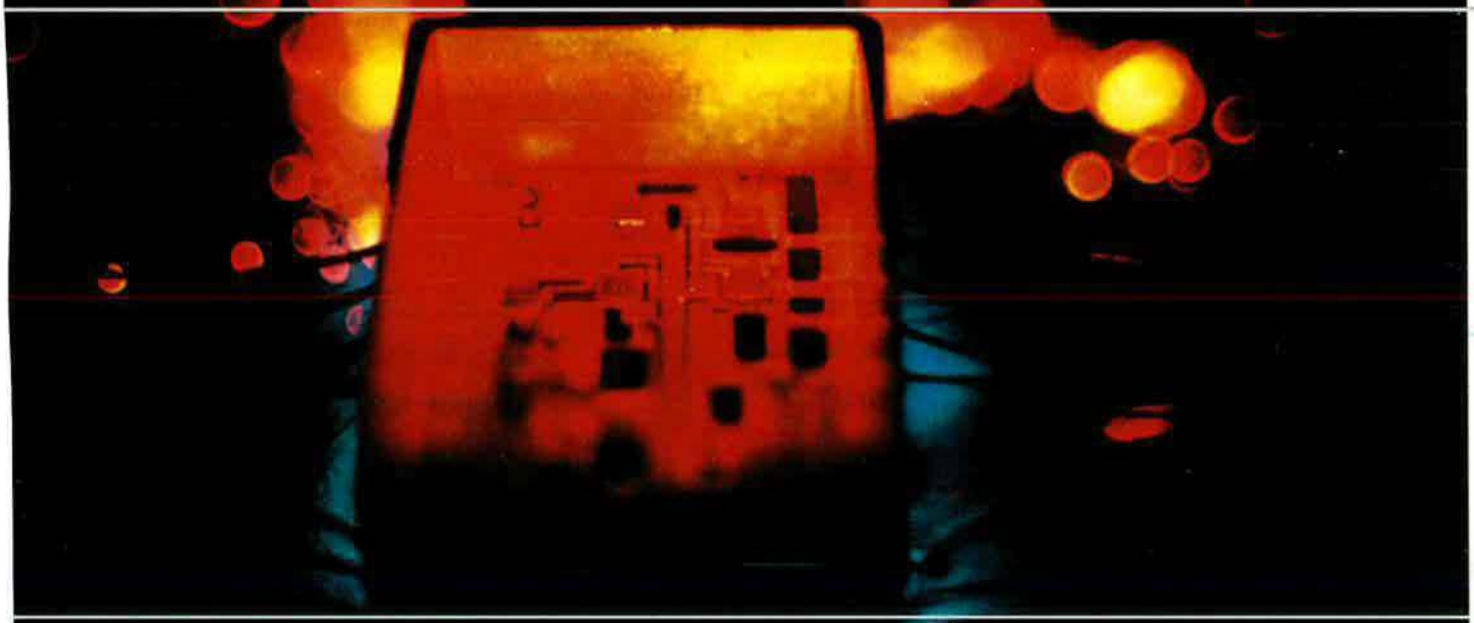
