given several days' warning before conducting an operation in an unconventional scenario. This period would give the unit time to tweak up the aircraft mechanically, collect intelligence, do detailed planning, and deploy. It's unlikely to happen that way, though, so the unit

has plans for every contingency and updates them regularly.

One of the training methods that the wing has found works best is to get the crews involved with the planning of operations. "We give them a complete package with intelligence and other elements, and we want to see how they do. It's almost like the old 'Mission: Impossible' TV show—here's your tape and here's your mission," said Colonel Stovall. "They do the planning for a tactical effort while considering the political overtones. International politics is part of anything we do."

At the end of the planning period, the crew's plan is presented to the other crews and reviewed. Sometimes two crews are given the same problem to work separately. The answers are then compared and contrasted in the review session. A lot of good information comes out of these sessions, but there are never any completely right answers.

The wing also plays "what-if" with the enemy, too. "When we got to Grenada and encountered heavy antiaircraft artillery fire, it was certainly more than we expected," noted Colonel Hooten. "You can never eliminate any possibility."

The mind-boggling progress so far in microelectronics is just a beginning. The potential for solving Air Force problems has scarcely been tapped.

The Microelectronics Revolution Rolls On

BY MAJ. GEN. JOHN C. TOOMAY, USAF (RET.)

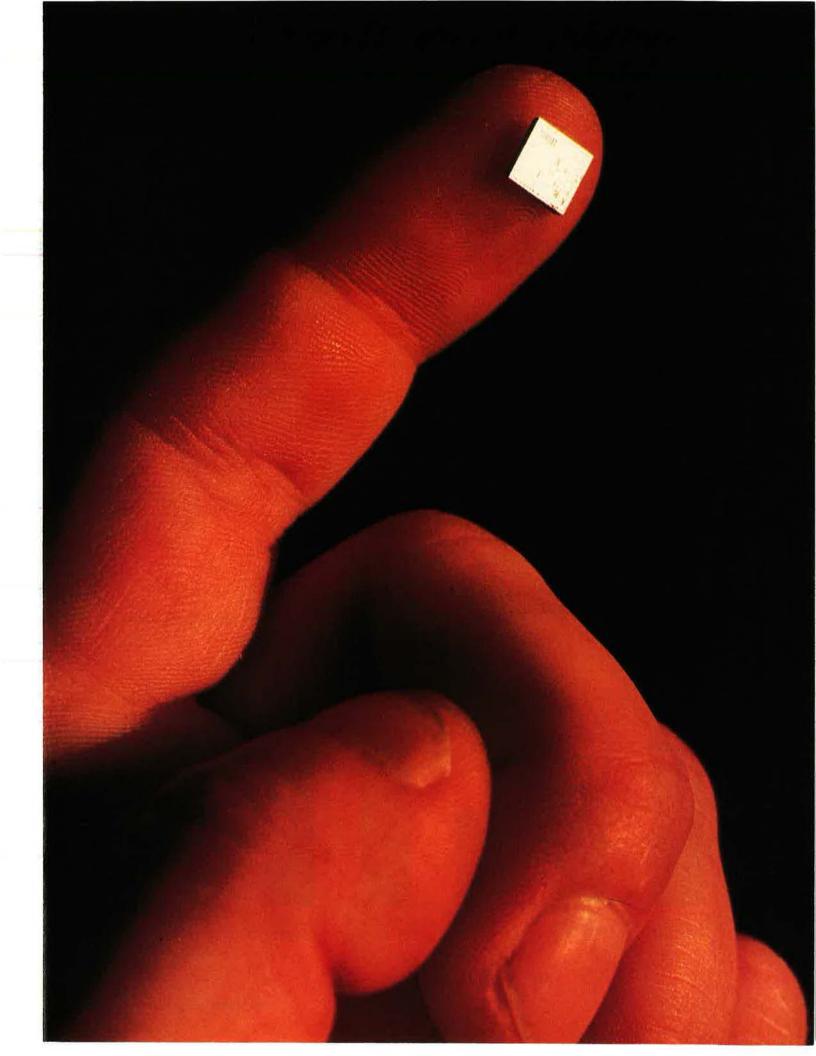
ICROELECTRONICS miracles are a long-standing phenomenon. The transistor was invented more than forty years ago, the integrated circuit thirty. We have been exposed to innumerable then-and-now pictures of massive early computers and the hand-held modern calculators that can outperform them. And few have missed the images of a microscopic segment of a modern chip across which has been laid a human hair, appearing gross and invasive against the delicate maze of circuitry behind it.

We are reminded that ten years ago, a tape casette held about twenty pages of data. A floppy disk of the early 1980s could store 500 pages (300 kilobytes), while the contemporary, state-of-the-art compact disk holds an entire encyclopedia. Yet these illustrations, graphic as they are, fail to convey the truly mind-boggling nature of what is being accomplished, of what the future may still hold, and of how the Air Force will be changed because of it.

The twentieth century has seen amazing progress in many fields, with automobiles, airplanes, spacecraft, and nuclear weapons being outstanding examples. But there has been no progress more amazing than that of microelectronics, from vacuum tubes—or electron tubes—to integrated circuits, with much more to come.

The small-signal triode, an electron tube with three elements, preceded the transistor, which at first represented a size reduction factor of about 100 from standard-sized tubes and of perhaps twenty to thirty from the smaller so-called "peanut tubes." Then the invention

One of the most amazing things about the microelectronics revolution
is that you have to look
hard to see it. The capacity of this microchip
is many times greater
than the vacuum tubes
or transistors it replaces.
As the size of the chips
decreases, the number
of possible uses increases.



of integrated circuits (ICs) put this electronics technology on a whole new curve. Today, a single "memory" chip a few tens of millimeters on a side, hardly larger than the first transistors, contains ten million transistors—a reduction in size from triodes of one billion—and affords its users four megabits of dynamic random access.

DRAM chip capacity has evolved in multiples of four over previous designs and at roughly three-year intervals since one-kilobit chips arrived on the scene in the early 1970s. The one-megabit DRAM now in full production for a worldwide market marks the seventh multiple of four—an improvement over the one-kilobit chip of three orders of magnitude in fifteen years. If this three-year cycle compresses slightly (and there are signs that it is doing just that), three more orders of magnitude of improvement should occur by the turn of the century, marking an improvement of six orders of magnitude in just over twenty-five years. These results can occur with no quantum changes in IC device design and production technology.

The beauty of it is that the improvements have occurred all across the board—in size, performance, power requirements, reliability, and cost.

Reduction of power required for a given task is best illustrated by a comparison between the old IBM 650 mainframe computer and today's small calculator. The IBM 650, vintage 1953, even had somewhat less capability than the modern programmable calculator. Moreover, it needed about eighteen kilowatts of power to drive and cool its 2,000 tubes. The modern calculator, on the other hand, uses two-tenths of a watt of power, or 100,000 times less!

Cost reductions are equally startling. A practical example: Memory chips in each generation eventually cost less than those in the preceding generation. Thus, four times as much capability can be bought for less money every three or four years. Another way to show cost reductions is by measuring the cost of computing power in, say, the cost per operation per second. This cost has dropped from about one dollar to about one one-hundredth of a cent in thirty years (four orders of magnitude). Current minicomputers have performance equal to that of early mainframe supercomputers for costs around \$500 (in 1985 dollars).

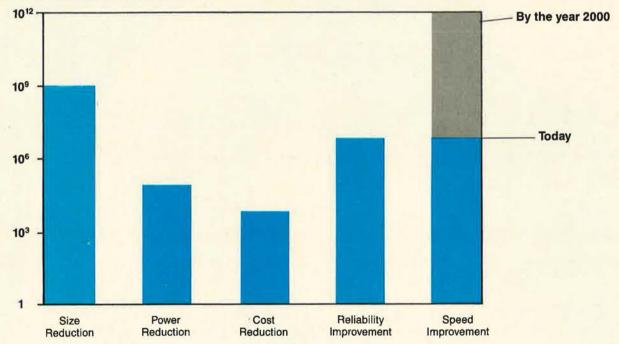
One would imagine that as chip complexity increases by orders of magnitude, reliability would suffer, but such is not the case. In fact, reliability has improved as fast as, or faster than, the other measures. In the period between the invention of IC and today, reliability (measured in terms of the rate of failures per thousand hours per transistor) has improved by an order of magnitude every four years. Beginning with about a ten percent failure rate in 1960, the failure rates today are less than one-millionth of a percent.

Computation's Long History

Computation has a 2,500-year history. In the two and a half millenia before the transistor, speeds of calculation, using various techniques and devices, increased by a factor of ten to a few tens of calculations per second. The early tube-driven computers did not exceed this speed. Today, however, a state-of-the-art microcomputer can do several tens of millions of single-string, sequential calculations per second—an improvement of

Charting the Revolution in Electronics

Improvement Factor Since 1950



seven orders of magnitude in just thirty years. Advances in very-large-scale integration (VLSI) technology already achieved in the laboratory assure further improvements of five to six orders of magnitude by the twentyfirst century—an astounding twelve orders of magnitude (one trillion) in forty years!

An overall measure of merit that assesses the aggregate upshot of improvements in the computational categories of speed, power, size, cost, and reliability would be so enormous as to exceed human comprehension.

There are several other noteworthy features of advancement in microelectronics. The microelectronics business has grown from less than \$1 billion in 1960 to about \$40 billion this year. It is a major and ever-increasing fraction of the total electronics business, which is

itself growing exponentially overall.

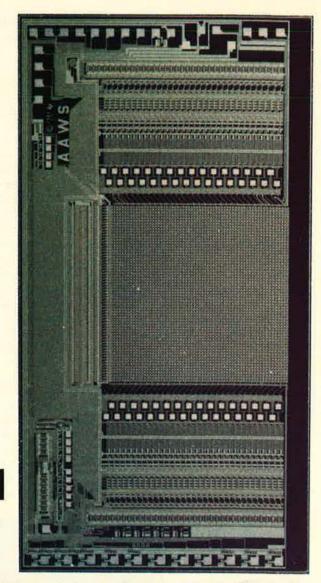
Microelectronics does not represent just a few thrusts involving a few technologies. It is extremely diverse, exploiting literally hundreds of technologies and at least three broad categories of capability: memory, logic, and signal processing (both digital and analog). The first two classes include all computer operations from mainframes to micros, general purpose or special purpose, standing alone or embedded in such systems as those for electronic surveillance, telecommunications, navigation, image processing, robotics, etc. Within these broad categories of application are thousands of circuit types and designs.

As generic ICs have become commodities (now dominated by the Japanese), companies in the United States have moved to capture and hold market niches with custom-built circuitry and with emphasis on service. Application-specific integrated circuits (ASICs) are now heavily emphasized. In keeping with this, the terms "gate array" and "standard cell" have entered the lexicon. They refer to concepts for achieving complex ASICs in minimum time and at minimum cost. Gate arrays embodying 100,000 gates ready to be wired together for a particular set of functions are available today. The objective is to be able to respond to a customer's special needs in only a few weeks.

Air Force Applications—True Synergy

The microelectronics revolution is made to order for the Air Force, for which missions for aircraft and space vehicles are becoming ever more demanding and operations, maintenance, and administration ever more complex. For aerospace vehicles, minimum volume, weight, and power and maximum reliability for onboard equipment are essential—the exact areas where microelectronics have been improving exponentially since the time of the F-86 and the B-36. Virtually all current aircraft and spacecraft contain stacks of printed circuit boards (PCBs) on which are mounted thousands of chips containing millions of circuits. Except for dumb bombs, virtually all Air Force munitions contain solid-state seekers, which themselves are integrated circuits, as well as more PCBs with more millions of transistors. It is microelectronics that made practical the "miracle at Thanh Hoa Bridge" and ushered in the era of such smart weapons as those that destroyed that bridge.

Solid-state electronics has eliminated major problems of the past while creating major new challenges for the future. For example, the lack of communications capac-



This blowup of a 64 × 64 element focal plane array graphically underscores the micro in the microelectronics revolution. The box just to the left of the photo approximates the actual size of the Texas Instruments mercury-cadmium-telluride (MCT) array. which is used in an antiarmor weapon system. Such arrays also have applications for fire-and-forget missiles.

ity, the bane of the military for centuries, is a solved problem. Gigabit data rates are feasible. That's the equivalent of 200 books per second—or the whole Stanford University library in a few hours. The challenge now, and far into the future, is data management, which is a software problem. It cannot be solved by human programmers, for whom an ever-deepening shortage is projected for the twenty-first century. Machines with software that can write software are required.

Whatever the achievements of the past and challenges of the future, the potential of microelectronics for solving Air Force problems has barely been tapped. Present major thrusts for systems that should be produced and deployed by the turn of the century, such as the Advanced Tactical Fighter, include multispectral focal plane arrays, gallium arsenide ICs-especially but not exclusively monolithic microwave integrated circuits (MMICs)—and artificial intelligence in brilliant weapons and in the cockpit. Accompanying these thrusts, of course, will be the continuing exponential improvements of the core microelectronics technologies in memory, logic, and signal processing.

A case in point is the focal plane array (FPA), a twodimensional mosaic of light-sensitive elements that provides real-time images of objects within its field of view. Currently, images are created by scanning a line of elements across the field of view. Long-wavelength sensors provide night viewing, the viewing of "cold" bodies (i.e., objects that may not be running engines or firing rockets), and increased penetration of clouds, smoke, and dust compared to the penetration of wavelengths in the visible range. Consequently, FPAs in long-wave infrared are receiving most attention, with mercury-cadmiumtelluride (MCT) being emphasized as a material of high sensitivity, broad bandwidth, and moderate cryogenic requirements. The high-resolution images that FPAs can generate will provide quantum improvements in at least three important areas: (1) automatic target recognition for conventional standoff weapons, (2) target acquisition, designation, and discrimination for the spacebased sensors of a strategic defense system, and (3) general space-based surveillance of earth and space.

Automatic Image Recognition

Automatic target recognition is already a reality for conventional weapons attacking fixed, high-value targets. For mobile targets, it is still in the future. Current smart weapons are locked on to a target after launch by such methods as picking up a coded designator signal or are guided by a weapons operator who views scenes that are gathered by sensors on the weapon and then datalinked back to him. The missing ingredient is automatic

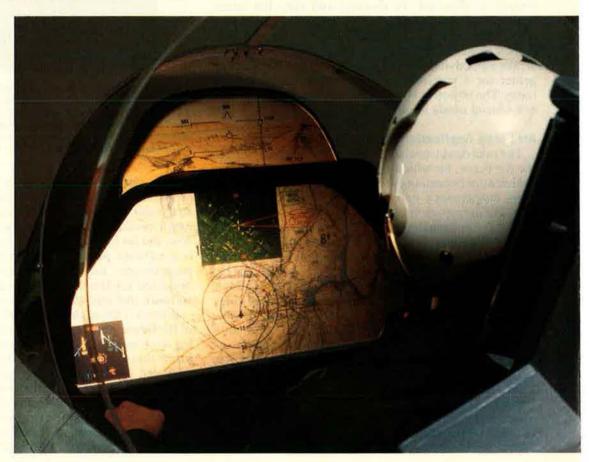
image recognition, which requires high-resolution, adverse-weather sensors and the accompanying electronics and algorithms. MCT FPAs of 128 × 128 elements may be adequate for this application. Handmade versions are already available; efficient production may be practical soon. The algorithms are not as certain.

For fixed targets, the ability to recognize an image from a number of perspectives is obviously required, but this is a determining process for which sufficient processing capacity is the key. Mobile targets are a more difficult problem; only the characteristics that are bound to the target are germane to its recognition, and they must be discerned precisely among potentially infinite arrays of surroundings. There is much optimism that heuristics will help solve the problem. Heuristics is a tool of the artificial-intelligence community, used to solve intricate and abstruse problems. The approach is to avoid a wasteful brute force approach by examining likely solutions early.

FPAs for the Strategic Defense Initiative and for space-based earth and space surveillance involve hundreds of thousands to millions of imaging elements and much larger optics. Silicon (with measured impurities of gallium or arsenic) is the preferred material. While it reaches to the far infrared in coverage, it also requires liquid helium coolers. The feasibility of this technology is not in doubt, but schedule and cost issues are unsettled.

Although gallium arsenide (GaAs) has been a known semiconductor material for decades, until recently its desirable qualities, particularly for military applications, have been insufficient to overcome its drawbacks. Its drawbacks are that its crystals have high numbers of

Microelectronics will make such cockpit displays as this McDonnell Douglas "Big Picture" a reality in future cockpits. "Big Picture" increases the pilot's situational awareness so that during each phase of a mission, the pilot has one source of information about the target, enemy threats, location of friendly forces, and the status of his airplane and weapons. In this photo, the display has located and identified a tank ahead of the pilot. Radar imagery is presented in the square in the middle, and a projection of a tank has been displayed.



defects, which affect its yield, and are very brittle—a manufacturing difficulty. Such temperamental qualities mean that GaAs will never replace silicon, but will supplement it in particular areas. GaAs advantages are in radiation hardness (it can stand a million rads total dose inherently, while silicon requires heroic efforts to attain such hardness), speed (it is five times as fast as silicon), low noise (a GaAs low-noise amplifier can operate uncooled while sitting in the hot sun), and optical properties (GaAs is transparent to infrared radiation, while silicon absorbs it).

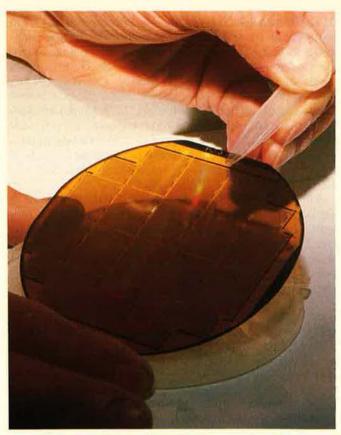
The VHSIC (Very-High Speed Integrated Circuits) program, on which the Defense Department has spent several hundred million dollars, was aimed at making state-of-the-art, silicon-based semiconductor technology suitable for defense applications. VHSIC has been viewed as only a qualified success. Consequently, a similar program—not as extensive or as generously funded—has been created for GaAs technology development with emphasis on monolithic microwave/millimeter-wave integrated circuits.

The Big Promise for MMICs

The big promise for MMICs is that they should allow the powerful thrusts that drive microelectronics technology to be brought to bear on antennas embodying electronically scanned arrays. Heretofore, these antennas, even though extensively used, have been extremely expensive, especially at high frequencies. Both the aperture of the array and its gain are proportional to the number of elements, and—since each element may contain a transmitter, receiver, phase-shifters, cooling, and various switches—price and complexity go up while



The state of the integrated circuit art is continually being refined, but because of their miniscule size and labyrinthine complexity, instruments such as this Auger spectrometer must be used to analyze the chips.



Bubble memory chips are made from this garnet wafer, which is overlaid with patterned magnetic films that control magnetic domains, or "bubbles," in the garnet material. A bubble memory device is in development for the Air Force that will hold 4,000,000 bits of information—or as much as a floppy disk.

reliability goes down. In even a fairly small aperture at high microwave frequencies, there are thousands of elements, and even the modest apertures in the millimeter-wave regime would have a million elements. If all the pieces of an array antenna element can be integrated on a single chip, all of the exponential benefits of the micro-electronics revolution should accrue: As millions of elements are produced, cost goes down dramatically even as reliability and complexity rise.

A demonstration model of an active antenna array of GaAs MMICs has already been built. Both Advanced Tactical Fighter development contractor teams have selected that technology for their multimode radars. A myriad of other possible applications exists, particularly in ground-based radars for SDI and in space-based global surveillance radars.

The speed, radiation tolerance, and thermal ruggedness of GaAs circuits make them exciting for many digital functions, such as radar, communications, and other signal-processing roles. While GaAs technology is far behind silicon in packaging densities, useful gate arrays, thirty-two-bit microprocessors, and static random access memories will be available by the late 1980s. To exploit the world of opto-electronics, on-chip lasers are required. GaAs-on-silicon lasers for that application have been demonstrated.

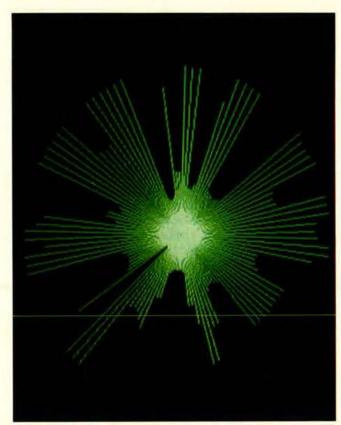
"Artificial intelligence" (AI) may be the capstone of all this. AI subsumes "machine intelligence," "expert systems," "knowledge-based systems," "inference engines," and "symbolic processing." By whatever name, AI is the key to innumerable Air Force problems from the integrated cockpit through optimum flight-line maintenance procedures to personnel selection and assignment. The possibility of intelligent software is a direct result of true computational plenty, and it is driving further progress in computation. Symbolic processors (a misnomer applied to computers that manipulate symbols other than numbers) have emerged as efficient users of artificial intelligence, but standard computers, including personal computers, have become capable in AI by virtue of their rapidly expanding power and versatility.

AI has doubtless already appeared in the Air Force in the complex software that governs our spacetrack network, our attack warning and assessment system, the electronic warfare suites in our advanced aircraft, and several other places. In the next decade, it will become pervasive. Particular AI thrusts have been publicized. One is aircraft avionics, in which long-standing attempts to integrate functions into groups (e.g., communications, navigation, and intelligence) will be successful with powerful AI software. Another is tactical fusion, where sufficient computer and programming power have become available to cope with unprecedented masses of data and the complexities of its handling. A third is SDI battle management, for which Air Force responsibilities include all space-based sensors—key players in any strategic defense system. The problems are so tough in this area that some software experts have declared them insolvable. Others, equally expert, are more optimistic.

Thoughts of the Future

Microelectronics will have ever-increasing impact on the Air Force of the twenty-first century. Of the five major areas of importance to the Air Force's future that were identified by Project Forecast II, two are predominantly linked with the microelectronics revolution. The "Electronics and Optics" section particularly calls for the mastery of photonics. Photonics will be a true extension of the microelectronics revolution for three reasons: It is already pervasive, since all radios and radars use long-wave photons to convey information; in modern solid-state physics, photons are simply the mediators of electrons in varying levels of excitation; and, for the present, there is nothing equivalent to the transistor in photonics. The "Information, Computation, and Displays" section of Forecast II calls for a great expansion in AI for applications in robotics as well as for the "supercockpit" and battle management—uses that are inextricably tied to computation.

In view of the synergistic relationship between ICs and the Air Force, the rapid ascendancy of the Japanese in this field is a profound worry. The Japanese have quadrupled their revenues in ICs since 1980, from about \$3.6 billion to \$14.5 billion annually, while the United States has grown about eighty percent from about \$7.5 billion to \$13.5 billion. Japanese inroads in the memory market (where they now have a more than seventy percent market share) have received the most publicity, but Japan also dominates in analog consumer devices and peripherals. The United States holds substantial leads in market share in bipolar digital ICs and analog nonconsumer products. Although recent trade agreements and



Artificial intelligence technology may one day give military equipment the ability to "think" its way through high-risk hazards to complete its mission. This is a simulated laser range scan that indicates the presence of obstacles (except for one path) in the way of an autonomous computer-driven land vehicle.

the increased value of the Japanese yen against the dollar have served to change the situation, a Defense Science Board study last year recommended that DoD make a major commitment to the semiconductor industry through about \$1 billion of support and the creation of a consortium (Sematech).

With the continued expansion of world markets, a thriving defense market, and strong governmental support, there is little doubt that our microelectronics revolution will continue until technology runs out. Technology already available seems capable of moving to 0.3 micrometer design rules for efficient production (from about 0.8 micrometers today). With this factor-of-sixteen improvement in area and exploitation of three-dimensional rather than planar packaging, 16,000,000,000 bits of information (4,000 books) will be packed into a four-inch cube by the end of the century. Accompanying processing and communications capabilities will be in the multiple gigabit per second range.

Maj. Gen. John C. Toomay, USAF (Ret.), is a consultant for government and industry. He is also a former member of AFA's Science and Technology Committee. General Toomay expresses his gratitude to Dr. George Heilmeier and Dr. Glenn Gaustad of Texas Instruments for their assistance during the preparation of this article. Also, the author wishes to cite an article by M. E. Jones, W. C. Holton, and R. Stratton in the December 1982 issue of the Proceedings of the IEEE, "Semiconductors: The Key to Computational Plenty," as a source for this article.

The Naga tribesmen of Burma had their own way of dealing with "unfriendlies. Lt. William L. Atwell. second from left, the AAF officer sent on the expedition to establish a hilltop air warning station, stares in wonder at King Tong's "trophy case," as Tong, the tribal leader (in the flowing robe), recounts some of the tribe's past victories.

T IS well-known who our allies were during World War II. But there are probably few Air Force veterans who know that Naga headhunters in the Burmese jungles should be counted among them. Their friendship and assistance were frequently needed during a desperate time when the Japanese were inching toward India through Burma and trying to cut off vital CBI supply lines for British and American forces. While the AAF was establishing bases in Burma to support the recapture of the Burma Road and provide supplies to China by air over the Hump, ground troops were fighting delaying actions against the marauding enemy in the steaming northern Burmese jungles.

Naga tribesmen fell victim to the enemy's vicious onslaught and began a war of their own against the Japanese invaders; they fought them by using their savage brand of warfare—ambush and decapitation. Fortunately, they found the Americans generous and friendly, and they assisted to safety many Air Transport Command and Tenth Air Force personnel who had crashlanded or bailed out during Hump operations.

One of the actions taken to slow down the Japanese offensive was

the establishment of an air warning system of observation posts set up in a wide circle spaced at intervals of twenty-five or thirty miles around or behind enemy lines. When Japanese ground troops were spotted pushing through the jungle, warnings would be given by any means possible-radio, telephone, telegraph, lights, or smoke signals-to alert friendly ground and air units. The Naga natives, always suspicious but generally friendly toward the British and American forces, were experts at jungle ambush and may have added many Japanese heads to their tribal collections. The Allies hired the Nagas as porters and paid them with coins, mirrors, knives, keys, and similar shiny objects that they prized highly. The natives had no sense of monetary values and were fascinated by any object that was new and different.

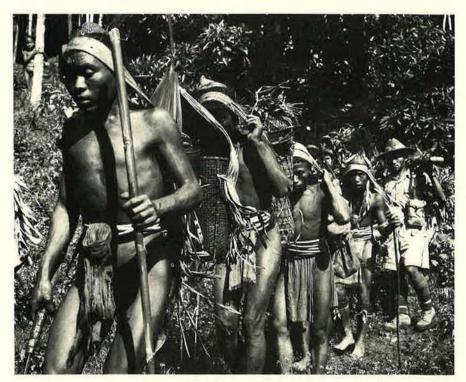
Uncertainty Always Prevailed

Although the basic plan to set up the warning posts was a good one, uncertainty always prevailed when dealing with the Nagas. Until the war, outsiders had not traversed their areas deep in the hills of northern Burma since 1880. The Nagas' primitive culture, including decapitation of their enemies, had survived through the centuries.

Trouble between tribes usually began when a grudge between villages was revived or instigated by some act of aggression or imagined insult. To avenge the grudge properly, a formal war had to be declared. This was accomplished by procuring the freshly severed head of an enemy tribesman. The mission was entrusted by the tribe's chief to a warrior who had to infiltrate the enemy village and decapitate a male victim with a dow knife, a deadly weapon shaped like a machete and kept sharp as a razor.

The enemy head was brought to the village, boiled in water, and presented to the chief, who displayed it on a bamboo pole as a symbol that the tribe was at war. Most Naga tribes also believed that the capturing of heads was essential for the well-being of a village and that a community that failed to bring in a head would suffer a decline in prosperity.

In late 1942, Lt. William L. Atwell of Marion, Va., was one of the AAF officers who led expeditions into Naga country along the Assam-Burma border to set up the observa-



Lieutenant Atwell hired Naga headhunters to serve as porters to carry food, clothing, ammunition, cots, tents, and the currency of the day—small gifts such as knives and shiny trinkets. The expedition had to travel through three villages on their way up the mountain—and had to negotiate with each one.



This Naga warrior was hired by Lieutenant Atwell to serve as interpreter for the expedition. Lieutenant Atwell, right, is admiring the warrior's three carved heads, which represent three triumphs over enemy warriors. The British officer on the trip, Captain Smith, on the left, looks on with interest.

tion posts. He knew from experience that the Nagas maintained a rigid guard on the trails into their territory. Whenever strangers approached, word was rushed by runner to the nearest friendly village. The message was spread with amazing speed from village to village across valleys and rivers and over mountains by beating hollow logs with elephant bones.

The story of how these primitive allies helped American forces has rarely been told. A few stories have been recorded in Air Force archives, and the experience of Lieutenant Atwell and his effort to buy a Burmese mountain from a Naga chieftain is typical of the way American and British forces were assisted during the dark days before the Japanese advance was finally halted.

Lieutenant Atwell was accompanied by Capt. Charles S. Welbourne, James Scanlan, and a Captain Smith, a British officer, two Burmese interpreters, and Naga porters on one of the 1943 expeditions to establish a mountaintop warning station in the hills of northwest Burma near the border with India. En route, the party would have to pass through three Naga villages. It was not known if they were friendly toward outsiders or if the

three tribes were at war with each other. Captain Welbourne described what he experienced when he trudged into the dense mountainous jungle:

"We started the long hike with all fears of a Jap ambush allayed because the natives had not seen a Jap in the vicinity for weeks. The sudden appearance of small boys and warriors from behind trees told us we were nearing the first village. In a few minutes, we sighted a bamboo platform extending a few feet from the side of a cliff and used as a lookout post because it commanded a view of the entire valley and the only trail leading to the village.

"Entering the village, we were led to the platform where the chief, surrounded by his warriors, waited to greet us. Word of our kindness to other Nagas and the trinkets we were carrying to give as gifts had reached him hours before. When Atwell presented the gifts of safety pins, coins, and similar objects to the king, we were guaranteed safe passage through the village and through the area controlled by that tribe. Unfortunately, that control did not extend a great distance, as we later learned."

Walk Through the Village

After the brief gift ceremony,

Welbourne and Atwell wandered through the village followed by a crowd of gaping, curious natives. Because of the continual fear of surprise from rival tribesmen, the Nagas lived in thatched huts built on high logs. The door was reached by a ladder, which was pulled up at night. The natives slept on hard bamboo beds suspended like hammocks from the ceiling.

"We slept in the village that night," Welbourne continued, "and learly next morning proceeded up the mountain toward the second village. Everything went according to plan until we were a few miles from our destination. Suddenly the native porters dropped our equipment and demanded payment. Questioning by Atwell revealed that the two villages were at war, and the porters feared the loss of their heads."

Atwell reluctantly paid them off. As each native received his payment in coins, he placed his thumbprint on a document signifying that he had worked for the United States Army and had received his compensation.

Atwell, Welbourne, Smith, and James Scanlan, a civilian photographer, accompanied by the two Burmese interpreters, decided to go on alone. "Although the jungle was silent," Welbourne said, "we knew we were being watched by the Nagas intensely. We continued until we sighted a platform where the chief of the second village waited, surrounded by his council.

"As we entered the village, the natives made no attempt to greet us. We were flanked by a dozen silent warriors carrying heavy dow knives. The situation left no alternative but to appear bold and confident. Atwell didn't flinch. He walked straight toward the chief, followed by the interpreters. Scanlan, Smith, and I stopped a short distance away.

"Atwell asked the interpreters to convey our greetings to the chief. The chief's reply was silence. Atwell tried another approach. He heaped praise on the warriors, the tribe, and the village. Still there was no reply. Then he pulled the trick that had not failed him before. He took out the trinkets he had brought—spoons, glasses, flashlights, safety pins, locks, and hair-

pins—and presented them to the chief. The chief passed them to the council without comment. Finally, Atwell took some coins from his pocket and explained that he was willing to pay the warriors if they would help him set up the observation post. The chief looked at the coins. He threw one back and kept the rest.

"'Go!,' he said sternly in Naga.

"Atwell turned and said, 'Let's scram out of here!'

"We made a slow retreat, trying not to show how scared we were. We backtracked down the trail to where we had left our equipment, knowing we were in a spot. We could not force the Nagas to let us go through, and we could not bypass the village as there were no other trails to get to the third village where we were to set up the air warning station.

"Atwell thought there was a possibility that the chief did not understand what we wanted. After a discussion with the interpreters, we decided that when the chief said 'Go!' he did not mean 'go back' or 'get out' but rather that we could go through his village."

Atwell was right. The expedition, without the equipment, hiked back through the second village toward the third village located on the top of the mountain and did not experience any difficulty in dealing with its chief, King Tong.

Buying a Mountain

"He was very obliging," Welbourne said, "especially when he understood that Atwell wanted to buy the mountain.

"After contracting for the services of the porters from Tong's village, we hiked to the top of the mountain, accompanied by the king, to select a site for the station. We found a ledge that commanded a view for miles on all sides, and Atwell bought the mountain from the king for 30 rupees (\$9) and a jack-knife.

"Now that we had purchased the site for the station, we thought our only problem would be to get the equipment to the site from the area of the second village. This was simplified by the fact that King Tong's village was at peace with the second tribe. However, when we started to load up, the chief of the second vil-



In a transaction not too unlike the purchase of Manhattan Island many years earlier, Lieutenant Atwell (in the hat) bought a mountain from King Tong (second from the left) for \$9 and a jackknife. The air warning station was then set up with a commanding view of the valley and the surrounding area.

lage had already learned through the jungle communication system what we had paid King Tong for the top of the mountain and demanded equal payment.

"Feeling that failure to comply would incite a war between the two tribes or place us in jeopardy, Atwell paid for the mountain a second time—another 30 rupees and another jackknife. The chief was now our friend and assured us that his tribe would let no Japanese through."

Over the next few days, Atwell and his party, assisted by Tong's tribesmen, built some thatched huts. When the camp was complete, Atwell radioed to his base that "Mount Atwell" was ready for airdrops of supplies.

When the job was complete, King Tong invited the new owners to his hut to view a rack filled with skulls of enemies who had fallen victim to his warriors. He assured his guests that he would protect them and add to the collection the heads of any Japanese who threatened them.

In the following weeks, the Nagas proved to be excellent companions, readily learning card games and American sports. They shared their food with their new friends; in turn, they received salt, sugar, candy, and household trinkets in payment for services rendered.

As a result of the friendship born of war, the Nagas proved to be valuable allies by rescuing American aircrews forced down in the jungles. The Nagas passed the Americans from tribe to tribe until they reached safety; their services were always rewarded with the simple items they prized so highly.

As a result of the courage of men like Bill Atwell in the trying days when it seemed the Japanese could not be stopped, the Nagas played an important role in keeping them at bay. The Nagas became allies to the American forces as staunch as their more civilized counterparts by assisting in neutralizing enemy infiltration and guaranteeing that no Japanese soldier would survive for long in headhunter country.

C. V. Glines, a retired Air Force colonel, is a free-lance writer, a magazine editor, and the author of numerous books. A frequent contributor to this magazine, his most recent offerings have included "The Low-Level World of the Bug-Smashers" (February '88 issue), "Wanted: Yesterday's Airplanes" (July '87), "What Has Happened to the Airlines?" (May '87), "Brain Buckets" (August '86), and "A Bolt From the Blue" (May '86).

Empty Options

By Gen. T. R. Milton, USAF (Ret.), CONTRIBUTING EDITOR

Limiting our military commitments to align them with our reduced resources may sound sensible—until we have to choose exactly what we will stop doing.



The Gramm-Rudman law, an election year, and the sound of guns still comfortably in the distance may perhaps explain the decision of Congress to deal the Pentagon a

hand from a marked deck. But whatever the motivation, the budget cuts mandated by our statesmen seem certain to have a decided effect on the readiness of the armed forces. That this should take place at a moment of rising danger somehow is reminiscent of the early 1950s. Secretary of Defense Louis Johnson, rather than Congress, was the axe-wielder, but the objective was the same: to save money by skimping the military. Our nuclear monopoly was deemed sufficient for big-time deterrence.

The North Koreans, of course, had either never heard of the atomic bomb or didn't care. More to the point, the bomb was inappropriate for the occasion, and there were other reasons for not using it. American troops, meanwhile, had been living the good life in occupied Japan and were about as well prepared for the brutalities of ground warfare as the Peace Corps. The Navy and Air Force were slightly better off, but only by comparison. Those first few Korean weeks were, as Wellington said of Waterloo, a near-run thing.

Current budget-trimming is already affecting combat crew training through both reduced flying hours and overseas deployments. Along with the flying-hour reductions will come a cutback in Red Flag and other

exercises that are the very heart of Air Force readiness training. As an inevitable spinoff, we can expect higher accident rates and, almost certainly, increased pilot defections to the airlines. There is no surer way to drive pilots out of the service than a cutback in training and flying hours.

Technical training will also suffer as formal schooling gives way to hit-ormiss on-the-job instruction. It takes no prophet to foresee lower aircraft-in-commission rates and more accidents because of shaky maintenance.

Perhaps the worst thing about this sudden cutback will be its downstream effect. Such projects as engine overhaul and corrosion control can be deferred, but the bills will come due later. If, in desperation, the Air Force dips into research and development and procurement funds in order to find money to satisfy its operations and personnel deficits, it will be practicing what can be best described as pawnshop economics.

Then, there are the personnel reductions, once again dealt from that marked deck. Cuts in operations and maintenance will have a dampening effect on the civilian work force; the major commands have already imposed hiring freezes. On the military side, the situation is at least as bleak. By the end of this year, troop strength must be reduced by 36,000. Three fighter wings are scheduled to be demobilized by 1991, but the personnel reductions this year would seem to make that later date academic. Along with this diminishing strength will come other inevitable actions, such as unit undermanning and a cutback in the enlistment of nonprior-service people to the lowest figure in Air Force history. The resemblance to the 1950s is striking.

All of this comes at a strange time. The INF Treaty, whether one is for or against it, puts NATO back to 1979 in terms of deterrence. With the intermediate missiles gone, the only theater nuclear weapons that can reach

the USSR's homeland are on F-111s. It is nonsense to speak reassuringly of the 4,600 nukes still available to NATO. for these are short-range warheadsartillery shells, Lance missiles, and the like—that can only fall on German soil. And East Germany, whatever its political and military alignment, is still Germany in the minds of our allies in Bonn. Nuclear strikes on German territory are understandably a delicate and unpopular topic. The emphasis in NATO, therefore, is once more, and heavily, on ready conventional forces. We are sending the allies a curious message as we begin to stack arms.

The Persian Gulf skirmish in April may have been a sign of things to come. Fortunately for our side, the Iranians chose to challenge the US Navy within easy reach of naval aircraft operating from a carrier in the Arabian Sea; a similar confrontation farther north would have created a problem of range and reaction time for the carrier. At some point in this dangerous Gulf situation, land-based air may be required, and in view of present budget trends, the sooner the better. A year from now, the Air Force may be hard pressed to undertake that sort of job. For that matter, the Navy may be as well.

Perhaps we have assumed too many military tasks for a country with deficit and trade balance problems. Frederick the Great had a freer hand than anyone has these days, but even he admitted that "whoever defends everything defends nothing."

What can we stop doing? Certainly, we cannot withdraw our support from NATO, although the time for a reduced US presence may be approaching. Nor can we give up our guardianship of the oil treasure in the Persian Gulf. As a Pacific nation, one of two Pacific powers, we can't reduce the already thin line there. Offhand, it is difficult to see where this country can back off enough to play the hand Congress has dealt from that marked deck.

ALL THE WORLD'S AIRCRAFT SUPPLEMENT

JUNE 1988



First pre-production McDonnell Douglas/BAe T-45A Goshawk trainer for the US Navy

MCDONNELL DOUGLAS/BAe

MCDONNELL DOUGLAS CORPORATION (Douglas Aircraft Company Division), 3855 Lakewood Boulevard, Long Beach, Calif. 90846, USA; and BRITISH AEROSPACE PLC (Military Aircraft Division), Richmond Road, Kingston upon Thames, Surrey KT2 5QS, England

MCDONNELL DOUGLAS/BAe T45TS US Navy designation: T-45A Goshawk

Initiated as a private venture in the early 1970s, the British Aerospace Hawk has become one of the most successful two-seat jet trainer/ground attack aircraft of its time. The initial production of 175 Hawk T. Mk I trainers for the Royal Air Force (88 of which have since been converted to T. Mk I As

carrying a pair of A1M-9L Sidewinder air-to-air missiles for secondary air defence duties) has been followed by orders for 176 of the higher powered, more combat-capable Mk 50 and Mk 60 series from the air forces of Finland (50 Mk 51), Kenya (12 Mk 52), Indonesia (20 Mk 53), Zimbabwe (eight Mk 60), Dubai (eight Mk 61), Abu Dhabi (16 Mk 63), Kuwait (12 Mk 64), Saudi Arabia (30 Mk 65), and Switzerland (20 Mk 66), Details of most of these export versions were given in the October 1984 "Jane's Supplement." Hawks in service have already flown more than half a million hours.

In the largest order of all, the Hawk was selected on 18 November 1981, out of six designs considered, as winner of the US Navy's VTXTS competition for an undergraduate jet pilot trainer, in which role it is to replace the T-2C Buckeye and TA-4J Skyhawk. The complete VTXTS system, since renamed T45TS (T-45 Training System), consists of modified Hawk aircraft (designated T-45A Goshawk) together with academic materials, flight simulators, computer aided training devices, a training integration system, and contractor operated logistics support.

The original plan for the US Navy to acquire an initial 54 'dry' (land based) T-45Bs followed by 253 carrier-capable 'wet' T-45As was amended in FY '84 to eliminate the interim B model in favour of an 'all-wet' fleet of T-45As, and current plans are to acquire a total of 300 production examples of this version. To meet USN specifications, the T-45A has new main and nose landing gear, an arrester hook,



Artist's impression of T-45A Goshawk carrier operations

and airframe strengthening to enable it to operate from aircraft carriers. The nose gear is twin-wheel, has a catapult launch bar/nosewheel tow, is steerable, and requires a slightly deeper nose contour to accommodate it when retracted. Two smaller fuselage-side airbrakes replace the single large underfuselage airbrake of the standard Hawk. The latter's twin ventral strakes are replaced by a single ventral surface, which is used also as a fairing for the arrester hook. Avionics and cockpit displays are modified for carrier-compatible operation, and weapons delivery capability for advanced training is incorporated. Douglas Aircraft Company manufactures the front fuselage at Long Beach, Calif., where the two flying pre-production Goshawks were assembled; final assembly and flight testing of production T-45As will be undertaken at US Air Force Plant 42 Palmdale, Calif. British Aerospace is principal T-45A subcontractor, its Kingston, Brough, Samlesbury, and Hamble factories being responsible for the wings, centre and rear fuselage, tail surfaces, windscreen, canopy, and flight controls.
Rolls-Royce (Derby) supplies the Adour turbofan engines; Honeywell manufactures the flight simulators at Reston, Va.

The T45TS programme entered the full-scale engineering development (FSED) phase in October 1984, and a contract fixing prices for the first three production lots (including 60 T-45A aircraft and 15 flight simulators during FYs '88-90) was signed on 16 May 1986. Twelve production T-45As are included in the FY '88 Lot I contract, awarded on 26 January 1988. The FY '89 budget includes \$517 million for 24 more Goshawks and associated equipment. Peak production is scheduled to reach 48 a year in 1993, with completion of all 302 aircraft in 1997

Drop tests of a non-flying airframe began in early 1988, and a second airframe, for fatigue testing, is being completed at BAe's Brough factory. The first of the two pre-production T-45As (BuAer number 162787), construction of which had started in February 1986, was rolled out at Long Beach on 16 March 1988. It made its first flight on 16 April, and was due to be joined in the 19-month test programme by the second example in June 1988. Main flight testing will be conducted from the McDonnell Douglas facility in Yuma, Ariz., and the US Naval Air Test Center at Patuxent River, Md.