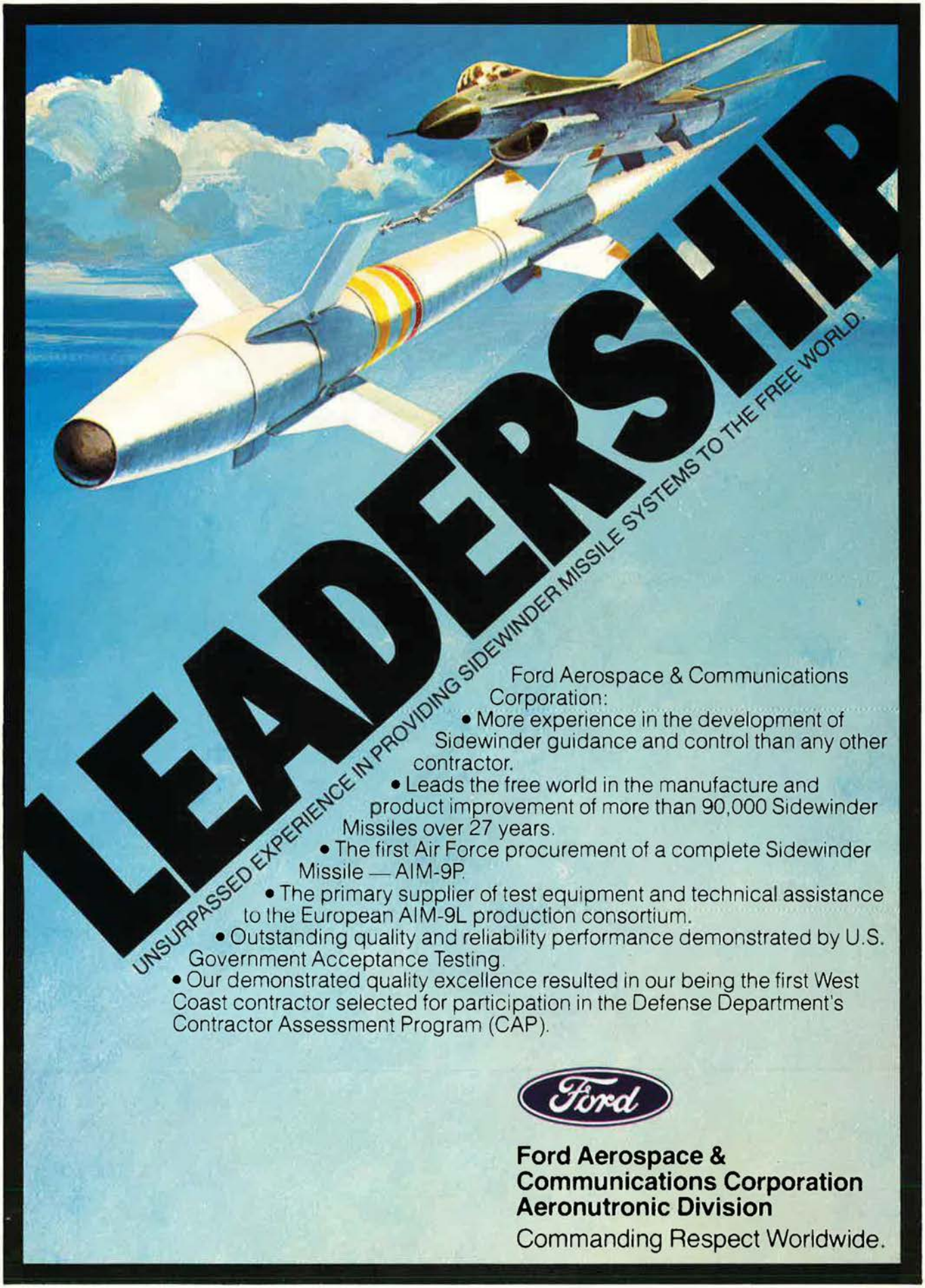
JULY 1981/$1