The T45TS is scheduled to become operational initially, with the first 12 Goshawks and their associated equipment, in the fourth quarter of 1990 at Kingsville Naval Air Station, Tex. The system will eventually be based also at NAS Chase Field, Tex., and NAS Meridian, Miss. The complete pro-

gramme will involve 300 production aircraft, 32 flight simulators, 49 computer aided instructional devices, four training integration system mainframes and 200 terminals, as well as academic materials, to allow the training of up to 600 pilots a year. Introduction of the Goshawk system is expected to meet the USN's training requirements with 42 percent fewer aircraft than at present, 25 percent fewer flight hours, and 46 percent fewer personnel, as well as saving up to 182 million litres (48 million US gallons; 40 million Imp gallons) of fuel per year.

The following description applies to the T-45A Goshawk:

Type: Two-seat basic and advanced jet trainer. WINGS: Low-wing monoplane, basically as for standard two-seat Hawk but redesigned and strengthened to accommodate modified main landing gear. Thickness/chord ratio 10.9% at root, 9% at tip. Dihedral 2°. Sweepback 26° on leading-edges, 21° 30' at quarter-chord. Onepiece aluminium alloy wing, with six-bolt attachment to fuselage, employing a spars-and-skin torsion box (two main spars, auxiliary spar, ribs, and machined skins with integral stringers), the greater part of which forms an integral fuel tank. Hydraulically actuated double-slotted flaps, with full span flap vanes. Ailerons, operated by AP Precision Hydraulics tandem actuators, are of honeycomb filled aluminium alloy and have increased travel compared with standard Hawk.

No tabs. Small fence, of composite material, on

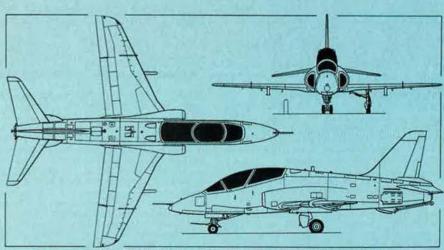
each leading-edge at approx two-thirds span.
FUSELAGE: Conventional all-metal aluminium alloy structure of longerons, frames, and stringers, cut out to accept one-piece wing. Metal airbrake on each side at rear, actuated by Dowty hydraulic jacks. Underfuselage arrester hook, deployable 20° to each side of the longitudinal axis.

TAIL UNIT: All-metal structure, with sweepback on all surfaces. One-piece all-moving anhedral tailplane, operated via push/pull rods powered by AP Precision Hydraulics tandem actuators. Forward of each tailplane leading-edge root is a small curved horizontal surface (US Navy 'smurf', or side mounted unit root fin) to eliminate pitchdown during low-speed flaps down/gear up manoeuvres. Rudder, operated manually via push/ pull rods, has an inset, electrically actuated trim tab. Small ventral fin/fairing at arrester hook attachment point.

LANDING GEAR: Wide-track hydraulically retractable tricycle type, stressed for vertical landing forces of up to 7.32 m (24 ft)/s. Single wheel and long-stroke oleo (increased from 28 cm; 11 in of standard Hawk to 48 cm; 19 in) on each main unit; twin-wheel steerable nose unit. Articulated main gear, by AP Precision Hydraulics, is of levered suspension (trailing arm) type with a folding sidestay. Cleveland Pneumatic nose gear, with Sterer steering system. Main units retract inward into wing, forward of front spar; nose unit retracts forward. All wheel doors are sequenced to close after gear lowering; inboard mainwheel doors are bulged to accommodate larger trailing arm and tyres. Goodrich wheels, tyres, and brakes. Main-wheel tyres size 24 × 7.7-10, pressure 20.69 bars (300 lb/sq in); 16 in diameter nosewheels have size 19 × 5.25-10 tyres, pressure 22.06 bars (320 lb/sq in). Hydraulic multi-disc mainwheel brakes with Dunlop adaptive anti-skid system.

Power Plant: One 24.24 kN (5,450 lb st) Rolls-Royce Turbomeca F405-RR-400L (Adour Mk 861-49) non-afterburning turbofan. Air intake on each side of fuselage, forward of wing leadingedge. Engine starting by Microturbo integral gas turbine starter. Fuel in one fuselage bag tank of 840 litres (222 US gallons; 185 Imp gallons) capacity and integral wing tank of 863 litres (228 US gallons; 190 Imp gallons), giving total internal capacity of 1,703 litres (450 US gallons; 375 Imp gallons). Pressure refuelling point in port air intake trunk, forward of wing leading-edge. Gravity refuelling point in top of fuselage. Smiths Industries fuel management system. Provision for carrying one 591 litre (156 US gallon; 130 Imp gallon) drop tank on each underwing pylon.

ACCOMMODATION: Crew of two in tandem under one-piece fully transparent acrylic canopy that opens sideways to starboard. Fixed front windscreen; separate internal windscreen in front of rear cockpit. Rear seat elevated. Martin-Baker Mk 14 NACES (Navy aircrew common ejection seat) rocket assisted zero/zero seat for each oc-



McDonnell Douglas/BAe T-45A Goshawk basic and advanced jet trainer (Pilot Press)



The 'trimaran' layout of the SCI Advanced Technology Tactical Transport proof-of-concept prototype reflects its Rutan parentage

WEIGHTS:

cupant, with MDC (miniature detonating cord) system to break canopy before seats eject. Dual controls standard. Entire accommodation pressurised, heated, and air-conditioned.

SYSTEMS: Air-conditioning and pressurisation systems, using engine bleed air. Duplicated hydraulic systems, each at 207 bars (3,000 lb/sq in) pressure, for actuation of control jacks, flaps, airbrakes, landing gear, nosewheel steering, antiskid wheel brakes, and arrester hook. No. 1 system has a flow rate of 36.4 litres (9.6 US gallons; 8.0 Imp gallons)/min, No. 2 system a rate of 22.7 litres (6.0 US gallons; 5.0 Imp gallons)/min. Reservoirs are nitrogen pressurised at 2.75-5.5 bars (40-80 lb/sq in). Hydraulic accumulator for emergency operation of wheel brakes. Pop-up Dowty Rotol ram air turbine in upper rear fuselage provides emergency hydraulic power for flying controls in the event of engine or No. 2 pump failure. No pneumatic system. DC electrical power from single brushless generator, with two static inverters to provide AC power and two batteries for standby power. Onboard oxygen generating system (OBOGS).

AVIONICS: AN/ARN-182 UHF/VHF com radios and AN/ARN-194 VOR/ILS by Rockwell Collins, Honeywell AN/APN-194 radio altimeter, Bendix APX-100 IFF, Sierra AN/ARN-136A Tacan, US Navy AN/USN-2 standard attitude and heading reference system (SAHRS), Smiths Industries Mini-HUD (front cockpit), Racal Acoustics avionics/com management system, GEC Avionics yaw damper computer, Electro Dynamics airborne data recorder.

ARMAMENT: No built-in armament. Single pylon under each wing for carriage of practice multiple bomb rack or auxiliary fuel tank. Provision also for carrying single stores pod on fuselage centreline. CAI Industries gunsight in rear cockpit.

DIMENSIONS, EXTERNAL:	
Wing span	9.39 m (30 ft 9¾ in)
Wing chord: at root	2.65 m (8 ft 81/4 in)
at tip	0.90 m (2 ft 11½ in)
Wing aspect ratio	5.3
Length:	
fuselage	10.89 m (35 ft 9 in)
overall, incl nose probe	11.97 m (39 ft 31/8 in)
Height overall	4.09 m (13 ft 5 in)
Tailplane span	4.39 m (14 ft 4¾ in)
Wheel track (c/l of shock	struts)
	3.90 m (12 ft 91/2 in)
Wheelbase	4.29 m (14 ft 1 in)
AREAS:	
Wings, gross	16.69 m ² (179.6 sq ft)
Ailerons (total)	1.05 m ² (11.30 sq ft)
Trailing-edge flaps (total)	
	2.50 m ² (26.91 sq ft)
Airbrakes (total)	0.79 m ² (8.55 sq ft)
Fin	2.51 m ² (27.02 sq ft)
Rudder, incl tab	0.58 m ² (6.24 sq ft)
Tailplane	4.33 m ² (46.61 sq ft)

Weight empty 4,261 kg (9,394 lb) Internal fuel 1,312 kg (2,893 lb) Max T-O weight 5,787 kg (12,758 lb) PERFORMANCE (estimated at max T-O weight): Design limit diving speed at 1,000 m (3,280 ft) 610 knots (1,130 km/h; 702 mph) Max Mach number in dive Max level speed at 2,440 m (8,000 ft) 538 knots (997 km/h; 620 mph) Max level flight Mach number at 9,150 m (30,000 ft) Max rate of climb at S/L 2,128 m (6,982 ft)/min Time to 9,150 m (30,000 ft), 'clean' 7 min 12 s 12,875 m (42,250 ft) 1,141 m (3,744 ft) Service ceiling T-O to 15 m (50 ft) Landing from 15 m (50 ft) 1,189 m (3,900 ft) Ferry range, internal fuel only 1,000 nm (1,850 km; 1,150 miles) g limits +7.33/-3

SCALED COMPOSITES

SCALED COMPOSITES INC (Subsidiary of Beech Aircraft Corporation), Hangar 78, Mojave Airport, Mojave, Calif. 93501, USA

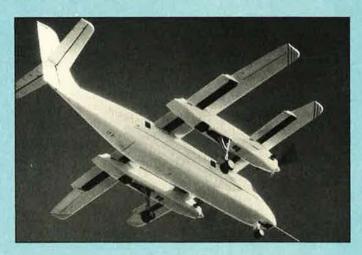
SCI ADVANCED TECHNOLOGY TACTICAL TRANSPORT

Under a \$2.5 million Defense Advanced Research Projects Agency (DARPA) contract, Scaled Composites Inc has designed, built, and test-flown a scale proof-of-concept version of an Advanced Technology Tactical Transport (AT3) intended to fill the void in military airlift capability between the Lockheed C-130 and large helicopters.

The AT3 proof-of-concept prototype (N133SC), designed by SCI's President Mr Burt Rutan, made a public 'commemorative' first flight from Mojave Airport, Calif., on 20 January 1988, although it had flown for the first time on 29 December 1987. The aircraft is 62 percent scale size with an airframe of composite glassfibre/foam and carbonfibre construction. To fulfil design goals of STOL performance and advanced aerodynamics, the aircraft features a 'trimaran' configuration, with tandem high aspect ratio wings connected by long engine nacelles each housing a 522 kW (700 shp) Pratt & Whitney Canada PT6A-135 turboprop and the main units of the retractable tricycle-type landing gear. The forward wing has dihedral, the rear one anhedral. Eight fast-acting electrically actuated flaps are extended aft, but not lowered, for the start of take-off roll, then lowered rapidly (full deflection takes about 1.5 seconds) to increase lift as rotation speed is reached, enhancing STOL capability. All fuel is contained in the wings and engine nacelles, leaving the fuselage free for cargo. A flight-openable rear loading door is incorporated for airdropping of supplies or paratroops. Cruciform tail surfaces comprise a sweptback fin with two-segment rudder, and a non-swept tailplane with elevators.

The DARPA contract provides for some 40 flights by the proof-of-concept scale demonstrator. Lockheed-Georgia has joined Beech in the project, which may lead to full-scale development of an AT3 able to carry a payload of 14 troops and 2,268 kg (5,000 lb) of cargo at 326 knots (604 km/h; 375 mph) over a low-altitude unrefuelled range of 2,400 nm (4,448 km; 2,764 miles), while operating from unimproved airstrips 305 m (1,000 ft) long. Maximum gross weight of the full size AT³ would be in the

22,680 kg (50,000 lb) class.



The AT3 fast-acting flaps are shown here in the extended, but not lowered, position used for initial take-off

SIKORSKY

SIKORSKY AIRCRAFT, Division of United Technologies Corporation, North Main Street, Stratford, Conn. 06601, USA

SIKORSKY S-70B US Navy designations: SH-60B and SH-60F Seahawk and HH-60H Rescue Hawk US Coast Guard designation: HH-60J

The US Navy's LAMPS (light airborne multipurpose system) programme was initiated in 1970, when the Kaman SH-2D Seasprite helicopter won the contract for the LAMPS Mk I aircraft. In 1974 IBM Federal Systems Division was selected as prime contractor for LAMPS Mk III, the proposed Mark II having been cancelled. Fly-off tests of competitive airframes from Boeing Vertol (now Boeing Helicopter) and Sikorsky were conducted in 1977, each manufacturer submitting a developed version of the aircraft it had built for the US Army's UTTAS competition. Sikorsky was selected to supply the LAMPS Mk III airframe, and General Electric to supply a navalised version of the T700 engine.

A key factor in selection of the Sikorsky S-70B airframe was its promise of reduced development costs, due to the high degree of commonality with the Army's UH-60A Black Hawk. The designation SH-60B and name Seahawk were allocated to the Navy model, which embodies changes to integrate the mission equipment and to provide shipboard compatibility. These changes include the addition of chin mounted pods for ESM equipment, pylons for two torpedoes or auxiliary fuel tanks, and a pylon for MAD equipment on the starboard side; installation of more powerful navalised engines; addition of a sensor operator's station and port side launcher for 25 sonobuoys in the cabin; increased fuel capacity; a rescue hoist; automatic main rotor folding system; main rotor brake; folding tail rotor pylon; modified, shorter-wheelbase landing gear. less complex than that of the UH-60A because of lower vertical impact requirements; a DAF Indal RAST (recovery assist, secure, and traverse) device to haul down the helicopter in rough seas on to a small deck, and to stow it in a ship's hangar; a sliding cabin door; hover in-flight refuelling system; and buoyancy features. The pilot's and co-pilot's seats are not armoured.

The first of five SH-60B prototypes (BuAer number 161169) flew on 12 December 1979. Production of a first batch of 18 aircraft was authorised in FY '82, followed by 27 more in FY '83. Total planned requirement for the US Navy is 204 aircraft. The first production Seahawk flew on 11 February 1983, and deliveries to the Navy continue at the rate of two per month. First USN squadron was HSL-41 at NAS North Island, San Diego, Calif. Operational deployment began in 1984, and by the Summer of 1987 six US Navy squadrons were operational, with four SH-60B detachments operating with the Atlantic Fleet and three with the Pacific Fleet. Mission capability of 97 percent had then been recorded by the USN SH-60B fleet.

Japan has selected the SH-60B to replace the SH-3A/Bs of the Japan Maritime Self Defence Force. Two Sikorsky built Seahawk airframes, designated XSH-60J, were delivered to Mitsubishi at Nagoya for installation of Japanese electronics and mission equipment under a \$27 million contract from the Japan Defence Agency's Technical Research and Development Institute. The first of these helicopters flew on 31 August 1987, and was followed by the second in early October, beginning a two year testing programme. The SH-60J Seahawk will be built by Mitsubishi, and is scheduled to enter service with the JMSDF in the early 1990s, with the replacement of SH-3s completed by the middle of the decade.

On 9 October 1984 the Royal Australian Navy confirmed an initial order for eight Seahawks for its full-spectrum ASW requirement, and ordered a further eight in May 1986. The Seahawks, designated S-70B-2 RAWS (role adaptable weapon system), will operate from the RAN's 'Adelaide' (FFG-7) class guided missile frigates, replacing Westland Wessex. The first RAN Seahawk flew from Sikorsky's West Palm Beach facility on 4 December 1987. Fourteen of the S-70B-2 RAWS will be as-



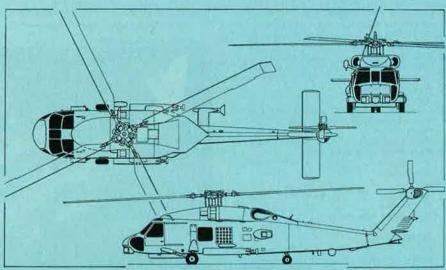
Sikorsky SH-60B Seahawk ASW/ASST helicopter of the US Navy

sembled in Australia by Hawker de Havilland. The RAN helicopters will be equipped with MEL Super Searcher radar and Collins integrated avionics, including cockpit controls and displays, navigation receivers and communications transceivers, an airborne target off-hand data link, and a tactical data system (TDS). The Spanish Navy has ordered six S-70Bs for 1988 delivery.

On 6 March 1985 Sikorsky received a \$50.9 million contract for full-scale development and production options for a 'CV-Helo' version of the Seahawk designated SH-60F and known officially as the CV Inner Zone ASW helicopter. Intended as a replacement for the SH-3H Sea King, this helicopter will operate from aircraft carriers to protect the inner zone of a carrier battle group from submarine attack. The SH-60F differs from the SH-60B in having all LAMPS Mk III avionics, sensors, and pneumatic sonobuoy launcher equipment removed. together with the cargo hook, recovery assist, secure, and traverse system main probe, and tail probe and control panel, although installation provisions will be retained. An integrated ASW mission avionics suite is installed, comprising a MIL-STD-1553B tactical data management system with dual Teledyne Systems AN/ASN-150 tactical navigation computers, a redundant digital databus, a tactical data link to other aircraft, a communications control system, and multi-function keypads and display units for each of the four crew members. Seahawk prototype 161170 was modified as an SH-60F test aircraft.

Additional equipment in the SH-60F includes an Allied Signal (Bendix Oceanics) AN/AQS-13F dipping sonar system, internal/external auxiliary fuel system, and an additional weapons station on an extended pylon on the port side of the fuselage. Armament includes Mk 50 acoustic homing torpedoes. Modifications include rearrangement of the cabin interior, removal of external sensor fairings, and improvements to the automatic flight control system to permit increased rates of deceleration on automatic approaches, in addition to automatic coupled sonar cable angle hover or coupled Doppler hover. Provision is made for a chaff/sonobuoy launcher system, an attitude/heading reference system, and global positioning system, with future growth potential for a fatigue monitoring system, surface search radar, FLIR. night vision equipment, passive ESM, MAD, air-to-surface missile capability, a sonobuoy data link, and an increase in max T-O weight to 10,659 kg (23,500 lb). Secondary missions will include SAR and standby during launch and recovery of the carriers' fixed-wing aircraft to provide a rescue service in case of ditching. The US Navy requirement is for 175 SH-60Fs. The initial contract provides production options for 76 helicopters in five lots. In January 1986 Sikorsky received a contract for the first seven SH-60Fs. The first of these flew on 19 March 1987. Production deliveries are scheduled to begin in Spring 1989.

In September 1986, the US Navy awarded Sikorsky a contract for an initial production increment of five combat search and rescue/special war-



Sikorsky SH-60B Seahawk twin-turbine ASW/ASST helicopter (Pilot Press)

fare support (HCS) helicopters for the Navy, designated HH-60H, and two medium range recovery (MRR) helicopters for the Coast Guard, designated HH-60J. This order was subsequently increased to nine HH-60Hs and five HH-60Js in a contract valued at \$135.2 million. The HH-60H/J 'Rescue Hawks' are close derivatives of the SH-60F. It is expected that 18 will eventually serve with the Navy and 35 with the Coast Guard, with deliveries commencing in 1989 and 1990 respectively. The Japan Air Self Defence Force was seeking funding for three HH-60J SAR helicopters in FY '88 budget requests.

Under a US Navy contract with Sikorsky and Rolls-Royce Turbomeca, an SH-60B began initial flight tests on 3 April 1987 with 1,566 kW (2,100 shp) RTM 322 turboshafts. A US Navy flight evaluation involving some 60 hours of flight testing was scheduled to follow at Sikorsky's West Palm Beach facility and at the Naval Air Test Center, NAS Pa-

The following description applies to the standard

Type: Twin-turbine ASW/ASST helicopter.

ROTOR SYSTEM: Four-blade main rotor. Sikorsky SC-1095 blade section, with thickness/chord ratio of 9.5%. Middle section has leading-edge droop and trailing-edge tab to overcome vortex impingement from preceding blade in cruising flight. Blade twist 18°. Blade tips swept back 20°.

can operate for 30 min following total oil loss. Intermediate and tail rotor gearboxes oil lubricated. Main rotor shaft can be lowered for storage or air transport.

FUSELAGE: Conventional semi-monocoque light alloy structure. Composite materials including glassfibre and Kevlar are used for the cockpit doors, canopy, fairings, and engine cowlings. Glassfibre/Nomex floors.

TAIL UNIT: Pylon structure with port-canted tail rotor mounted on starboard side. Tail pylon design permits normal forward flight and roll-on landing if tail rotor is destroyed. Large variable incidence tailplane has a control system that senses airspeed, collective lever position, pitch attitude rate, and lateral acceleration. Tailplane is set at about +34° incidence in the hover, and -6° for autorotation. Tailplane moved by dual electric actuators, with manual backup. Tailboom folds (to starboard) immediately forward of tail rotor pylon for shipboard stowage

LANDING GEAR: Non-retractable tailwheel type with single wheel on each main unit. Multiple disc brakes on mainwheels, tyre size 26 10.00-11; tailwheel unit mounted amidships with twin wheels, tyre size 17.5 × 6.00-6.

POWER PLANT: Two 1,260 kW (1,690 shp) General Electric T700-GE-401 turboshafts. Crashworthy, bulletproof fuel cells, with combined usable ca-pacity of 2,233 litres (590 US gallons; 491 Imp



Prototype Sikorsky SH-60F CV-Helo for close-in protection of carrier battle groups

Each blade consists of a hollow oval titanium spar, Nomex honeycomb core, graphite trailingedge and root, covered with glassfibre/epoxy, with glassfibre leading-edge counterweight, titanium leading-edge sheath, and Kevlar tip. Blades are tolerant to 23 mm gunfire damage and are pressurised and equipped with gauges providing fail-safe confirmation of blade structural integrity. Electrically heated de-icing mat in leading-edge of each blade on both main and tail rotors. Forged titanium one-piece rotor head with C/R Industries elastomeric bearings that require no lubrication, reducing rotor head maintenance by 60%. Bifilar self-tuning vibration absorber on rotor head. Electric main rotor blade folding. Rotor brake standard. Canting of tail rotor 20° to port increases vertical lift and allows greater CG travel. 'Cross beam' four-blade tail rotor of composite materials, eliminating all rotor head bearings.

ROTOR DRIVE: Conventional transmission system with both turbines driving through freewheeling units to main gearbox. This is of modular construction to simplify maintenance. Transmission gallons), aft of cabin. Single-point pressure refuelling, or gravity refuelling via point on each tank. Hovering in-flight refuelling capability. Two auxiliary fuel tanks on fuselage pylons optional.

ACCOMMODATION: Pilot and airborne tactical officer/backup pilot in cockpit, sensor operator in specially equipped station in cabin. Dual controls standard. Sliding door with jettisonable window on starboard side. Accommodation is heated,

ventilated, and air-conditioned. Systems: Solar 67 kW (90 hp) T-62T-40-1 APU; Garrett engine start system. Bendix 30/40kVA and 20/30kVA electrical power generators; 17Ah nickel-cadmium battery. Engine fire extinguishing system. Rotor blade de-icing standard.

AVIONICS AND EQUIPMENT: Com equipment comprises Collins AN/ARC-159(V)2 UHF and AN/ ARC-174(V)2 HF, Hazeltine AN/APX-76A(V) and Bendix AN/APX-100(V)1 IFF transponders, TSEC/KY-75 voice security set, TSEC/ KG-45(E-1) com security, Telephonics OK-374/ ASC com system control group, and Sierra Research AN/ARQ-44 data link and telemetry. Nav equipment comprises Collins AN/ARN-118(V) Tacan, Honeywell AN/APN-194(V) radar altimeter, Teledyne Ryan AN/APN-217 Doppler, and Collins AN/ARA-50 UHF DF. Mission equipment includes Sikorsky sonobuoy launcher, Edmac AN/ARR-75 and R-1651/ARA sonobuoy receiving sets, Texas Instruments AN/ ASQ-81(V)2 MAD, Raymond MU-670/ASQ magnetic tape memory unit, Astronautics IO-2177/ASQ altitude indicator, Fairchild AN/ ASQ-164 control indicator set and AN/ASQ-165 armament control indicator set, Texas Instruments AN/APS-124 search radar (under front fuselage), IBM AN/UYS-1(V)2 Proteus acoustic processor and CV-3252/A converter display, Control Data AN/AYK-14(XN-1A) digital computer, and Raytheon AN/ALQ-142 ESM (in chin mounted pods). External cargo hook and rescue hoist standard.

ARMAMENT: Includes two Mk 46 torpedoes. Qualification of Kongsberg Penguin antiship missile under way for 1989 introduction.

DIMENSIONS, EXTERNAL:

Main rotor diameter 16.36 m (53 ft 8 in) Main rotor blade chord 0.53 m (1 ft 8¾ in) Tail rotor diameter 3.35 m (11 ft 0 in) Length overall: rotors turning 19.76 m (64 ft 10 in)

rotors and tail pylon folded

12.47 m (40 ft 11 in) 15.26 m (50 ft 01/4 in) Fuselage: Length Max width 2.36 m (7 ft 9 in) Max depth 1.75 m (5 ft 9 in)

Width overall, rotors folded

3.26 m (10 ft 81/2 in)

Height: to top of rotor head 3.63 m (11 ft 11 in) overall, tail rotor turning

5.18 m (17 ft 0 in) overall, pylon folded 4.04 m (13 ft 31/4 in) Wheel track 2.79 m (9 ft 2 in) Wheelbase 4.83 m (15 ft 10 in)

AREAS

Main rotor blades (each)

4.34 m2 (46.70 sq ft) Tail rotor blades (each) 0.41 m2 (4.45 sq ft) Main rotor disc 210.05 m2 (2,261 sq ft) Tail rotor disc 8.83 m2 (95.0 sq ft) 4.18 m2 (45.0 sq ft) Tailplane Vertical stabiliser 3.00 m2 (32.3 sq ft) WEIGHTS (estimated. A, ASW mission; B, ASST

mission; C, utility role): 6.191 kg (13,648 lb) 9.182 kg (20,244 lb) 8.334 kg (18,373 lb) Weight empty: A Mission gross weight: A B

Max gross weight: C PERFORMANCE:

engine out

Dash speed at 1,525 m (5,000 ft), tropical day 126 knots (234 km/h; 145 mph)

9,926 kg (21,884 lb)

137 m (450 ft)/min

Vertical rate of climb at S/L, 32.2°C (90°F) 213 m (700 ft)/min Vertical rate of climb at S/L, 32.2°C (90°F), one

CONSTRUCCIONES AERONAUTICAS SA, Rev Francisco 4, Apartado 193, 28008 Madrid, Spain; and INDUSTRI PESAWAT TERBANG NUSAN-TARA, PO Box 563, Jalan Pajajaran 154, Bandung, Indonesia

Airtech is a joint company formed by CASA of Spain and IPTN of Indonesia to develop a twinturboprop transport aircraft known as the CN-235. Design and production work is shared 50-50 between the two companies.

AIRTECH (CASA/IPTN) CN-235 SERIES 100

Preliminary design of the CN-235 was initiated in January 1980. Detail design work began a year later, and prototype construction started in May 1981. Two prototypes were built, one in each country (ECT-100 and PK-XNC), plus static and fatigue test airframes. Simultaneous rollouts were made on 10 September 1983, and first flights took place on 11 November (CASA) and 30 December 1983 (IPTN).

The first production CN-235 made its initial flight on 19 August 1986. Certification by the Spanish and Indonesian authorities had been received by that date (on 20 June 1986), and FAA type approval to FAR Pts 25 and 121 followed on 3 December that year. First delivery, of an IPTN aircraft to Merpati Nusantara Airlines, was made on 15 December 1986; the first two CN-235s from the CASA assembly line, equipped as VIP transports for the Royal Saudi Air Force, were handed over on 4 February 1987, with two more (in CN-235 M military transport configuration) following in April 1987.

Firm orders for the CN-235 totalled 114 by the

Firm orders for the CN-235 totalled 114 by the Spring of 1988 (57 civil and 57 military). Twenty-two of these are for Spanish regional airlines, including eight for an Iberia/Aviaco Canary Islands subsidiary; four are for Saudi Arabia, two for the Botswana Defence Force, and one for the Panamanian Air Force. The other 85 are for Indonesian customers (Deraya 11, Merpati 14, Pelita 10, Indonesian Air Force 32, and Indonesian Navy 18, including six in ASW/maritime patrol configuration). CASA markets the aircraft in the Americas and Europe, IPTN in Asia, with other markets shared as appropriate.

CASA builds the wing centre-section, inboard flaps, forward and centre fuselage, and engine nacelles; the outer wings, outboard flaps, ailerons, rear fuselage, and tail unit are built by IPTN. Numerical control machinery is used extensively in the CN-235's manufacture. Design has been optimised for short-haul operations, enabling the CN-235 to fly four 100 nm (185 km; 115 mile) stage lengths, with reserves, before needing to refuel, and to operate from either paved runways or unprepared strips.

Initial production CN-235s had General Electric CT7-7A engines, as described in the 1986–87 and previous editions of *Jane's*, and are designated Series 10. The following description applies to the current production Series 100 version, with CT7-9C engines in new composites nacelles, which became available in mid-1988:

TYPE: Twin-turboprop commuter and utility trans-

port.
Wings: Cantilever high-wing monoplane. NACA 653-218 wing section. Constant chord centre-section, without dihedral; 3° dihedral on tapered outer panels. Incidence 3°. Sweepback 3° 51' 36" at quarter-chord on outer panels. Three main assemblies each consist of a machined fail-safe box structure of aluminium/copper alloy, with main spars at 15% and 55% chord, plus leadingand trailing-edge structures. Inboard flaps on centre-section, outboard flap segments and ailerons on outer panels. Fail-safe attachment of centre-section to top of fuselage; large wing/fuselage fairing, made of composites. Chemically milled skins. Leading-edges each made up of a false spar, ribs, and skin panels. Flap segments each have a machined aluminium spar, two sheet metal ribs of aluminium/zinc alloy, and leading/trailingedges of composite materials (glassfibre laminates with honeycomb core). Inboard and outboard pairs are interchangeable port/starboard. Flaps are single-slotted and actuated hydraulically by Dowty Rotol irreversible jacks. Ailerons, of similar construction to flaps, are statically and dynamically balanced and have duplicated flight controls. Mechanically operated servo tab and electrically actuated trim tab in each aileron. Raked wingtips are of glassfibre. Pneumatic boot anti-icing of leading-edges outboard of engine nacelles

FUSELAGE: Conventional fail-safe pressurised semi-monocoque structure (including baggage compartment), built mainly of aluminium/copper and aluminium/zinc alloy longerons, frames, stringers, and skin panels. Flattened circular cross-section, upswept at rear. Glassfibre nose radome, reinforced with glassfibre/Nomex honeycomb/glassfibre sandwich, forward of front pressure bulkhead. Forward pressurised section includes flight deck and bulkhead at front of passenger cabin. Central (passenger cabin) section is 19 frames long, at 508 mm (20 in) pitch. Rear fuselage, 15 frames long, includes rear cargo ramp and door, baggage compartment, and the tailcone, which incorporates the rear pressure



Spanish production example of the Airtech CN-235 in VIP transport form for the Royal Saudi Air Force

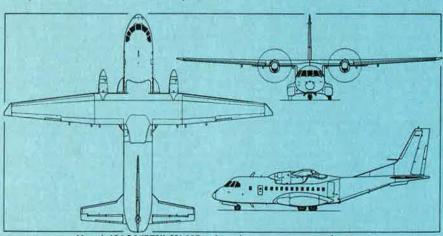
bulkhead. Composite fairings on fuselage sides house some equipment and systems, in addition to retracted main landing gear.

TAIL UNIT: Cantilever structure, comprising sweptback fin and statically and dynamically balanced rudder, large dorsal fin, two small honeycomb ventral fins, and non-swept fixed incidence tailplane with statically and dynamically balanced elevators. Main fin and tailplane boxes are twospar aluminium/copper alloy structures, with detachable leading-edges and glassfibre tips. Rudder and elevators have glassfibre skin, Nomex honeycomb core, and leading-edge vortex generators. Rudder and elevators actuated mechanically. Mechanically operated servo tab and electrically actuated trim tab in rudder and starboard elevator; trim tab only in port elevator. Pneumatic boot anti-icing of fin and tailplane leading-edges.

LANDING GEAR: Messier-Hispano-Bugatti retractable tricycle type with levered suspension, suitable for operation from semi-prepared runways. Electrically controlled hydraulic extension/retraction, with mechanical backup for emergency extension. Oleo-pneumatic shock absorber in each unit. Each main unit comprises two wheels in tandem, retracting rearward into fairing on side of fuselage. Mainwheels semi-exposed when retracted. Single steerable nosewheel retracts forward into unpressurised bay under flight deck. Dunlop 28 × 9.00-12 (12 ply rating) tubeless mainwheel tyres standard, pressure 5.17 bars (75 lb/sq in) on civil version, 5.58 bars (81 lb/sq in) on military version; low pressure mainwheel tyres optional, size 11.00-12/10, pressure 3.45 bars (50 lb/sq in). Dunlop 24 × 7.7 (10/12 ply rating) tubeless nosewheel tyre, pressure 5.65 bars (82 lb/sq in) on civil version, 6.07 bars (88 lb/sq in) on military version. Dunlop hydraulic differential disc brakes; Dunlop antiskid units on main gear. Power PLANT: Two General Electric CT7-9C turboprops, each flat rated at 1,305 kW (1,750 shp) (S/L, to 41°C) for take-off and 1,394.5 kW (1,870 shp) up to 31°C with automatic power reserve. Hamilton Standard 14RF-21 four-blade constant-speed propellers, with full feathering and reverse-pitch capability. Blades are of glassfibre, with metal spar and urethane foam core. Light-

verse-pitch capability. Blades are of glassfibre, with metal spar and urethane foam core. Lightweight low-drag composites nacelles. Fuel in two 1,042 litre (275 US gallon; 229 Imp gallon) integral main tanks in wing centre-section and two 1,592 litre (421 US gallon; 350 Imp gallon) integral outer-wing auxiliary tanks; total fuel capacity 5,268 litres (1,392 US gallons; 1,158 Imp gallons), of which 5,128 litres (1,355 US gallons; 1,128 Imp gallons) are usable. Single pressure refuelling point in starboard main landing gear fairing; gravity filling point in top of each tank. Propeller braking permits engine to be used as an on-ground APU. Oil capacity 13.97 litres (3.69 US gallons; 3.07 Imp gallons).

ACCOMMODATION: Crew of two on flight deck, plus cabin attendant (civil version) or third crew member (military version). Accommodation in commuter version for up to 45 passengers in four-abreast seating, at 76 cm (30 in) pitch, with 22 seats each side of central aisle. Toilet, galley, and overhead luggage bins standard. Pressurised baggage compartment at rear of cabin, aft of movable bulkhead; additional stowage in rear ramp area and in overhead lockers. Can also be equipped as mixed passenger/cargo combi (e.g., 19 passengers and two LD3 containers), or for all-cargo operation, with roller loading system, carrying four standard LD3 containers, five LD2s, or two



Airtech (CASA/IPTN) CN-235 twin-turboprop transport (Pilot Press)

 2.24×3.18 m (88 \times 125 in) and one 2.24×2.03 m (88 × 80 in) pallets; or for military duties, carrying up to 48 troops or 46 paratroops. Other options include layouts for aeromedical (24 stretchers and four medical attendants), ASW/ maritime patrol (with 360° search radar and Exocet missiles or Mk 46 torpedoes), electronic warfare, and geophysical survey or aerial photographic duties. Main passenger door, outward and forward opening with integral stairs, aft of wing on port side, serving also as a Type I emergency exit. Type III emergency exit facing this door on starboard side. Crew/service downward opening door (forward, starboard) has built-in stairs, and serves also as a Type I emergency exit, or as passenger door in combi version; a second Type III exit is provided, opposite this door, on the port side. Wide ventral door/cargo ramp in underside of upswept rear fuselage, for loading of bulky cargo. Accommodation fully air-conditioned and pressurised.

SYSTEMS: Hamilton Standard air-conditioning system, using engine compressor bleed air. Garrett electro-pneumatic pressurisation system (max differential 0.25 bars; 3.6 lb/sq in), giving cabin environment of 2,440 m (8,000 ft) up to operating altitude of 5,485 m (18,000 ft). Hydraulic system, operating at nominal pressure of 207 bars (3,000 lb/sq in), comprises two engine driven, variable displacement axial electric pumps, a self pressurising standby mechanical pump, and a modular unit incorporating connectors, filters, and valves; system is employed for actuation of wing flaps, landing gear extension/retraction, wheel brakes, emergency and parking brakes, nosewheel steering, cargo ramp and door, and propeller braking. Accumulator for backup braking system. No pneumatic system. 28V DC primary electrical system powered by two 400A Auxilec engine driven starter/generators, with two 24V 37Ah nickel-cadmium batteries for engine starting and 30 min (minimum) emergency power for essential services. Constant frequency singlephase AC power (115/26V) provided at 400Hz by three 600VA static inverters (two for normal operation plus one standby); two three-phase engine driven alternators for 115/200V variable frequency AC power. Fixed oxygen installation for crew of three (single cylinder at 124 bars; 1,800 lb/ sq in pressure); three portable units and individual masks for passengers. Pneumatic boot antiicing of wing (outboard of engine nacelles), fin, and tailplane leading-edges. Electric anti-icing of propellers, engine air intakes, flight deck windscreen, pitot tubes, and angle of attack indicators. No APU; starboard engine, with propeller braking, can be used to fulfil this function. Hand type fire extinguishers on flight deck (one) and in passenger cabin (two); smoke detector in baggage compartment. Engine fire detection and extinguishing system.

AVIONICS AND EQUIPMENT: Standard avionics include two Collins VHF-22B com radios, one Avtech DADS crew interphone, one Collins TDR-90 ATC transponder, two Collins VIR-32 VOR/ILS/ marker beacon receivers, one Collins DME-42, one Collins ADF-60A, one Collins WXR-300 weather radar, two Collins 332D-11T vertical gyros, two Collins MCS-65 directional gyros, two Collins ADI-85A, two Collins HSI-85, two Collins RMI-36, one Collins APS-65 autopilot/ flight director, one Collins ALT-55B radio altimeter, one Fairchild/Teledyne flight data recorder, one Fairchild A-100A cockpit voice recorder, one Avtech PACIS PA system, two Collins 345A-7 rate of turn sensors, one Sfena H-301 APM standby attitude director indicator, one Dorne & Margolin ELT 8-1 emergency locator transmitter, and one Sundstrand Mk II GPWS. Collins EFIS-85 five-tube CRT system optional. Other options include Collins EFIS-85B; second TDR-90, DME-42, and ADF-60A; plus Collins HF-230 com radio, Collins RNS-325 radar nav, Litton LTN-72R inertial nav, or Global GNS-500A Omega navigation system. Navigation lights, anti-collision strobe lights, 600W landing light in front end of each main landing gear fairing, taxi lights, ice inspection lights, emergency door lights, flight deck and flight deck emergency lights, cabin and baggage compartment lights, individual passenger reading lights, and instrument panel white lighting are all standard.

ARMAMENT (military version): Three attachment points under each wing. Indonesian Navy ASW version can be fitted with two AM39 Exocet antishipping missiles.

DIMENSIONS, EXTERNAL:

Wing span 25.81 m (84 ft 8 in) 3.00 m (9 ft 10 in) Wing chord: at root 1.20 m (3 ft 111/4 in) at tip Wing aspect ratio 11.3 21.353 m (70 ft 0¾ in) Length overall Length of fuselage 20.90 m (68 ft 7 in) 2.90 m (9 ft 6 in) Fuselage: Max width 2.615 m (8 ft 7 in) Max depth Height overall 8.177 m (26 ft 10 in) Tailplane span 11.00 m (36 ft 1 in) Wheel track (c/l of mainwheels)

3.90 m (12 ft 91/2 in) Wheelbase 6.919 m (22 ft 81/2 in) Propeller diameter 3.35 m (11 ft 0 in) Propeller ground clearance

1.66 m (5 ft 51/4 in)

Distance between propeller centres

7.00 m (22 ft 111/2 in) Passenger door (port, rear), paratroop door (stbd, rear) and service door (stbd, fwd): 1.70 m (5 ft 7 in) Height 0.73 m (2 ft 43/4 in) Width Height to sill 1.22 m (4 ft 0 in) Ventral upper door (rear): 2.366 m (7 ft 91/4 in) Length

2.349 m (7 ft 81/2 in) Width Height to sill 1.22 m (4 ft 0 in) Ventral ramp/door (rear): 3.042 m (9 ft 11¾ in) Length Width 2.349 m (7 ft 81/2 in)

Height to sill 1.22 m (4 ft 0 in) Type III emergency exits (port, fwd, and stbd, rear):

Height 0.91 m (3 ft 0 in) Width 0.51 m (1 ft 8 in)

DIMENSIONS, INTERNAL: Cabin, excl flight deck:

Length 9.65 m (31 ft 8 in) 2.70 m (8 ft 101/2 in) Max width Width at floor 2.366 m (7 ft 9 in) Max height 1.88 m (6 ft 2 in) Floor area 22.822 m2 (245.65 sq ft) Volume 43.24 m3 (1,527.0 cu ft) Baggage compartment volume:

5.30 m3 (187.2 cu ft) ramp overhead bins 1.68 m3 (59.3 cu ft) AREAS:

59.10 m2 (636.1 sq ft) Wings, gross Ailerons (total, incl tabs) 3.07 m2 (33.06 sq ft)

Trailing-edge flaps (total)

10.87 m2 (117.0 sq ft) Fin, incl dorsal fin 11.38 m² (122.49 sq ft) 3.32 m² (35.74 sq ft) Rudder, incl tabs Tailplane 21.20 m2 (228.2 sq ft) Elevators (total, incl tabs)

6.17 m2 (66.41 sq ft)

WEIGHTS AND LOADINGS:

Operating weight empty:

9,400 kg (20,725 lb) passengers cargo and military versions

8,600 kg (18,960 lb) 4,230 kg (9,325 lb) Max fuel Max payload: passengers 4,200 kg (9,260 lb) cargo and military versions

5,000 kg (11,025 lb)

Max weapon load (CN-235 M)

3,500 kg (7,716 lb) 15,100 kg (33,290 lb) 15,050 kg (33,180 lb) Max T-O weight Max landing weight Max zero-fuel weight 13,600 kg (29,980 lb) Cabin floor loading:

cargo and military versions

1,504 kg/m² (308.0 lb/sq ft) 255.5 kg/m² (52.36 lb/sq ft) Max wing loading Max power loading without APR

5.78 kg/kW (9.51 lb/shp) Performance (civil versions at max T-O weight,

ISA, except where indicated): Max operating speed at S/L

240 knots (445 km/h; 276 mph) IAS

Max cruising speed at 4,575 m (15,000 ft)

244 knots (452 km/h; 280 mph) Stalling speed at S/L:

flaps up

100 knots (186 km/h; 116 mph) IAS flaps down

84 knots (156 km/h; 97 mph) IAS Max rate of climb at S/L 465 m (1,527 ft)/min Rate of climb at S/L, one engine out

128 m (420 ft)/min 8,110 m (26,600 ft) Service ceiling Service ceiling, one engine out

4,550 m (14,925 ft) 554 m (1,818 ft) T-O run T-O to 10.7 m (35 ft) at S/L 687 m (2,254 ft) Landing from 15 m (50 ft) at S/L

585 m (1,920 ft)

Min ground turning radius

18.98 m (62 ft 31/4 in) Range at 5,485 m (18,000 ft), reserves for 87 nm (161 km; 100 mile) diversion and 45 min hold: with max payload

208 nm (385 km; 239 miles)

with max fuel

2,110 nm (3,910 km; 2,429 miles)

OPERATIONAL NOISE LEVELS (civil versions): T-O 84.0 EPNdB Approach 87.0 EPNdB Sideline 86.0 EPNdB

PERFORMANCE (CN-235 M, at max T-O weight,

ISA, except where indicated): As for civil versions except:

Max rate of climb at S/L 579 m (1,900 ft)/min Rate of climb at S/L, one engine out

156 m (512 ft)/min Service ceiling 7,620 m (25,000 ft)

Service ceiling, one engine out 4,665 m (15,300 ft)

T-O to 15 m (50 ft) 732 m (2,400 ft) Landing from 15 m (50 ft) 772 m (2,530 ft) Landing run, with propeller reversal

286 m (939 ft)

Range at 6,100 m (20,000 ft), long-range cruising speed, reserves for 45 min hold:

with max payload

669 nm (1,240 km; 770 miles) with 2,400 kg (5,291 lb) payload

2,304 nm (4,270 km; 2,653 miles)

CONAIR

CONAIR AVIATION LTD, PO Box 220, Abbotsford, British Columbia V2S 4N9, Canada

The 356th Tactical Airlift Squadron of AFRES at Rickenbacker ANGB, Ohio, is the US Defense Department's only fixed-wing aerial spray unit. For many years, it was equipped with Fairchild UC-123K Provider aircraft, the last four of which were retired in 1986. Since then the squadron has been receiving in their place specially modified versions of the Lockheed C-130A Hercules, and the first of two more such aircraft, fitted with a 7,560 litre (1,997 US gallon; 1,663 Imp gallon) modular spray system, is due for delivery in 1988. A 6,000 litre (1,585 US gallon; 1,320 Imp gallon) retardant dispersal system is installed in eight Aeritalia G222SAA (Sistema Aeronautico Antincendio) firefighting aircraft used extensively by the Italian Air Force since the late 1970s.