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION



THE ELECTRONIC AIR FORCE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AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

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This Month

JULY 1981 • VOLUME 64, NUMBER 7

ABOUT THE COVER

Fiber optics is one of several technologies that promises to revolutionize modern warfare. Shown on this month's cover is Sperry Univac's hybrid fiber-optic digital transmitter module. For more on electronics technologies, see "The Electronic Air Force" section beginning on p. 38. (Photo by Giannetti/Hagen Photography)

Departments

Add a couple of you may not need the

Needless to say, the purchase of different aircraft to meet different mission requirements is, to some extent, inevitable.

A jet fighter will never double as a cargo plane.

But the number of aircraft types you need to buy in order to perform such missions as priority personnel transport, cargo transport, air ambulance service, flight inspection/calibration, pilot and systems training, remote surveillance, search and rescue and reconnaissance and mapping can, in fact, be reduced dramatically.

To one.

For example, a Canadair Challenger outfitted for cargo transport can quickly be converted into a 28-passenger people-hauler. Or a 14-passenger people-hauler with a large cargo area.

A Canadair Challenger outfitted for priority transport of V.I.P. personnel can, with the addition of two partitioned operators' consoles, easily double as a surveillance or flight inspection/calibration aircraft.

A Challenger outfitted for remote sensing and surveillance can quickly be refitted for reconnaissance and mapping.

A Challenger outfitted as an air ambulance or MED/EVAC aircraft can, with relative ease, switch to a flight inspection/calibration interior. Or an advanced pilot and systems trainer interior. Or a maritime surveillance/search and rescue interior.

All told, the variations of equipment you can move into and out of a Challenger are far too numerous to mention.

What's just as important, the Challenger gives you more AC power to run it on than any other aircraft in its class.

In fact, it's the only all-AC electrical system you'll find on any jet short of the latest commercial airliner. Unlike DC systems, AC gives you the benefits of extreme light weight in relation to power produced and far less chance of electrical failure due to low current, constant frequency and the obvious fact that there's no need for cumbersome inverters.

As for those of you who just want to get from point A to point B, you'll find the Challenger will fly you more economically and in greater comfort than any comparable jet in the world.

Overall, the Canadair Challenger averages a 22% lower rate of fuel consumption per mile than a Gulfstream III, virtually the same rate of fuel consumption per mile as the far smaller Falcon 50 and, hard as it may be to believe, a 24% lower rate of fuel consumption per mile than the small, short-range T-39.

Yet the Challenger is actually bi ger than all of them in the one dime sion crucial to passenger comfort and a realistic working environment width.

Measured at the floor line, both the Canadair Challenger and the bigger, even longer-range Canadair Challenger E are roughly 30% wider than the Gulfstream III, and 48% wider than the Falcon 50.

And speaking of range.

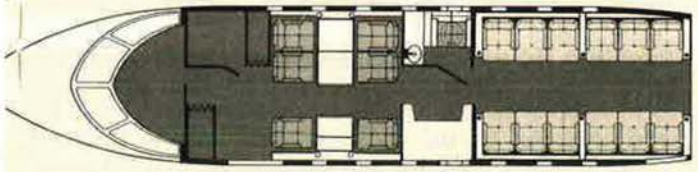
With the Challenger's big fuel tanks and extremely low rate of fuel burn, you can cross the Pacific with one stop, fly from New York to the Middle East with one stop or fly fror Washington to London non-stop.

Or, getting back to multiple mis sions, fly a thousand miles out for, remote surveillance and still remair on station for four to five hours before flying back.

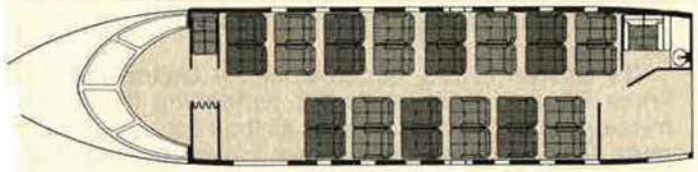
To find out more about the aircraft that can perform the roles of two or three or four aircraft, just cal Mr. James B. Taylor, President of Canadair Inc., at 203-226-1581. O write Canadair Inc., 274 Riverside Avenue, Westport, CT 06880.

canadair challenge

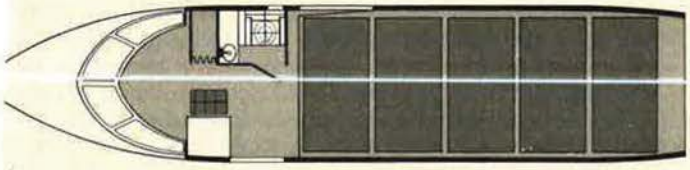
these to your fleet and fleet.