Supplier of these systems is Conair Aviation Ltd. a company that has specialised for many years in aerial control services such as forest fire, oil spill, and insect control, forest fertilisation, and salmonid enhancement. Conair designs, manufactures, and installs many specialty aviation systems such as fire retardant delivery systems, dispersal equipment, and various spray systems. Among these are underbelly retardant tanks for a range of helicopters including the Bell 205 and 212 and the Aérospatiale Ecureuil, Lama, and Puma, and an 11,365 litre (3,002 US gallon; 2,500 Imp gallon) ventral retardant tank for a firefighting version of the Douglas DC-6B. Since 1978 Conair has convert-



Conair Firecat fire control conversion of a Grumman S-2A/S2F-1 Tracker anti-submarine aircraft

ed 30 Grumman or Canadian built S-2 Tracker aircraft to Conair Firecat air tanker configuration, and was due to fly the first turboprop powered Turbo Firecat in mid-1988.

In addition to the modified C-130As for the 356th TAS, orders due for delivery in 1988 included a prototype 15,000 litre (3,963 US gallon; 3,300 Imp gallon) eight-door delivery system for a firefighting version of the Shin Meiwa US-1 amphibian; one SA 330 and two AS 350B₁ helitanker systems for the French Securité Civile; and a third AS 350B₁ system for Aérospatiale Helicopter Corporation of Grand Prairie, Tex. In addition to the C-130 spray system, Conair produces similar modifications for the Douglas DC-6, Fokker F27, and Aeritalia G222. In 1986 the company received a five-year contract to maintain and operate the four Canadair CL-215 water bombers of the Yukon and Northwest Territories; these aircraft are equipped with Conair foam injection systems to enhance water drops.

CONAIR FIRECAT

The Firecat is converted from standard Grumman S-2A (S2F-1) or de Havilland Canada CS2F-1/2/3 Tracker aircraft for specialised fire control operation, and the aircraft so converted are part of Conair's own fleet as well as being available for export. Of the 30 conversions delivered by mid-1988, 15 were for Conair, 14 for the French government's Securité Civile, and one for the government of Saskatchewan. The Canadian type certificate for the S2F/CS2F was transferred to Conair from de Havilland Canada in 1984, and special purpose Canadian type approval A-107 was awarded for the Firecat on 1 January that year.

The Conair conversion includes raising the cabin floor by 20.3 cm (8 in) and installing a 3,296 litre (870 US gallon; 725 Imp gallon) retardant tank in the fuselage; modifying the landing gear by fitting larger wheels with low pressure tyres for soft field operation; inspecting the wing spar caps for corrosion, and repairing or replacing them as necessary; removing 1,361 kg (3,000 lb) of military equipment; completely rewiring the aircraft; and rebuilding/ updating the flight deck instrument panels. Options include a hydraulic or pneumatic system for discharging the retardant, and a microcomputer system to control the retardant drop pattern. The retardant tank has four compartments that can be discharged in a single salvo, two two-door salvos, or four single-door drops. A 227 litre (60 US gallon; 50 Imp gallon) foam injection system is available for enhancing water drops.

Power Plant: Two 1,100 kW (1,475 hp) Wright 982C9HE2 (R-1820-82) Cyclone nine-cylinder aircooled radial engines, each driving a Hamilton Standard 43D51-355 three-blade constant-speed propeller. Total internal fuel capacity 1,968 litres (520 US gallons; 433 Imp gallons).

ACCOMMODATION: Minimum crew: one pilot. WEIGHTS:

Operating weight empty
Max payload
Max fuel
Max T-O weight
Max landing weight
PERFORMANCE (at max T-O weight):

6,895 kg (15,200 lb)
4,746 kg (10,464 lb)
1,418 kg (3,126 lb)
11,793 kg (26,000 lb)
11,113 kg (24,500 lb)

Never-exceed speed

280 knots (519 km/h; 322 mph) Max level speed at 1,220 m (4,000 ft) 244 knots (452 km/h; 281 mph)

Max cruising speed 220 knots (408 km/h; 253 mph)

Normal drop speed

120 knots (222 km/h; 138 mph)

Stalling speed, flaps down, power off

82 knots (152 km/h; 95 mph) Max rate of climb at S/L 366 m (1,200 ft)/min Rate of climb at S/L, one engine out

Service ceiling 6,860 m (22,500 ft)
Service ceiling, one engine out

T-O to 15 m (50 ft)
Landing from 15 m (50 ft)
Min field length
Endurance with max payload

4,115 m (13,500 ft)
368 m (1,208 ft)
549 m (1,800 ft)
915 m (3,000 ft)
4 h 30 min

CONAIR TURBO FIRECAT

This turboprop version of the Firecat, with Pratt & Whitney Canada PT6A-67AF engines (max

cruise rating 761 kW; 1,020 shp) and a computer controlled dispersal system (with foam injection) for retardant, was developed in 1987 and was due to make its first flight in mid-1988. The programme is a joint one between Conair and IMP of Halifax, Nova Scotia.

The four-compartment tank is dimensionally similar to that of the Firecat, but is 4 kg (9 lb) heavier. In addition to 3,296 litres (870 US gallons; 725 Imp gallons) of normal retardant, the Turbo Firecat can carry 173 litres (46 US gallons; 38 Imp gallons) of foam concentrate.

WEIGHTS:

Operating weight empty 6,169 kg (13,600 lb)
Max T-O weight 11,793 kg (26,000 lb)
PERFORMANCE (estimated at max T-O weight):

Max cruising speed 220 knots (408 km/h; 253 mph)

Normal drop speed 120 knots (222 km/h; 138 mph)

T-O run 442 m (1,450 ft) Endurance with max payload 5 h 6 min

CONAIR HELITANKERS

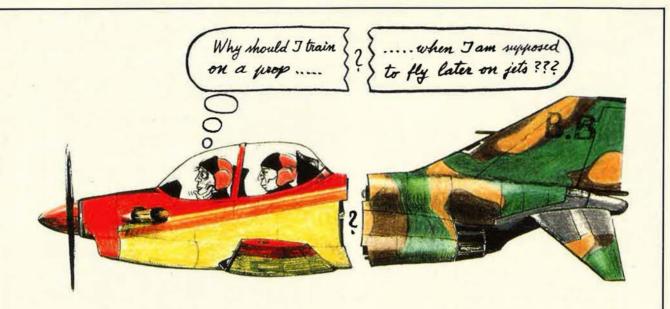
Conair has developed a growing number of helicopter-mounted fire control systems known as helitankers. Of semi-monocoque construction, the belly-mounted tanks feature individually operated, full-length rigid doors that may be opened in various combinations over a wide range of airspeeds to permit variable retardant line lengths and drop concentrations. A self-loading hover-fill system allows the tank to be filled while the helicopter hovers above a remote water source, and an offload feature allows the water payload to be pumped to a portable ground reservoir for the use of ground-based firefighters. A foam injection system permits the fire suppressing qualities of a water payload to be greatly enhanced. A reversible pump allows single-point loading injection into the tank and single-point offloading

Helitanker system sales up to mid-1988 have included seven Bell 205/212s to Frontier Helicopters (a Conair subsidiary) and five to the National Safety Council of Australia; four Aérospatiale AS 350B₁ Ecureuils to the French Securité Civile and one to Aérospatiale Helicopter Corporation in the USA; and three SA 315B Lamas to the Securité Civile. System capacities are 1,360 litres (359 US gallons; 299 Imp gallons) for the Bell 205/212; 900 litres (238 US gallons; 198 Imp gallons) for the Lama; and 800 litres (211 US gallons; 176 Imp gallons) for the Ecureuil. The Bell 205 and 212 helitankers are also offered with a rappelling system to deliver firefighters to remote fire sites.

Conair is building a 2,355 litre (622 US gallon; 517.5 Imp gallon) tank for the Aérospatiale SA 330 Puma for delivery to the Securité Civile in 1988. This system features a 798 litre (211 US gallon; 175.5 Imp gallon) two-door belly tank, and a 1,296 litre (342 US gallon; 285 Imp gallon) fuselage main tank with two internal doors for reloading the external tank via a 261 litre (69 US gallon; 57 Imp gallon) chute. Foam tank capacity is 173 litres (46 US gallons; 38 Imp gallons).



Conair equipped Bell 212 firefighting helitanker hovering to pick up water from a lake



Why should I need to know and to master:

- Propeller gyroscopic effects
- Propeller RPM selection and adjustments
- Propeller hazards for ground crews and formation flying
- · Propeller icing problems and deicing techniques
- · Mixture/fuel flow adjustments
- · Carburetor icing/CAT adjustments
- ... and many other operating techniques, systems and problems of piston and turboprop engines, which a future jet pilot will never encounter again?

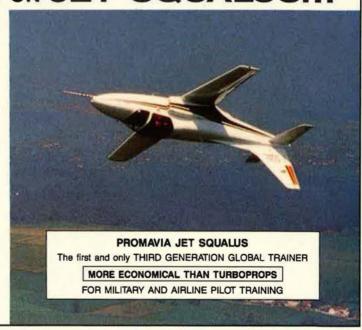
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Airman's Bookshelf

"The Other Theater"

The Ravens: The Men Who Flew in America's Secret War in Laos, by Christopher Robbins. Crown Publishers, New York, N. Y., 1987. 432 pages with bibliography and index. \$19.95.

When the Vietnam War began to heat up in the pivotal year of 1964, American pilots were already engaged in a "secret" sideshow in Laos. While this theater of the war in Southeast Asia was finally recognized both belatedly and with little fanfare, it was just as hot and nasty—and filled with more than a little intrigue and mystery.

In 1962, the United States signed an accord in Geneva that guaranteed American neutrality in the Laotian conflict. But with the widening war that ensued and with an increasing awareness of the strategic importance of that country to the American domino theory of Southeast Asian geopolitics, the US responded by upping the ante and intervening in the war in an incremental and secretive fashion.

One of the first American combat units sent to assist in the training of the pro-Western Royal Laotian Army and Air Force was USAF's 1st Air Commando Wing, stationed in Udorn, Thailand. Arriving in 1964, many of these volunteers flew as forward air controllers (FACs). While these men served both bravely and well, before long the critically important job of forward air control was taken over by a newly created, devil-may-care bunch of extraordinarily competent pilots who were known by their radio call sign—the Ravens.

The Ravens were selected from pilots who had served a minimum of six months in South Vietnam. By means of a complicated process, they volunteered for what came to be known as "The Steve Canyon Program." Named after the popular cartoon strip character and committed to the philosophy of "any assignment so long as it's perilous, exciting, and decent," the program confronted the newly

minted Raven with a hot welcome.

Forbidden to dress in regulation USAF uniforms, the Ravens were usually found attired in denim cutoffs, faded blue jeans, T-shirts, broadbrimmed cowboy hats, and the like. Their official "cover" stories were that they were forest rangers assigned to the US Agency for International Development (AID). However, almost everyone—including the Communists (but not the American people)—knew who they were and why they were there.

If the astronomical casualty rate (approaching fifty percent) didn't get them, the Ravens still had to face the possibility of assassination. Each Raven had a price on his head. If captured, the pilots were obliged to swallow a CIA-concocted shellfish toxin that would result in almost instant death.

While Ravens served in every military region of "The Other Theater" (Laos), the assignment of choice was to Long Tieng. This town appeared on no map of Laos, but was the hub and nerve center of the clandestine war. By the late 1960s, it had grown to be the second-largest city in Laos, surpassed only by Vientiane. Because of the large number of CIA agents there, it became known as "Spook Heaven" and "the most secret spot on earth."

Flying out of Long Tieng, the Ravens supported the pro-Western forces of Meo tribesmen under the wily, cruel, but effective General Vang Pao. For most of their years in Laos, they took to the air in flimsy Cessna O-1 Bird Dogs (L-19s in US Army parlance). Built in the early 1950s, these high-wing, fore-and-aft monoplanes had no armor whatsoever, no self-sealing fuel tanks, and no weapons. When fully configured for combat, they could not exceed a top speed of seventy knots.

The role conceived for the Ravens in the early and mid-1960s was modest. They and the other American forces operating primarily "in the black" in Laos were to buy time until conventional American units could win the war in South Vietnam. Then, with their mission completed, they would be withdrawn.

But things went horribly wrong. As Robbins points out, "Nobody could foresee that this small, deniable, clandestine arrangement would mushroom into a massive military commitment, an ever-escalating policy of devastation, bombing, and a ten-year secret war."

The Ravens' aerial conflict in Laos was engineered primarily by the CIA. The Ravens and their air commando predecessors had flown FAC support since at least 1964, but the US government, as late as March 1970, officially listed their role as solely one of "armed reconnaissance."

Whatever the politics of the war, the fighting itself placed a backbreaking work load on the Ravens. Never more than twenty-two pilots at one time, the Raven contingent by 1969 was nevertheless directing up to 500 USAF/USN fighter-bomber sorties per day—a rate equal to that of the maximum effort of the air war against North Vietnam. Flying as many as six combat missions each day, the Ravens were decimated by fatigue—but they stayed in the air. The low man for one month that year had 156 flying hours.

And the cost to American men and machines was cruel. One Raven noted that during his six-month tour, ninety percent of their planes had been hit by ground fire and thirty percent of the pilots killed.

The Ravens served in Laos until the end came in 1973. When they returned home, many were bitter. "We turned them [the Meo tribesmen] out to slaughter," one Raven recalled. Another observed that because of the limitations of a political war, "it would have been a hell of a lot better if we'd never fired a shot."

But as they look back on their careers, the Ravens today remember such colorful characters as "Magnet Ass," who had eleven planes shot out from under him but who never wavered in his enthusiasm for the fray. And at their reunions, the former secret warriors always think of their comrades who never came back.

Until the publication of this book, the story of the Ravens was largely locked away in classified archives.

Airman's Bookshelf

This account, which relies on selected, recently declassified official documents and which is bolstered by oral histories and personal interviews, tells the story of a war long covered up—a war that many never even knew took place. A convincing unit biography told in a riveting fashion, *The Ravens* is compelling reading for anyone who can appreciate an intriguing tale of derring-do and heroism above the call.

—Reviewed by Dr. William Teague. Dr. Teague teaches American government at the University of Texas at Dallas and is a regular reviewer for this magazine.

Challenging the Odds

The Day I Owned the Sky, by Brig. Gen. Robert Lee Scott, Jr., USAF (Ret.). Bantam Books, New York, N. Y., 1988. 304 pages with photographs and index. \$17.95.

Robert Lee Scott is the renowned author of God Is My Copilot, which has continuously been in print since the 1940s. His new book tells more of the

career of this remarkable fighter pilot.

In his prologue, General Scott describes an air battle over China that reveals his penchant for challenging the odds, forging ahead, and getting into hot water. Scott, leading a flight of eighteen P-40s, attacked twenty-three Kawasaki bombers. His flight shot down all twenty-three bombers against the loss of one American pilot. For this action, Scott was very nearly court-martialed.

It seems that Scott had commandeered some vital Lend-Lease vehicles to get his pilots to their planes when the scramble signal was given. Only through the intervention of General Chennault was Scott saved from grim punishment.

In this riveting book, such tales of scrapes and narrow escapes accumulate to form a mosaic of perseverance and high adventure.

General Scott starts his story by telling of his dogged determination to enter West Point. He had flunked out of three colleges, including The Citadel. There was one last hope—to enlist in the Regular Army and somehow win acceptance to the West Point Preparatory School.

He was accepted, and the following

months of desperate cramming paid off. He became first in the class and subsequently a cadet at West Point.

Later, after flight school, Scott was assigned to Mitchel Field, N. Y., to fly Curtiss Falcons. The first week, he flew for thirty-two hours. He was then promptly grounded for eight months for exceeding his flight time!

But soon after, the Army began airmail operations. Scott's grounding was rescinded, and he flew night and day, hauling tons of mail between Newark, Cleveland, and Chicago. Such reversals of fortune seemed often to fall Scott's way.

He challenged the odds again when he was courting his beloved "Kitty Rix"—Catherine Rix Green, the young college girl from Georgia who later became his wife. Kitty was a good 1,500 miles away from Randolph Field. The third week of flight training, Scott decided to see her. So he pointed his red Chevy convertible, modified with a fifty-five-gallon fuel drum in the back seat, toward Georgia. He figured he had to average a mile a minute to cover the 3,000 miles and be back in Texas by Monday morning.

And he made it. Before the year of

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2600 Post Road, Southport, CT 06490 • (203) 255-4613 Toll-free, outside CT: (800) 243-4260 flight training came to an end, he had made twenty such dashes!

After a stint of making speeches and appearances at production plants during the war, Scott returned to China. He relates how he was assigned to the General Staff Corps instead of the Army Air Forces and ordered not to fly combat over enemy lines again.

He reported to General Chennault, but kept his restricting orders in his briefcase and over the next two weeks flew fourteen missions. By the second week, he had received an "eyes only" message from General Arnold about his defiance of orders. He was ordered to return immediately to Washington. Before he was to leave, General Chennault, his granite jaw set squarely, told him off in spitfire terms.

But later, Chennault motioned Scott to join him in the shade of Scott's P-51, where he apologized. He had remembered Scott telling of some Navy rockets Chennault could use to knock out locomotives. Chennault promised to go to bat for him with Arnold if Scott could get him those Navy rockets.

All Scott had to do when he returned to the US was to find the rockets (he eventually found 100,000 of them), arrange to get them to China, train twelve pilots in the new rocketry techniques, and return to China himself. Of course, he carried it all off.

The book describes many adventures, capped, I think, by the one that resulted from his determination to walk the Great Wall of China-a nearly 2,000-mile stroll. In 1980, he set out on this journey after provisioning himself with 1,200 cookies that he had baked himself. All that he was to carry on the trip was carefully packed in a seventy-pound bag.

At the age of seventy-two and after many difficulties, he finally completed his odyssey along the Great Wall of China, fulfilling a lifelong dream. He ate the last cookie, now just a handful of crumbs, as a dessert to a simple Chinese meal on the last leg of his journey.

This book is well written, and despite the descriptions of many hairy situations, its style is easy-going. But the book needs some maps. The unending list of foreign cities and towns detracts from the reader's concentration on the story. I spent much time trying to orient myself.

It's still a whale of a story. By all means, read it.

> -Reviewed by Richard H. Becker. Mr. Becker is a National Director of the Air Force Association.

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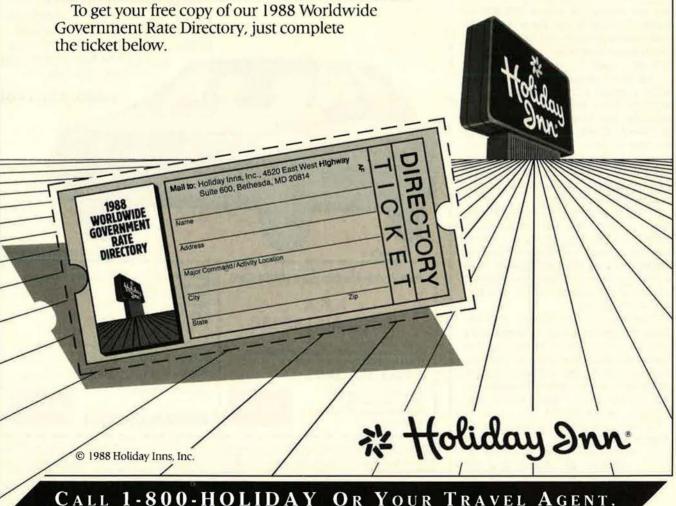
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First at Balikpapan

In August 1943, crews of the 380th Bomb Group flew three of the most daring missions of World War II.

BY JOHN L. FRISBEE CONTRIBUTING EDITOR

THE October 1987 "Valor" story "Top Gun" credited Fifth Air Force fighter pilots with escorting the first AAF bombing attack on oil refineries at Balikpapan, Borneo. It was the first strike accompanied by fighters, but honors for the very first attack on Balikpapan belong to the 380th Bombardment Group, "The Flying Circus," assigned to Fifth Air Force but operating in considerable obscurity with the Royal Australian Air Force.

The 380th, commanded by Lt. Col. William A. Miller, arrived at bases near Darwin in northern Australia during the spring of 1943. Within a few weeks, the scant intelligence available indicated that the refineries at Balikpapan, which had been disabled by the retreating Dutch, were back in full swing, reportedly producing more than half of Japan's aviation fuel and lubricating oils. It was a fat target, but there were problems, described in the Presidential Unit Citation later awarded to the Group.

The seventeen-hour mission would cover 2,700 miles, longer than "any strike previously attempted in the Southwest Pacific." Most of the route was over water and past Japanese air bases of undetermined strength. Target data was meager, and weather forecasts were of dubious accuracy.

Colonel Miller and his staff were confident that their B-24s could do the job. A twelve-plane mission was laid on for August 13, 1943. Each bomber would carry an overload of fuel and six 500-pound bombs. They were to take off from Darwin at five-



B-24 pilot Capt. Gus Connery, right, and Lt. Jim Wright, bombardier, were among the first to strike Balikpapan.

minute intervals, beginning at 1700 hours in order to reach hopefully moonlit targets shortly after midnight. Crews would navigate to the area independently, where half the force would bomb refineries, and the other half would bomb shipping in the harbor from minimum altitude. The bombers had to penetrate three severe tropical fronts. Because of weather, mechanical problems, and fuel shortages, only nine reached Balikpapan.

First over the target at 0020 hours was Capt. Gus Connery's B-24. The Japanese, believing they were beyond the range of American bombers, were taken by surprise. The city and harbor were brightly lighted. Connery's bombardier, Lt. Jim Wright, better known today as Speaker of the House of Representatives, dropped his bombs on one of the refineries. The lights immediately went out, and succeeding B-24s were met by a barrage of flak.

The last B-24, flown by Lt. Douglas Craig, cleared the area at 0200 hours. Then for all of them, many with battle damage, it was eight long hours back through those vicious fronts. All made it except Craig's crew, which was attacked by fighters near Timor. Evasive action burned so much fuel that they had to land on a salt flat in north Australia.

How much damage had Balikpapan suffered? The next day, August 15, two B-24s flown by Lts. Jack Banks and Howard Hahn were dispatched on a daylight photo mission to find out. Both got excellent photos, dropped their three bombs, and were attacked by fighters. Banks ended up in an hour-long engagement during which his crew shot down four Zeros, while Hahn's crew was credited with one kill.

After seeing the photos, the Group was eager for another go at a target they knew would be on alert and probably reinforced. On August 17, eleven B-24s launched into very bad weather for a second night strike. Again, only nine reached Balikpapan. Hits on Lt. Jim Soderberg's plane set a fire that finally was put out. Three of Capt. Bill Shek's crew were wounded.

Cannon fire got Lt. Bob Fleming's bombardier, Lt. Elvin Mellinger, and started a fire in the nose compartment. The bleeding bombardier dropped his bombs on a tanker and put out the fire before submitting to first aid. The attack also knocked out Fleming's No. 1 engine. Near Timor, No. 2 quit. The crew nursed their limping bomber 400 miles to a safe landing.

From the start, no one thought the 380th's few B-24s could put Balikpapan permanently out of action. Nevertheless, in twenty sorties the Group had temporarily shut down the refineries, destroyed many tons of stored fuel, sunk 30,000 tons of shipping, and forced the Japanese to redeploy elements of their defense forces from New Guinea to Borneo. Not a bad show.

The 380th, while still in Australia, earned a second Unit Citation before moving to the Philippines in the spring of 1945. There, they operated against targets on Taiwan and the Asian mainland. But for the men of the 380th Bombardment Group, the high point of its long and distinguished combat record will always be those first long, pioneering missions to Balikpapan, the Ploesti of the Pacific.

The annual Salute honors Secretary Aldridge.

Iron Gate's Silver Anniversary

BY JAMES A. McDONNELL, JR. MILITARY RELATIONS EDITOR



Secretary of the Air Force Edward C. Aldridge, Jr., was the honoree at AFA's Iron Gate Chapter's twenty-fifth annual Air Force Salute. Secretary Aldridge, right, was presented the Maxwell A. Kriendler Award by Iron Gate Chapter President Dan F. Huebner.

FA's New York City Iron Gate Chapter held its twenty-fifth annual national Air Force Salute in early April. The evening's honoree, Air Force Secretary Edward C. "Pete" Aldridge, Jr., received the Maxwell A. Kriendler Memorial Award. The award, originally known as the Bronze Eagle, was renamed in 1974 in honor of Mr. Kriendler, one of the Chapter's founders.

Secretary Aldridge was cited for his outstanding record as the top civilian leader of the Air Force, for his deep concern for the people of the total Air Force, and for his determined championship of the nation's space program. During the presentation, Chapter President Dan F. Huebner said that "every rocket being launched these days should have "Thank you, Pete," written on its side."

During the evening, Mr. Huebner presented Aerospace Education Foundation Fellowships to several Salute guests. Both Gen. Duane H. Cassidy, CINCMAC and CINC of USTRANSCOM, and Gen. John T. Chain, Jr., CINCSAC, received Ira C. Eaker Fellowships. The Chapter also presented its first Barry M. Goldwater Fellowship to Chapter Secretary and Salute Coordinator Dorothy L. Welker.

The Salute, a major fund-raiser for Air Force-related charities, has raised more than \$1.5 million to



Some of the attendees at the Salute included, left to right, Iron Gate Chapter President Dan F. Huebner, retired Air Force Maj. Gen. John T. Buck, Secretary of the Air Force Edward C. Aldridge, Jr., Salute Coordinator Dorothy Welker, Air Force Chief of Staff Gen. Larry D. Welch, and William I. Lees.



AFA National Secretary and Iron Gate Chapter National Salute Chairman Tom McKee, second from left, presents a \$35,000 check to Air Force Secretary E. C. "Pete" Aldridge, Jr., and to USAF Chief of Staff Gen. Larry Welch, far left. The amount represents the net proceeds from Iron Gate's annual fund-raiser that benefits Air Force charities and AFA's Aerospace Education Foundation. At the right is Iron Gate Chapter President Dan Huebner.

date. AFA National Secretary and Salute Chairman Thomas J. McKee noted that last year's event generated a record-breaking \$96,000 in contributions. The money raised is distributed among the Air Force Assistance Fund, the Falcon Foundation, the Air Force Historical Foundation, the Air Force Museum, the National Aviation Hall of Fame, and AFA's own Aerospace Education Foundation. Proceeds are also set aside for scholarships for Civil Air Patrol and USAF Academy cadets.

The crowd of more than 1,000 was entertained by Broadway singer Barbara Cook. In addition, Salute guests were treated to a special videotape presentation prepared by Robin Whittle, AFA Director of Communications. The video, narrated by former Salute master of ceremonies and longtime CBS News anchorman Walter Cronkite, highlighted the Chapter's accomplishments and honorees since the Salute's inception in 1964 (see box).

Next year's Air Force Salute will take place in New York City on Saturday, April 8, 1989.

Iron Gate Chapter's Silver Anniversary Roster of Honorees

HONODED

YEAR	HONORED
1964	Maj. Gen. H. C. Davidson, Gen. Curtis LeMay, Eddie Rickenbacker, and the Hon. Eugene M. Zuckert
1965	Gen. Curtis LeMay and Gen. John P. McConnell
1966	The Air Pioneers and the Air Forces of the Western Hemisphere
1967	The Hon, L. Mendel Rivers
1968	The Men and Women of the Air Forces in Southeast Asia
1969	The Secretaries and Chiefs of Staff of the Air Force
1970	The Men and Machines of the Air Force
1971	The United States Air Force Academy
1972	The United States Air Force on Its Silver Anniversary
1973	President Richard M. Nixon and the Men and Achievements of the Space Program
1974	Sen. Barry M. Goldwater
1975	Sen. W. Stuart Symington, J. Raymond Bell, and the Hon. John L. McLucas
1976	(none)
1977	Lt. Gen. and Mrs. James H. Doolittle, USAF (Ret.)
1978	Gen. David C. Jones, USAF
1979	Sen. Howard W. Cannon and J. Gilbert Nettleton, Jr.
1980	Bob Hope
1981	Milton Caniff
1982	Sen. John G. Tower
1983	Rep. Samuel S. Stratton
1984	The Hon. Verne Orr
1985	Gen. John W. Vessey, Jr., USA
1986	Gen. Charles A. Gabriel, USAF
1987	Col. Francis S. Gabreski, USAF (Ret.)
1988	The Hon. Edward C. "Pete" Aldridge, Jr.



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By Robin L. Whittle, DIRECTOR OF COMMUNICATIONS

Arkansas AFA Markets The Mission

In February, Arkansas AFA President **Bud Walters** placed an AFA supplement in a Sunday edition of the Blytheville Courier News. Then-Communications Vice President **Jim Waller**, who at the time was also the editor of the Courier News, helped Mr. Walters develop the first issue. The supplement included reprints of AFA's White Papers, charts and graphs from the February issue of AIR FORCE Magazine, and a description and map from the Arkansas Democrat on how each county in the state would be affected by defense budget cuts.

The project was financed by Blytheville Chapter Community Partners and Arkansas AFA chapters. Arkansas AFA's "Blytheville Edition," which listed the names of the Blytheville Community Partners on the front page, reached 10,500 subscribers in northeast Arkansas and

southeast Missouri.

In addition, Mr. Walters provided Col. D. Bruce Smith, who was then Commander of the 97th Bombardment Wing at Blytheville AFB, and Vice Commander (who became Commander on May 26) Col. David McElvoy with 500 additional copies for active-duty personnel. Colonel Smith sent the new state AFA newspaper to his public affairs officer for publication in the weekly base newspaper Blythe-Spirit. Further, Colonel Smith addressed the Base Community Council and the Blytheville Rotarians and commended AFA on both occasions for its White Paper program. Mr. Walters also left extra copies with Col. Norman Butler, 42d Air Division Chief of Staff.

For the second edition, Mr. Walters replaced the Blytheville Chapter name in the masthead with the locations of the four other Arkansas chapters, which include the David D. Terry Chapter in Little Rock, the Razorback Chapter in Fayetteville, the Fort Smith Chapter in Fort Smith, and the recently chartered Ouachita Chapter in Hot Springs. This effort allowed these chapters to use the paper for local

Arkansas AFA State President Bud Walters, left, and Tommy Wilson, General Manager and Editor of the Courier News in Blytheville, Ark., look over a production proof of the special AFA supplement that ran in the paper last February. The supplement was financed by **Blytheville Chapter Community Partners** and Arkansas AFA chapters.



membership recruiting and community outreach.

Mr. Walters also worked out an arrangement to customize the newspaper to different AFA states and chapters. These local AFA editions list the names and titles of state officers as well as the names and locations of state chapters. The Courier Newspublished 1,000 copies for each AFA state, and AFA headquarters paid the printing and shipping costs.

AFA President Sam E. Keith, Jr., said that the effort is "one of the most innovative I've seen. In fact, it's difficult to imagine a better example of

'marketing the mission.' "

The state newspaper is now printed bimonthly, and *Courier News* editor **Tommy Wilson** has been selected as the new Communications Vice President.

Lancaster Addresses Scott Berkeley Chapter

In his first major address on de-

fense policy since becoming a member of the House Armed Services Committee earlier this year, Rep. Martin Lancaster (D-N. C.) told AFA's Scott Berkeley Chapter that he is concerned about two matters in particular—the conventional-force imbalance in Europe and a program of national service for young Americans. The speech took place in March at the Chapter's "Salute to TAC and SAC" at Seymour Johnson AFB, N. C.

Chapter President Ray Kuhlman said that Representative Lancaster's comments on defense issues were "well received." After the speech, Mr. Kuhlman introduced Col. William J. Ball, 4th Tactical Fighter Wing Commander, and Col. Edward Grillo, Commander of SAC's 68th Air Refueling Wing.

"Gentlemen, it is your job to protect this country so that we can sleep at night," Mr. Kuhlman said to the wing commanders. Turning toward Representative Lancaster, Mr. Kuhlman

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Litton Industries ITT Defense Communications Div. ITT Defense Technology Corp. John Deere Technologies Int'l, Inc. Kilgore Corp. Kollmorgen Corp., Electro-Optical Div. Kollsman Lear Siegler, Inc. Lear Siegler, Inc., Instrument & Avionic Systems Div. Lewis Engineering Co., Inc.

Litton-Amecom Litton Applied Technology Litton Data Systems Litton Guidance & Control Systems Litton Industries Lockheed Aircraft Service Co. Lockheed-California Co. Lockheed Corp. Lockheed Engineering & Management Services Co., Inc. Lockheed-Georgia Co. Lockheed Missiles & Space Co. Lockheed Space Operations Co. Logicon, Inc. Loral Corp.
Loral Systems Group
LTV Aircraft Products Group LTV Missiles and Electronics Group, Sierra Research Div. Magnavox Government & Industrial Electronics Co. Martin-Baker Aircraft Co. Ltd. Martin Marietta Astronautics Group
Martin Marietta Corp.
Martin Marietta Electronics &
Missiles Group
Martin Marietta Energy Systems, Martin Marietta Information Systems Group MBB McDonnell Aircraft Co. McDonnell Douglas Astronautics McDonnell Douglas Corp. McDonnell Douglas-INCO, Inc. MITRE Corp., The Moog, Inc. Morton Thiokol, Inc. Moser Corp.
Motorola, Inc., Government
Electronics Group NORDAM
Northrop Advanced Systems Div.
Northrop Corp., Aircraft Div.
Northrop Corp., ElectroMechanical Div.
Northrop Corp. Electropics Div. Northrop Corp., Electronics Div. OEA, Inc O. Miller Associates ORI, Inc. Oshkosh Truck Corp. PACCAR Defense Systems Pan Am World Services, Inc., Pan Am World Services, Inc.,
Aerospace Div.
Perkin-Elmer Corp.
Pilatus Aircraft, Ltd.
Planning Research Corp.
Plessey Electronic Systems, Inc.
Pneumo Abex Corp.
Products Research & Chemical Corp. RAND Corp., The Raytheon Co. RCA Aerospace & Defense RECON/OPTICAL, Inc., CAI Div. Rediffusion Simulation, Inc. Reflectone Inc. Republic Electronics Co. Rexham Aerospace and Defense Group Rockwell Int'l Collins Government Avionics Div. Rockwell Int'l Corp. Rockwell Int'l Electronics Operations
Rockwell Int'l North American **Aircraft Operations**

Rockwell Int'l North American Space Operations Rohr Industries, Inc. Rolls-Royce plc Rosemount Inc. Sabreliner Corp. Sanders Associates, Inc. Schneider Services International Science Applications Int'l Corp. Short Brothers USA, Inc. Singer Co., The Singer Co., The Link Flight Simulation Div. Smiths Industries, Aerospace & Defence Systems Co. Snap-On Tools Corp. Soffech Software AG
Southwest Mobile Systems Corp.
Space Applications Corp.
Space Images
Space Ordnance Systems Standard Manufacturing Co., Inc. Stewart & Stevenson Services, Inc. Sundstrand Corp. Sverdrup Corp. Syscon Co. Systematic Management Services, Inc. Systems Control Technology, Inc. Systems Research Laboratories Defense Electronic Systems Systron Donner, Safety Systems Talley Defense Systems Tandem Computers Inc., US Federal Operations
Technology Applications, Inc.
Teledyne CAE Teledyne, Inc.
Teledyne Ryan Aeronautical
Texas Instruments, Defense Systems & Electronics Group Textron Defense Systems Textron, Inc.
Thomson-CSF, Inc.
3M Stormscope Weather Mapping Systems Titan Severe Environment Systems Titan Systems, Inc.
Tracor Aerospace, Inc.
Trident Data Systems
TRW Defense Systems Group TRW Federal Systems Group TRW Inc., Electronic Systems Group Group
TRW Space & Defense Sector
TRW Space & Technology Group
Unisys Corp., Defense Systems
United Airlines Services Corp.
United Technologies Corp.
UTC, Advanced Systems Div.
UTC, Hamilton Standard
UTC, Norden Systems, Inc.
UTC, Pratt & Whitney
UTC, Research Center UTC, Research Center UTC, Sikorsky Aircraft UTC, Space Transportation Systems Universal Propulsion Co., Inc. Varo, Inc. Vega Precision Laboratories V. Garber Int'l Associates, Inc. Vitro Corp. Walter Kidde Aerospace Operations Watkins-Johnson Co. Western Gear Corp. Westinghouse Electric Corp., Baltimore Div. Williams International Wyle Laboratories

Elbit/Inframetrics

Intercom

To coincide with the arrival of the 384th Bomb Wing's first B-1B, the 384th Bomb Group from World War II held its reunion at McConnell AFB, Kan., in February, AFA **National Director Nate** Mazer, second from right, organized the gathering. He's shown with fellow 384th BG members, left to right: Sheldon McMillin, Lloyd W. Whitlow, Frederick Nowosad, and Walter Harvey. Wearing the hat is Sam lacobellis, President of Aerospace Operations for Rockwell International.



said, "And, sir, it is your job to make sure that they have the tools to do theirs."

The Chapter event not only generated local publicity but national coverage as well.

AFAer Assumes State Post

Pennsylvania AFA President **David**L. Jannetta was sworn in as Secretary of General Services by Gov. Robert P. Casey on March 22.

The Department of General Services is the central maintenance, purchasing, publishing, and building construction agency for the state. Mr. Jannetta will oversee the Department's \$147 million annual budget and nearly 1,400 employees.

Among the several hundred wellwishers at the swearing-in ceremony were legislators, cabinet members, government officials, Air National Guard officers, Pennsylvania Adjutant General **Gerald T. Sajer**, and community leaders from Altoona, Pa. Mr. Jannetta recently completed his four-year term as the mayor of Altoona.

AFA National Director Judge John G. Brosky and several other AFA leaders also witnessed the ceremony, and they include AFA National Director Carl J. Long and his wife Gladys and son Carl, National Directors Jack B. Gross and Robert L. Carr, National



AFA National President Sam E. Keith, Jr., recently visited the USAF Senior NCO Academy, Gunter AFB, Ala., where he presented the National Security Affairs/Force Employment Award for Class 88-B to SMSgt. Michael L. Luken, left, who's assigned to Randolph AFB, Tex.



Secretary of Defense Frank C. Carlucci was recently honored at a special dinner in Washington, D. C., and named the Nation's Capital Chapter's Distinguished American. Here, Secretary Carlucci, right, receives his award from Chapter President Denny Sharon.

Vice President for the Northeast Region Jack Flaig, and Pennsylvania AFA state officials Ron Chromulak, Tillie Metzger, Anthea Germano, Frank Juliano, Ed Gagliardi, Jim Cain, and Gene Goldenberg.

"Governor Casey had high praise for David and the managerial skill that he will bring to the Department of General Services," said Judge Brosky.

Jones Chapter Reports Flurry of Activity

Mike Fedorchak, President of AFA's General David C. Jones Chapter, reported a flurry of Chapter activity during the first quarter of 1988. "We sat down and planned our involvement, and the results speak for themselves." he said.

The Chapter, located near Minot AFB, N. D., held its annual awards banquet in March. AFA President Sam E. Keith, Jr., was the guest speaker. Twelve historical flags were presented to the Fifteenth Air Force NCO Leadership School, and the winners of the Chapter's local school essay contest were recognized. In addition, the Chapter's Community Partners presented plaques to twenty-one outstanding Air Force professionals stationed at Minot AFB. The event attracted more than 300 people, including Minot Mayor George Chris-

Return Those Questionnaires!

AFA Life Members are asked to please return your questionnaires for AFA's Life Member Directory right away. If you are not an AFA Life Member and wish to be included in this valuable, comprehensive volume, simply sign up as a Life Member by the end of this month.

Handled by Harris Publishing Co. of White Plains, N. Y., at no cost to AFA, the Life Member Directory will provide current biographical data, including name, address, spouse's name, current military status, occupation, firm name, business address, and telephone numbers. This resource is scheduled for release in February 1989, and it will be an excellent tool for locating and contacting other AFA Life Members around the country. It will be easy to use because of its alphabetical and geographical listings.

In coming months, Life Members will be contacted by telephone to verify the accuracy of the data to be printed in the directory. At that time, members who wish to purchase a copy of the directory will have the opportunity to do so. The number of volumes printed will depend on the prepublication orders placed at that time.

AFA Life Members who do not return their questionnaires and who are not reached by telephone will be listed with whatever address information is currently on file. And, of course, AFA will honor the request of any Life Member who prefers that his or her name not be included in the directory. If you would prefer not to be, please send this request in writing to both AFA's membership office and the Harris Publishing Co. The address is Directory Publication Office, P. O. Box 5027, White Plains, N. Y. 10602-5027.

Please return your questionnaire today!

tiansen, AFA Vice President for the North Central Region Paul Markgraf, Under-Forty National Director J. Michael Phillips, North Dakota AFA President Ralph Ehlers, state senators, and Minot officials.

The Chapter also sent letters to AFA members regarding a public meeting to be held on the proposed Peace-keeper rail-garrison system. In the in-

Coming Events

June 3-4, Louisiana State Convention, New Orleans . . . June 10-11, Oklahoma State Convention, Tinker AFB . . . June 10-12, Washington State Convention, Seattle . . . June 17-19, Georgia State Convention, Athens . . . June 17-19, New Jersey State Convention, Cape May ... June 17-19, Ohio State Convention, Columbus. . . June 26, Minnesota State Convention, Rochester . . . July 8-9, Missouri State Convention, Springfield . . . July 15-16, Mississippi State Convention, Columbus . . . July 15-17, Pennsylvania State Convention, Pittsburgh . . . July 22-24, Texas State Convention, Kerrville . . . July 23-24, North Carolina State Convention, Raleigh . . . July 29-30, Colorado State Convention, Lowry AFB . . . July 29-31, Florida State Convention, Fort Lauderdale . . . August 4-6, California State Convention, San Diego . . . August 5-7, New York State Convention, Long Island . . . August 12-13, Illinois State Convention, Chicago . . . August 18-19, Delaware State Convention, Dover AFB . . . August 19-20, Oregon State Convention, Portland . . . August 20, Indiana State Convention, Grissom AFB . . . August 26, Arkansas State Convention, Little Rock . . . September 19-22, AFA National Convention and Aerospace Development Briefings and Displays, Washington, D. C.



In ceremonies at the Pentagon on February 10, then AFA Executive Director John O. Gray, left, and Mrs. Jeanne Bell present MSgt. Raymond C. Gose a check and an AFA pen as the award for Print Journalist of the Year, an AFA Aerospace Education Foundation-funded program established to honor the memory of the late J. Raymond Bell, an AFA field leader of long standing.

Terry Bell Operations Manager PES



Ican save money leasing a new car

And help with your comparison shopping, too!

sponsored program.

a new car is so convenient that they wish they'd done it years ago. And inexpensive, too! They customers calls leasing a car "a just complete a form like the one good deal with no muss and no below and ask me to send them

If you're in the market to lease detailed leasing information for a new car, truck or van-or want the car of their choice. I also send is. About the only exception is to get comparative prices before them actual price information on that some of the more exotic buying a new car-I can help you the same car-both dealer and save money through this AFA retail prices-so that if they decide to buy, rather than lease, they have current information for sustomers tell me that leasing comparative shopping purposes new car is so convenient that when visiting automobile dealer showrooms. One of my repeat

And most of the time it really pricing information is not always available on foreign cars ... but I can almost always help you with full leasing information on all domestic and foreign cars.

So, if you're in the market to lease a new car, please ask us to help. I think we can save you both time ... and money!

Model	Body Style
Equipment Se	ection
Engine 1 4 c	yl. 🗆 6 cyl. 🗆 Other
Transmission	☐ Automatic ☐ Manual
Air Condition	ing 🗆 Standard 🗀 Auto. temp. control
Emission	alifornia 🗆 High altitude
Gauges Sta	ndard Electronic
Mirrors 🗆 LH	remote RH manual Other
Moldings 🗆 B	odyside Rocker panel Other
Paint [two-t	one 🗆 stripe
Power Equipm	ent 🗆 Brakes 🗆 Steering
☐ Antenn	a 🗆 Door locks
☐ Mirrors	☐ Windows ☐ Tailgate/trunk release
☐ Seats	driver passenger bench
Radio AM	☐ AM/FM Stereo
□ AM/	FM Stereo with cassette player
	FM Stereo w/cassette & premium sound
Roof Full v	inyl 🗆 Other
Seats Bence	h □ Notchback 55/45 □ 45/45
□ Buck	et 🗆 Other
Seat Trim 🗆	Cloth 🗆 Vinyl 🗆 Leather
	el □ Tilt □ Telescopic
Tires White	e SW 🗆 Black SW 🗆 Other
Wheel Covers	☐ Standard ☐ Wire

☐ H. D. cooling

☐ Impact strips

☐ Glass, tinted

☐ Light group

☐ Luggage rack

☐ Visor, illuminated vanity

☐ Console

Wheels | Aluminum | Other

☐ Bumper guards

☐ Cruise control

☐ Door edge guards

☐ Floor mats (F & R)

☐ Headlamps group

☐ Defogger, rear window

Other

H. D. battery

W/S Wipers □ Intermittent □ Rear Window

New Vehicle Cost and Lease Request



Additional Equipment

Proposed leasing period

Check enclosed	for \$7.00	
Charge \$7.00 to:		
□ AFA/VISA □	Other VISA	☐ MasterCard
cct. No.		Exp. Date

Name Address_ _State_ 0:(_ Phone H: (____)_ Mail the New Vehicle Request and \$7 for each new car

inquiry to: AFA Auto Lease Program, c/o PES, Box 208, Wauseon, OH 43567.

For more information call (800) 227-7811, or in Ohio. (419) 335-2801.

Program not available in the state of Louisiana.

AFA State Contacts



Following each state name are the names of the communities in which AFA chapters are located. Information regarding these chapters or any of AFA's activities within the state may be obtained from the appropriate contact.

ALABAMA (Birmingham, Gadsden, Huntsville, Mobile, Montgomery, Selma): Robie Hackworth, 206 Dublin Circle, Madison, Ala. 35758 (phone 205-532-4920).

ALASKA (Anchorage, Fairbanks): Theron L. Jenne, 2501 Banbury Dr., Anchorage, Alaska 99504 (phone 907-337-3360).

ARIZONA (Green Valley, Phoenix, Sedona, Sierra Vista, Sun City, Tucson): Robert A. Munn, 7042 Calle Bellatrix, Tucson, Ariz. 85710 (phone 602-747-9649).

ARKANSAS (Blytheville, Fayetteville, Fort Smith, Hot Springs, Little Rock): Bud A. Walters, 903 Dixie Dr., Blytheville, Ark. 72315 (phone 501-763-1825).

CALIFORNIA (Apple Valley, Camarillo, Edwards, Fairfield, Fresno, Los Angeles, Merced, Monterey, Novato, Orange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, Sunnyvale, Vandenberg AFB, Yuba City): Harold Strack, 28063 Lobrook Dr., Rancho Palos Verdes, Calif. 90274 (phone 213-541-6226).

COLORADO (Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Littleton, Pueblo): Jack G. Powell, 1750 S. Ironton, Aurora, Colo. 80012 (phone 303-370-4787).

CONNECTICUT (Brookfield, East Hartford, Middletown, Storrs, Stratford, Torrington, Waterbury, Westport, Windsor Locks): Joseph Zaranka, 9 S. Barn Hill Rd., Bloomfield, Conn. 06002 (phone 203-242-2072).

DELAWARE (Dover, Milford, Newark, Rehoboth Beach, Wilmington): **Horace W. Cook**, 112 Foxhall Dr., Dover, Del. 19901 (phone 302-674-1051).

DISTRICT OF COLUMBIA (Washington, D. C.): Denny Sharon, 1501 Lee Highway, Arlington, Va. 22209-1198 (phone 703-247-5820).

FLORIDA (Avon Park, Broward County, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Homestead, Jacksonville, Leesburg, Miami, New Port Richey, Orlando, Palm Harbor, Panama City, Patrick AFB, Port Charlotte, Redington Beach, Sarasota, Spring Hill, Tallahassee, Tampa, West Palm Beach, Winter Haven): Roy P. Whitton, P. O. Box 1706, Lake Placid, Fla. 33852 (phone 813-465-7048).

GEORGIA (Athens, Atlanta, Columbus, Dobbins AFB, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): Robert W. Marsh, Jr., P. O. Box 542, Springfield, Ga. 31329 (phone 912-964-1941, ext. 206).

GUAM (Agana): Michael C. Wilkins, Box CV, Agana, Guam 96910 (phone 671-646-5259).

HAWAII (Honolulu, Puunene): **Don J. Daley**, P. O. Box 3200, Honolulu, Hawaii 96847 (phone 808-525-6296).

IDAHO (Boise, Mountain Home, Twin Falls): Chester A. Walborn, P. O. Box 729, Mountain Home, Idaho 83647 (phone 208-587-7185).

ILLINOIS (Belleville, Champaign, Chicago, Elmhurst, Moline, Peoria, Springfield-Decatur): Glen W. Wensch, R. R. #1, Box 54, Champaign, III. 61821 (phone 217-352-2777).

INDIANA (Bloomfield, Fort Wayne, Grissom AFB, Indianapolis, Lafayette, Marion, Mentone, South Bend, Terre Haute): Don McKellar, 2324 Pinehurst Lane, Kokomo, Ind. 46902 (phone 317-455-0933).

IOWA (Des Moines, Sioux City): Carl B. Zimmerman, 608 Waterloo Bldg., Waterloo, Iowa 50701 (phone 319-232-2650).

KANSAS (Garden City, Topeka, Wichita): Cletus J. Pottebaum, 6503 E. Murdock, Wichita, Kan. 67206 (phone 316-683-3963).

KENTUCKY (Lexington, Louisville): Bryan J. Sifford, Rte. 4, Box 431, Cynthiana, Ky. 41031 (phone 606-234-1642).

LOUISIANA (Alexandria, Baton Rouge, New Orleans, Shreveport): Paul J. Johnston, 1703 W. Medalist Dr., Pineville, La. 71360 (phone 318-640-3135).

MAINE (Bangor, Loring AFB, North Berwick): Alban E. Cyr, Sr., P. O. Box 160, Caribou, Me. 04736 (phone 207-496-3331).

MARYLAND (Andrews AFB area, Baltimore, Rockville): William T. Reynolds, 11903 Chesterton Dr., Upper Marlboro, Md. 20772 (phone 301-249-5438).

MASSACHUSETTS (Bedford, Boston, East Longmeadow, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): Leo O'Halloran, 420 Bedford St., Suite 290, Lexington, Mass. 02173 (phone 617-264-4603).

MICHIGAN (Alpena, Battle Creek, Calumet, Detroit, Kalamazoo, Marquette, Mount Clemens, Oscoda, Petoskey, Southfield): William Stone, 7357 Lakewood Dr., Oscoda, Mich. 48750 (phone 517-724-6266).

MINNESOTA (Duluth, Minneapolis-St. Paul): Earl M. Rogers, Jr., 325 Lake Ave. South, Duluth, Minn. 55802 (phone 218-727-8711).

MISSISSIPPI (Biloxi, Columbus, Jackson): Henry W. Boardman, 10 Bayou Pl., Gulfport, Miss. 39503 (phone 601-896-8836).

MISSOURI (Kansas City, Richards-Gebaur AFB, Springfield, St. Louis, Whiteman AFB): Raymond W. Peterman, P. O. Box 9605, Kansas City, Mo. 64134 (phone 816-761-7453).

MONTANA (Bozeman, Great Falls): Ed White, 2333 6th Ave., South Great Falls, Mont. 59405 (phone 406-453-2054).

NEBRASKA (Lincoln, Omaha): Ralph Bradley, 3902 Davenport, Omaha, Neb. 68131 (phone 402-554-6220).

NEVADA (Las Vegas, Reno): Emery S. Wetzel, Jr., 2938 S. Duneville St., Las Vegas, Nev. 89102 (phone 702-362-1767).

NEW HAMPSHIRE (Manchester, Pease AFB): Robert N. McChesney, Scruton Pond Rd., Barrington, N. H. 03825 (phone 603-664-5090).

NEW JERSEY (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, Forked River, Fort Monmouth, Jersey City, McGuire AFB, Middlesex County, Newark, Old Bridge, Trenton, Wallington, West Orange, Whitehouse Station): Robert Gregory, R. D. #2, Box 216, Wrightstown, N. J. 08562 (phone 609-758-2973).

NEW MEXICO (Alamogordo, Albuquerque, Clovis): Louie T. Evers, P. O. Box 1946, Clovis, N. M. 88101 (phone 505-762-1798).

NEW YORK (Albany, Bethpage, Brooklyn, Buffalo, Chautauqua, Griffiss AFB, Hudson Valley, Nassau County, New York City, Niagara Falls, Patchogue, Piattsburgh, Queens, Rochester, Rome/Utica, Suffolk County, Syosset, Syracuse, Westchester, Westhampton Beach, White Plains): Gerald V. Hasler, P. O. Box 5254, Albany, N. Y. 12205 (phone 518-785-5020).

NORTH CAROLINA (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Kitty Hawk, Raleigh, Wilmington): Robert C. Newman, Jr., 3037 Truitt Dr., Burlington, N. C. 27215 (phone 919-584-7069).

NORTH DAKOTA (Concrete, Fargo, Grand Forks, Minot): Ralph Ehlers, 1207 Glacial Dr., Minot, N. D. 58701 (phone 701-852-3221).

OHIO (Akron, Cincinnati, Cleveland, Columbus, Dayton, Mansfield, Newark, Youngstown): Cecil H. Hopper, 537 Granville St., Newark, Ohio 43055 (phone 614-344-7694).

OKLAHOMA (Altus, Enid, Oklahoma City, Tulsa): Terry Little, 4150 Timerlane, Enid, Okla. 73703 (phone 405-234-9624).

OREGON (Eugene, Klamath Falls, Portland): Hal Langerud, 10515 S. W. Clydesdale Terrace, Beaverton, Ore. 97005 (phone 503-644-0645).

PENNSYLVANIA (Allentown, Altoona, Beaver Falls, Bensalem, Coraopolis, Drexel Hill, Erie, Harrisburg, Homestead, Indiana, Johnstown, Lewistown, Mon Valley, Philadelphia, Pittsburgh, Scranton, Shiremanstown, State College, Willow Grove, York): David L. Jannetta, P. O. Box 643, Altoona, Pa. 16603 (phone 814-943-8023).

PUERTO RICO (San Juan): Fred Brown, 1991 Jose F. Diaz, Rio Piedras, P. R. 00928 (phone 809-790-5288).

RHODE ISLAND (Warwick): Thomas R. Portesi, 102d Tactical Control Squadron, North Smithfield ANG Station, Slatersville, R. I. 02889 (phone 401-762-9100).

SOUTH CAROLINA (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): Wesley H. Davis, 7916 Bay Springs Rd., Columbia, S. C. 29233 (phone 803-788-5267).

SOUTH DAKOTA (Rapid City, Sioux Falls): John Kittelson, 141 N. Main, Suite 308, Sioux Falls, S. D. 57102 (phone 605-336-2498).

TENNESSEE (Chattanooga, Knoxville, Memphis, Nashville, Tri-Cities Area, Tullahoma): Everett E. Stevenson, 4792 Cole Rd., Memphis, Tenn. 38117 (phone 901-767-1315).

TEXAS (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): John P. Russell, 118 Broadway, Suite 234, San Antonio, Tex. 78205 (phone 915-698-8586).

UTAH (Bountiful, Clearfield, Ogden, Salt Lake City): Marcus C. Williams, 4286 South 2300 West, Roy, Utah 84067 (phone 801-627-4490).

VERMONT (Burlington): Ralph R. Goss, 8 Summit Circle, Shelburn, Vt. 05482 (phone 802-985-2257)

VIRGINIA (Alexandria, Charlottesville, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **Don Anderson**, Box 54, 2101 Executive Dr., Hampton, Va. 23666 (phone 804-868-8756).

WASHINGTON (Seattle, Spokane, Tacoma, Yakima): Alwyn T. Lloyd, P. O. Box 24271, M/S 6A-30, Seattle, Wash. 98124 (phone 206-251-2055).

WEST VIRGINIA (Huntington): Ron Harmon, 1933 Ohio Ave., Parkersburg, W. Va. 26101 (phone 304-485-2088).

WISCONSIN (Madison, Milwaukee, Mitchell Field): Gilbert Kwiatkowski, 8260 W. Sheridan Ave., Milwaukee, Wis. 53218 (phone 414-463-1849).

WYOMING (Cheyenne): Irene G. Johnigan, 503 Notre Dame Court, Cheyenne, Wyo. 82009 (phone 307-775-3641). formation-packed letter, Mr. Fedorchak encouraged AFA members to participate in the upcoming meeting. Consequently, the March meeting attracted more than 500 people, and the Chapter took the opportunity to present a resolution in support of Minot AFB as a possible deployment site for the system.

In conjunction with Jack Moore. the Missile Cable Affairs Officer at Minot AFB, Chapter officials participated in an information blitz in order to better educate the surrounding communities about the continuing modernization of the missile cable system in the area. The Chapter made posters, advertised, scheduled meetings, and developed the program format. After the meetings, Mr. Fedorchak concluded that "the response has been positive, with many landowners' questions being answered to everyone's satisfaction.

Mr. Fedorchak also appeared on several local television programs in order to promote the AFA mission.

On the Scene

In other chapter news, the Albuquerque Chapter held a luncheon



Brig. Gen. Frank K. Martin, left, Commander of the Air Force Office of Security Police at Kirtland AFB, N. M., accepts a plaque from Roscoe L. Bell, then President of AFA's Albuquerque Chapter. AFOSP was honored for its outstanding contributions to the nation's defense. Several other Kirtland organizations were also honored at the March luncheon. (See item.)

Alice Turner Retires From AFA



After thirty years with AFA's headquarters staff, Alice Turner retired on May 31.

If you came into AFA headquarters on a Saturday—any Saturday in the last thirty years-you could count on one thing: Alice Turner would be there, sorting out membership and insurance records for hundreds of thousands of AFAers. May 31 marked the end of Alice's thirty-year career at AFA as both Fulfillment Director and Manager of Policy Issue and Accounting for Max Keeney, Director of AFA's Insurance and Membership Services Department.

"Alice Turner was one of our most loyal and hardworking employees during AFA's forty-two-year history," said AFA President Sam E. Keith, Jr., one of the scores of AFA national officers and directors as well as state and chapter presidents who knew Alice well and respected her accomplishments.

When Alice came to AFA in 1958 from the FBI, she encountered a recordkeeping system in which names and addresses of AFA members were kept on index cards and stored in large steel tubs. It didn't take Alice long to straighten things out to ensure that everything from membership applications and renewals to changes of address and rank were all in order. Now, several computer conversions and thousands of members and patrons later, Alice has decided to retire from the staff after completing years of "outstanding service to AFA and its members and patrons," Mr. Keith said.

"Ten- to twelve-hour days were routine with Alice, as were her countless hours of providing personal service to the thousands of members who called in. We will all miss Alice more than we can possibly say," the AFA President declared.

meeting in March at the Kirtland AFB. N. M., Officers' Club. Brig. Gen. Frank K. Martin, Commander of the Air Force Office of Security Police, accepted a plaque from then-Chapter President Roscoe L. Bell on behalf of the organization's outstanding contributions to the nation's defense effort. Other Kirtland AFB organizations honored with plaques at the luncheon included the Air Force Operational Test and Evaluation Center. the Air Force Contract Management Division (AFSC), the 1606th Air Base Wing (MAC), the Air Force Weapons Laboratory (AFSC), the Air Force Space Technology Center (AFSC), Detachment 1 of the Air Force Inspection and Safety Center, the 3098th Aviation Depot Squadron (AFLC), and the 1550th Combat Crew Training Wing (MAC).

In March, AFA's San Diego Chapter sponsored a luncheon honoring former Chairman of the Joint Chiefs of Staff Gen. John W. Vessey, USA (Ret.). Several defense organizations attended the luncheon as well. General Vessey, a member of the Commission on Integrated Long-Term Strategy, gave a speech on defense strategy for the future. Following the talk, the San Diego Chamber of Commerce presented General Vessey with a miniature replica of the America's

Cup victor Stars and Stripes.

Intercom

Texas AFA recently held its spring executive meeting in Denton, Tex. During the meeting, the state winner of the Earle North Parker Essay Contest, Maria Isabel Ahumada, was honored. Miss Ahumada, a senior at Tulia High School in Tulia, Tex., will receive a \$1,250 scholarship when she graduates this June. Earlier this year, Miss Ahumada won the Greater Amarillo Chapter essay competition. Earle North Parker, a former Texas AFA president, was on hand to present the award.

AFA's Eagle Chapter plans to host the Northeast '88 Electa-Olympic Expo, a high-technology exhibition and conference, on October 21–22 at the Harrisburg Marriott in Harrisburg, Pa. The theme for the exhibition is the upcoming Presidential election and the 1988 Olympic Games, and the event is open to the public. The Chapter plans to invite military and civilian personnel as well as government and industry representatives to the exhibition.



Almost two years ago, Tucson, Ariz., AFA Chapter Vice President Robin Stoddard, right, founded Wright Flight, Inc., in order to motivate area students through the allure of flight. Here he helps student Heather Otto complete a preflight check before she takes her first Wright Flight lesson.

Unit Reunions

AACS Alumni Ass'n

Airways and Air Communications Service alumni will hold a reunion on October 6–9, 1988, in Santa Maria, Calif. **Contact:** Cal Venable, 4131 Oakwood Rd., Lompoc, Calif. 93436. Phone: (805) 733-3780.

American Ex-Prisoners of War

Former POWs will hold their annual convention on September 25–30, 1988, in Las Vegas, Nev. Contact: Herman E. Molen, 4299 Calimesa St., Las Vegas, Nev. 89115-2301. Phone: (702) 644-0034.

Eagle Squadron Ass'n

The Royal Air Force Eagle Squadrons will hold their reunion on September 14–18, 1988, at the Delta Hotel in Winnipeg, Manitoba. **Contact:** James A. Gray, 7283 Kolb Pl., Dublin, Calif. 94568. Phone: (415) 828-1350.

Gibbs Field Reunion Ass'n

Personnel who served at Gibbs Field/Fort Stockton Army Air Base, Tex., will hold a reunion on September 29–October 1, 1988, in Fort Stockton, Tex. Contact: Fort Stockton Chamber of Commerce, P. O. Box C, Fort Stockton, Tex. 79735. Phone: (915) 336-2264.

Hq. SAC/LGM

Personnel who served at Hq. SAC/LGM (1967-77) will hold a reunion on June

10-12, 1988, in Bellevue, Neb. **Contact:** Lt. Col. Walter E. Husten, USAF (Ret.), 309 Martin Dr., N., Bellevue, Neb. 68005. Phone: (402) 291-1545.

1st Service Group

Members of the 1st Service Group will hold a reunion on October 13–15, 1988, at the Ramada Inn in Bakersfield, Calif. Contact: Hoyett L. Smothers, 2425 9th St., Wasco, Calif. 93280. Phone: (805) 758-2330 or (805) 758-2065.

1st Strategic Air Depot Ass'n

Members of the 1st Strategic Air Depot who were stationed at Honington-Troston, England, between 1942–46 will hold a reunion on September 22–25, 1988, in Nashville, Tenn. **Contact:** Earl A. Dosey, 7336 Mikesell Dr., Indianapolis, Ind. 46260.

3d Hospital Group

Members of the 3d Hospital Group and the 7510th USAF Hospital (Wimpole Park, England) will hold a reunion on October 15–16, 1988, in Orlando, Fla. Contact: Neil B. Hadley, 7000 Oak Forest Lane, Bethesda, Md. 20817. Phone: (301) 365-1253.

3d Motor Transport Squadron

Members of the 3d Motor Transport Squadron who served at RAF Sealand, England, will hold a reunion on July 15–17, 1988, in Memphis, Tenn. **Contact:** William C. Ponting, 718 Hoorne, Colorado Springs, Colo. 80907. Phone: (719) 599-3391.

4th Fighter Squadron

Veterans of the 4th Fighter Squadron will hold a reunion on July 21–23, 1988, in Dayton, Ohio. The 2d and 5th Fighter Squadrons are also invited. **Contact:** Frank Dorfmeyer, 2115 Carol Park Way, Kettering, Ohio 45440. Phone: (513) 434-5738.

4th Tow Target Squadron

Members of the 4th Tow Target Squadron will hold a reunion on October 6–8, 1988, in Nashville, Tenn. **Contact:** Ed R. Zaino, 212 Garritt Dr., Nashville, Tenn. 37211. Charles A. McCown, P. O. Box 185, Saint

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.

Simons Island, Ga. 31522. Larry Raynor, Rte. 1, Box 64, Woodcrest Way, Conklin, N. Y. 13748.

7th Fighter Command

The 7th Fighter Command will hold a reunion on September 8-11, 1988, at the Stouffer Dayton Plaza Hotel in Dayton, Ohio. Contact: Mary Anne Gates, Stouffer Dayton Plaza Hotel, Fifth and Jefferson Sts., Dayton, Ohio 45402. Phone: (513) 224-0800.

7th TDS/400th MMS

Members of the 7th TDS/400th MMS will hold a reunion on August 12-14, 1988, in Albuquerque, N. M. Contact: Walter E. Buck, 531 Ursula St., Aurora, Colo. 80011. Phone: (303) 344-1319.

8th Tactical Fighter Wing

The 8th Tactical Fighter Wing will hold a reunion on October 6-9, 1988, at the El Tropicano Hotel in San Antonio, Tex. Contact: Col. Philip P. Combies, USAF (Ret.), P. O. Box 791261, San Antonio, Tex. 78279.

10th Fighter Squadron

Veterans of the 10th Fighter Squadron, 50th Fighter Group (WW II), will hold a reunion in October 1988 in Asheville, N. C. Contact: B. B. Morrison, 1462 Ester Ct., P. O. Box 1258, Riverdale, Ga. 30274. Phone: (404) 996-7253.

15th Troop Carrier Squadron

The 15th Troop Carrier Squadron of the 61st Troop Carrier Group will hold a reunion on October 21-23, 1988, at the Northwest Loop Holiday Inn in San Antonio, Tex. Contact: G. B. Smith, 3510 Backbay Dr., San Antonio, Tex. 78230. Phone: (512) 696-4698.

25th Fighter Squadron

The 25th Fighter Squadron "Assam Draggin" and the 26th Fighter Squadron "China Blitzers" will hold a joint reunion on July 24-27, 1988, at the Dunes Hotel in Las Vegas, Nev. Contact: Joseph E. Santa, 24331 Olivera Dr., Mission Viejo, Calif. 92691. Phone: (714) 951-2794. Stanley A. Strout, 4717 Montgomery Dr., Santa Rosa, Calif. 95409. Phone: (707) 539-0357.

27th Air Depot Group

The 27th Air Depot Group and attached units (Fifth Air Force) will hold a reunion on June 23-25, 1988, at the Patterson Inn in Fairborn, Ohio. Contact: Howard Fritz, 220 Harrison St., Enon, Ohio 45323.

32d Troop Carrier Squadron

Members of the 32d Troop Carrier Squadron, 314th Troop Carrier Group, will hold a reunion on October 6-10, 1988, in Sacramento, Calif. Contact: Sherman F. Schroder, P. O. Box 1385, Diamond Springs, Calif. 95619. Phone: (916) 626-6272.

33d Air Depot Group

Veterans of the 33d Air Depot Group will hold a reunion on September 16-17, 1988, in Dayton, Ohio. Contact: Herbert L. Cooper, 643 Reynosa Ct., Berea, Ohio 44017. Phone: (216) 234-9007. Robert W. Gocholl, 10280 Pendery Dr., Cincinnati, Ohio 45242. Phone: (513) 891-7742.

38th Air Depot Group

The 38th Air Depot Group Repair Squadron (WW II) will hold a reunion on October 6-8, 1988, at Days Inn in Atlanta, Ga. Contact: Charles O. Sulkala, 808 Neponset St., Norwood, Mass. 02062. Phone: (617) 762-5769. Beatram N. Sullenger, 2214 Crenshaw Dr., Roswell, N. M. 88201. Phone: (505) 622-4075.

40th Bomb Group Ass'n

The 40th Bomb Group will hold a reunion on September 8-10, 1988, at the Hershey Hotel in Philadelphia, Pa. Contact: C. E. Hall, 12719 Keystone Dr., Sun City West, Ariz. 85375.

43d Bomb Group Ass'n

Members of the 43d Bomb Group "Ken's Men" will hold a reunion on October 5-9, 1988, at the Daytonian Hilton in Dayton, Ohio. Contact: Lloyd Boren, 102 Beechwood, Universal City, Tex. 78148. Phone: (512) 658-5978.

Class 43-G

Members of Class 43-G (Brooks Field, Tex.) will hold a reunion on September 11-13, 1988, at the Sands Hotel in Las Vegas, Nev. Contact: L. W. "Dusty" Rhoads, 1221 Terrace Trail, Hurst, Tex. 76053. Phone: (817) 282-5002.

45th Air Depot Group

Veterans of the 45th Air Depot Group will hold their annual reunion on September 7-11, 1988, in Dayton, Ohio. Contact: Charles F. Guemelata, 119 Aigler Blvd., Bellevue, Ohio 44811. Phone: (419) 483-4371.

47th Bomb Group

Members of the 47th Bomb Group, Twelfth Air Force, will hold a reunion on October 13-16, 1988 in Oklahoma City, Okla. Contact: Costa Chalas, 67 Trapelo Rd., Belmont, Mass. 02178. Phone: (617) 484-5620. Morris Elder, 2502 Jobar Ct., Colorado Springs, Colo. 80909. Phone: (719) 471-7056.

47th Bomb Squadron

The 47th Bomb Squadron, 41st Bomb Group, Seventh Air Force, will hold a reunion in November 1988 in Orlando, Fla. Contact: John Mahan, P. O. Box 232, Hinsdale, N. H. 03451.

Class 47-C

Members of Class 47-C will hold a reunion on October 13-15, 1988, at the Space and Rocket Center in Huntsville, Ala. Contact: Bob Campion, P. O. Box 607, Seguin, Tex. 78156.

Class 48-C

Members of Class 48-C will hold a reunion on October 6-8, 1988, in San Antonio, Tex. Contact: Col. George Lutz, USAF (Ret.), 5415 Fremont St., North Springfield, Va. 22151. Phone: (703) 256-7873. Michael Loyd, 62 Lake View Dr., Daly City, Calif. 94015. Phone: (415) 994-1646.

54th Fighter Squadron

The 54th Fighter Squadron will hold a reunion on September 29-October 2, 1988, in Fort Myers, Fla., for members who



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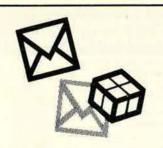


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Unit Reunions

served in Alaska and the Aleutians during WW II. Contact: Doug Stewart, 5751 Reims Pl., Fort Myers, Fla. 33919. Phone: (813) 489-0991.

Class 56-F

Members of Class 56-F will hold a reunion on September 3–5, 1988, in San Antonio, Tex. Contact: David Holland, 5622 Evers Rd., #4801, San Antonio, Tex. 78238. Phone: (512) 681-9540. Dennis E. Cost, 2103 Harwick Dr., Austin, Tex. 78745. Phone: (512) 443-6137.

Class 64-D

Members of Class 64-D (Reese AFB, Tex.) are planning to hold a reunion in October 1988 at the Air Force Academy. **Contact:** Bill Darrow, 6370 Hawaii Kai Dr., #25, Honolulu, Hawaii 96825. Phone: (808) 396-9040 (home) or (808) 531-4202 (work).

Class 69-01

Members of Class 69-01 (Williams AFB, Ariz.) will hold a reunion on September 9-11, 1988, in Mesa, Ariz. **Contact**: Gary Totten, Rte. 14, Box 270, Cumming, Ga. 30130. Phone: (404) 887-8296.

71st Tactical Reconnaissance Group

The 71st Tactical Reconnaissance Group will hold a reunion on September 16–18, 1988, in Columbus, Ohio. **Contact:** Bob Roberts, 3520 Medina Ave., Columbus, Ohio 43224. Phone: (614) 262-3163.

79th AEW&C Squadron

Former crew members and support personnel of the 79th Airborne Early Warning and Control System Squadron, which flew EC-121 "Connies" and operated from Homestead AFB, Fla., and of the 915th Airborne Early Warning and Control Group will hold a reunion on September 23–25, 1988, in Miami, Fla. Contact: Laurie A. Haire, 9311 Orange Grove Dr., #307, Fort Lauderdale, Fla. 33324. Phone: (305) 825-7000 (days).

86th Fighter-Bomber Group Ass'n

The 86th Fighter-Bomber Group (WW II) will hold a reunion on June 16–19, 1988, in Saratoga Springs, N. Y. **Contact**: Sidney Howard, 211 Brownstone Dr., La Habra, Calif. 90631. Phone: (714) 992-2504.

90th Bomb Group

The 90th Bomb Group "Jolly Rogers" will hold a reunion on October 16–20, 1988, in Reno, Nev. **Contact:** Tom Keyworth, 38 Crestlyn Dr., E., York, Pa. 17402. Phone: (717) 741-3998.

92d Bomb Group

Veterans of the 92d Bomb Group will hold a reunion on October 13–15, 1988, in San Antonio, Tex. **Contact:** Perry H. Burnham, 111 Roleto Dr., San Antonio, Tex. 78213. Phone: (512) 342-1864.

93d Troop Carrier Squadron

Members of the 93d Troop Carrier Squadron will hold a reunion on September 28-October 1, 1988, at the Holiday Inn in Arlington, Tex. **Contact**: Lt. Col. Thomas L. Morris, USAF (Ret.), 456 St. George's Ct., Satellite Beach, Fla. 32937. Phone: (305) 773-6960.

97th Bomb Wing

The 97th Bomb Wing (1946-59) will hold a reunion on September 29-October 1, 1988, at the Red Lion Inn in Colorado Springs, Colo. Contact: Carl T. Griffith, 1619 Babcock Lane, Colorado Springs, Colo. 80915. Phone: (719) 597-2795.

123d FIS

Members of the 123d Fighter-Interceptor Squadron (Oregon Air Guard) will hold a reunion on September 9–11, 1988, in Sunriver, Ore. **Contact:** Maj. Tom Tutt or Mike Timm, 108 N. E. Barnes Ave., Gresham, Ore. 97030. Phone: (503) 288-5611, ext. 244.

246th Signal Operations Company

The 246th Signal Operations Company will hold a reunion on August 6, 1988, in Chattanooga, Tenn. Contact: Johnnie Huggins, 30031 S. W. 169th Ave., Homestead, Fla. 33030.

306th Bomb Group Ass'n

The 306th Bomb Group, Eighth Air Force (1942–45), will hold its reunion on October 30–November 3, 1988, at the Hacienda Resort Hotel/Casino in Las Vegas, Nev. Contact: Edward J. Hennessy, 2013 Plaza del Padre, Las Vegas, Nev. 89102. Phone: (702) 362-0424.

307th Air Refueling Squadron

Members of the 307th Air Refueling Squadron will hold a reunion on August 19–21, 1988, at the Holiday Inn in Mount Clemens, Mich. **Contact:** Art Balke, 29394 Cotton Rd., Mount Clemens, Mich. 48045. Phone: (313) 949-4729.

315th Troop Carrier Group Ass'n

Veterans of the 315th Troop Carrier Group will hold a reunion on October 13–16, 1988, in San Antonio, Tex. **Contact:** Gordon Tull, 11611 Forest Rain, San Antonio, Tex. 78233. Phone: (512) 656-7532.

340th Bomb Group

The 340th Bomb Group will hold a reunion on October 7–9, 1988, in Albuquerque, N. M. Contact: Col. Stephen B. Fish, USAF (Ret.), 3009 Toreador Dr., N. E., Albuquerque, N. M. 87111. Phone: (505) 299-6917.

375th Troop Carrier Group

Members of the 375th Troop Carrier Group, comprising the 55th, 56th, 57th, and 58th Troop Carrier Squadrons, will hold a reunion on October 6–9, 1988, at the Menger Hotel in San Antonio, Tex. Contact: Eugene A. Diemand, 625 S. Wheaton Ave., Wheaton, III. 60187. Phone: (312) 668-9575.

381st Bomb Group Ass'n

The 381st Bomb Group will hold a reunion on September 29-October 2, 1988, at the Holiday Inn in Phoenix, Ariz. **Contact:** T. Paxton Sherwood, 515 Woodland View Dr., York, Pa. 17402.

391st Bomb Group Ass'n

The 391st Bomb Group, Ninth Air Force, will hold a reunion on October 6–8, 1988, at the Embassy Hotel in Tampa, Fla. Contact: Tommy Tucker, 214 Wax Myrtle Trail, Kitty Hawk, N. C. 27949. Phone: (919) 261-2311.

409th Bomb Group

The 409th Bomb Group will hold a reunion on November 3–6, 1988, in San Antonio, Tex. Contact: Al Sherrell, 104 Windmill, San Antonio, Tex. 78231. Phone: (512) 492-1776.

449th/452d Bomb Squadrons

Members of the 449th and 452d Bomb Squadrons will hold their reunion on October 6–9, 1988, in Shreveport, La. **Contact**: B. E. Forrest, 3213 Oakbrook Dr., Del City, Okla. 73115. Phone: (405) 677-0458. Wiley Scarborough, 1647 Avenue "L" N. W., Winter Haven, Fla. 33880. Phone: (813) 294-9267.

451st Bomb Group Ass'n

Veterans of the 451st Bomb Group and the 60th Service Squadron who served in Italy during World War II will hold a reunion in October 1988 in Norfolk, Va. **Contact**: Bob Karstensen, 1032 S. State St., Marengo, III. 60152. Phone: (815) 568-7766.

451st Bomb Squadron

Members of the 451st Bomb Squadron, 322d Bomb Group, will hold a reunion on September 30-October 1, 1988, in San Diego, Calif. **Contact:** James J. Crumbliss, 2014 Shady Grove Dr., Bossier City, La. 71112. Phone: (318) 742-1225.

454th Bomb Group

Members of the 454th Bomb Group who served in Italy during World War II will hold their reunion on October 12–15, 1988, in San Francisco, Calif. **Contact:** Ralph Branstetter, P. O. Box 678, Wheat Ridge, Colo. 80034. Phone: (303) 422-6740.

455th Bomb Squadron Ass'n

The 455th Bomb Squadron, 323d Bomb Group, Ninth Air Force (WW II), will hold a reunion on October 6-8, 1988, in Baltimore, Md. Contact: Ernie Trimble, 316 Merri Hunt Dr., Timonium, Md. 21093.

461st/484th Bomb Groups

Veterans of the 461st and the 484th Bomb Groups (WW II) will hold a reunion on September 1–4, 1988, at the San Francisco Airport Marriott Hotel in Burlingame, Calif. Contact: Bud Markel, 1122 Ysabel St., Redondo Beach, Calif. 90277. Phone: (213) 316-3330.

555th TFTS

The 555th Tactical Fighter Training Squadron will hold a reunion on July 29–31, 1988, in Phoenix, Ariz. **Contact:** Lt. Col. Jerry J. Thorius, USAF, Commander, 555th TFTS/CC, Luke AFB, Ariz. 85309-5000. Phone: (602) 856-7150.

559th Bomb Squadron

Members of the 559th Bomb Squadron, 387th Bomb Group, will hold a reunion in September 1988 in Portland, Ore. **Contact:** Pasquale A. Razzano, 10 Robin Hood Rd., Suffern, N. Y. 10901. Phone: (914) 357-5983

574th/565th Signal Aircraft Warning Battalions

Members of the 574th and 565th Signal Aircraft Warning Battalions, Fifth Air Force, will hold a reunion on September 16–19, 1988, in Charleston, S. C. Contact: R. L. Zierjack, 1305 Ventura Pl., Mount Pleasant, S. C. 29464. Phone: (803) 884-5973.

902d Troop Carrier Group

Members of the 902d Troop Carrier Group stationed at Grenier Field, N. H., from late 1955 through 1966 will hold a reunion on September 17, 1988, at the New Hampshire Highway Motel in Concord, N. H. Contact: John L. Whenal, 36 Mill Rd., North Hampton, N. H. 03862. Phone: (603) 964-9564.

906th Air Refueling Squadron

Members of the 906th Air Refueling Squadron (1959–69) and support personnel will hold a reunion on October 6–9, 1988, in Houston, Tex. Contact: Kemp F. Martin or Thomas H. Shull, Jr., 8433 Katy Freeway, Suite 102, Houston, Tex. 77024-1997.

7330th Flying Training Wing

The 7330th Flying Training Wing will hold its reunion on September 12–18, 1988, at Fürstenfeldbruck AB, Germany. **Contact:** Father William L. Travers, American Embassy, Box 270, APO New York 09080.

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	COVERAGE	COVERAGE	COVERAGE
20-24	\$400,000	\$300,000	\$200,000
25-29	350,000	262,500	175,000
30-34	250,000	187,500	125,000
35-39	180,000	135,000	90,000
40-44	100,000	75,000	50,000
45-49	60,000	45,000	30,000
50-54	40,000	30,000	20,000
55-59	28,000	21,000	14,000
60-64	18,000	13,500	9,000
65-69	8,000	6,000	4,000
70-74	5.000	3,750	2,500

Disability Waiver of Premium—If you become totally disabled at any time prior to age 60 for a period of at least nine months while your coverage remains in force, you may apply for the Disability Waiver of Premium Benefit. Upon approval, your Eagle Series insurance will remain in force without further payment of premiums for as long as you continue to be totally disabled.

Dividend Policy—AFA has continuously provided program improvements in addition to paying substantial year end dividends based on actual program experience.

Effective Date of Coverage—All certificates are dated and take effect on the last day of the month in which your application for coverage is approved and coverage runs concurrently with AFA membership.

Termination of Coverage—Your coverage can be terminated only if you are no longer an Air Force Association member in good standing, if you do not pay your premium, if the AFA Master Policy is discontinued, or on the first renewal date following your 75th birthday.

Professionally Administered—AFA's Eagle Series Insurance program is administered by the Association's staff of professionally trained insurance personnel with extensive experience in group insurance programs and requirements.

Convenient Payment Plan—Premium payments may be made directly to AFA in quarterly, semi-annual, or annual installments, or by monthly government allotment. If you make payments directly to AFA, the Association will mail renewal statements approximately 30 days in advance of each premium due date. For active duty and retired personnel, however, AFA recommends that payments be made automatically by monthly government allotment (payable to the Air Force Association) so as to prevent any possible lapse in coverage.

Exceptions—Group Life Insurance: Benefits for suicide or death from injuries intentionally self-inflicted while sane or insane shall not be effective until coverage has been in force 12 months. Benefits for a war related aviation accident in which the Insured was serving as pilot or crew member of the aircraft involved are 50% of the scheduled amount of coverage.

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(May be added to Standard, High Option, or High Option PLUS Plan) PREMIUM: \$2.50 Per Month

Member's Attained Age	Life Insurance Coverage for Spouse	Life Insurance Coverage for Each Child		
20-24	\$50,000	\$5,000		
25-29	50,000	5,000		
30-34	40,000	5.000		
35-39	30,000	5,000		
40-44	20,000	5.000		
45-49	10,000	5.000		
50-54	7,500	5,000		
55-59	5.000	5,000		
60-64	3,000	5,000		
65-69	2.000	5,000		
70.74	1,000	5,000		

Between the ages of six months and 21 years, each child is provided \$5,000 coverage. Children under 6 months are provided with \$250 coverage once they are 15 days old and discharged from the hospital.

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Please indicate below the Mode of Payment the Plan you elect: Mode of Payment		dard Plan Member and		of Insurance Option Plan Member and	High C	ption PL	US Plan
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Quarterly. I enclose amount checked.	□ \$ 30.00	□ \$ 37.50	□ \$ 45.00	□ \$ 52.50	□ \$ 60.00	□ \$	67.50
Semi-Annually. I enclose amount checked.	□ \$ 60.00	□ \$ 75.00	□ \$ 90.00	□ \$105.00	□ \$120.00	□ \$	135.00
Annually. 1 enclose amount checked.	□ \$120.00	□ \$150.00	1 □ \$180,00	□ \$210.00	\$240.00	□ \$:	270.00
Names of Dependents To Be Insu	ired Re	lationship to Men	nber	Mo, Day Yı	: He	eight	Weight
Have you or any dependents for whom you are nteriosclerosis, high blood pressure, heart dise Have you or any dependents for whom you are Have you or any dependents for whom you are or using medications for any disease or disorde	ease or disorder, stroke requesting insurance requesting insurance er?	e, venereal disease or been confined to an e received medical at	r tuberculosis? y hospital, sanatoriu ttention or surgical :	m, asylum or similar i advice or treatment in	nstitution in the p the past 5 years (ast 5 years or are now	Yes □ No Yes □ No under treatmo Yes □ No
if YOU ANSWERED "YES" TO ANY OF THE A sheet of paper if necessary.)		EXPLAIN FULLY in	cluding date, name,	degree of recovery an			
I apply to United of Omaha Life Insurance Association Group Insurance Trust. Informati the plan requested and is true and complete initial premium paid. I hereby authorize any licensed physician, meorganization, institution or person, that has a A photographic copy of this authorization shall	Company for insurant on in this application to the best of my kn dical practitioner, hos any records or knowle	nce under the group n, a copy of which s nowledge and belief. spital, clinic or other edge of me or my he inal. I hereby acknow	o plan issued to the hall be attached to 1 agree that no insu- medically related fa ealth, to give to the cledge that I have a co	First National Bank and made a part of r grance will be effective cility, insurance comp United of Omaha Li oppy of the Medical Info	ny certificate whe we until a certifica any, the Medical I we Insurance Com	n issued, is te has been nformation pany any so	given to obtain issued and Bureau or otach informati

FORM 3767GL App REV 10-79



Group Policy GLG-2625 United of Omaha Life Insurance Company Home Office Omaha Nebraska

6-88

Bob Stevens'

There I was..."

DESIGNED FOR SHORT-FIELD OPERATIONS, SHE HAD SOME WEIRD INSTRUMENTATION— LIKE NO OIL DURING SAUGES AND SWITCHES WE DEDICATE THIS PAGE TO THAT RE-CENTLY RETIRED OLD WORKHORSE, THE C-123"PROVIDER." PILOTS IN 'NAM CALLED HER THE "BOOKIE BIRD." SHE WAS NO BEAUTY QUEEN. BUILT FROM THE PLANS OF A DEFLINCT TOWED GLIDER, SHE DE-PENDED ON TWO OL' R-2800 ROUND ENGINES TO BLAZE ALONG AT ABOUT 125 KTS!

THE INTERIOR WAS, LIH, SPARTAN-





THE LITTLE KNOWN "XB-123" DROPPED BOMBS OUT THE BACK, CEP? 2 MILES @ 90001









NEW AIRLIFTER DESIGNED TO FLY DIRECT TO THE FRONT.

The C-17, now in production, is designed to fly military cargo routinely from the U.S. directly into combat zone airstrips as short as 3,000 feet.

With this short-field capability, plus exceptional ground maneuverability, all Army and Marine Corps battle gear the higgest tanks, artillery pieces, even helicopters—will move in a rapid, sustained flow right to the fight.

The C-17—it's the fastest way to deliver the goods.

MCDONNELL DOUGLAS