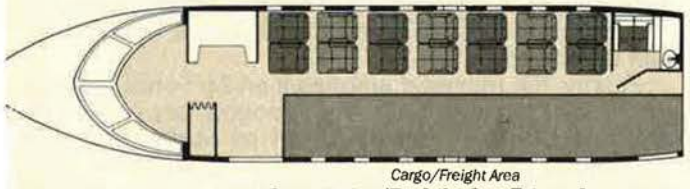
VIP Interior



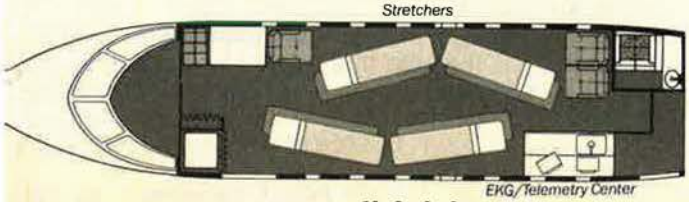
28-Passenger Interior



Cargo Configuration

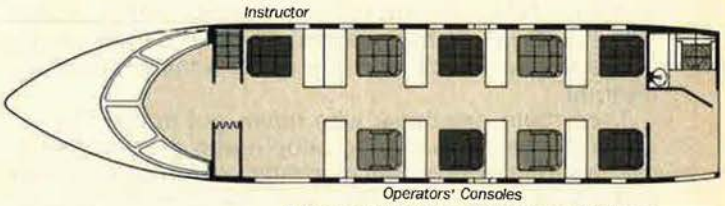


Passenger/Freight Configuration



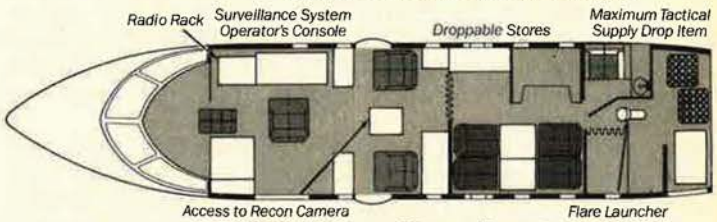
Air Ambulance

Flight Inspection/Calibration

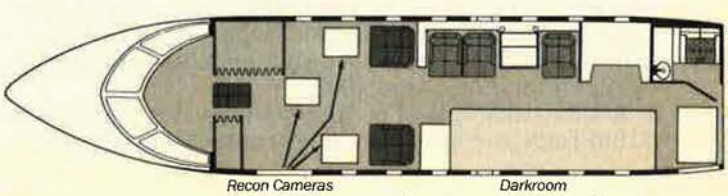


Advanced Pilot and Systems Trainer

Remote Sensing and Surveillance



Maritime Surveillance/Search and Rescue



Reconnaissance and Mapping

AN EDITORIAL

Affinities and Reunions

WITH summer comes the reunion season, and it is at its height in July. The reunions range from family get-togethers to high school and college classes, and also include reunions of Air Force units. A common thread in reunions is a desire for affinity—that is, to renew ties of the past, ties whose pull is strong enough to create these occasions.

Of course, one of the main activities at reunions is seeing how time has treated those attending. Who, once slim, now carries extra poundage, and who among the men has lost the most hair? Or, is the remembered beauty of the prom queen still as memorable after marriage, children, and divorce or a career?

Another element of reunions is noting the gaps in the ranks, the persons who are not present. The absence can be due to conflicting plans, inability to travel, or death. For military units in particular, the gaps are especially poignant, because one recalls having enjoyed telling war stories with those people at earlier reunions. Now they are gone, perhaps spinning those same yarns in a far happier place where flak and enemy fighters never reach, and where the weather is always tranquil.

Then there are those who never got to the first reunion. These are the young people who died in combat or in training, giving their own lives so the rest of us can enjoy ours longer and in security. These are the people who are forever young, because they did not have the opportunity to age. Ask a combat veteran what is most remembered about these young ones, and the answer almost invariably is, "Their faces; I always remember their faces, and how young they look."

Perhaps that is why the affinity among Air Force organizations is so strong. It comes from a shared experience and knowledge that the risks can be fatal, whether in combat or in training, and that the families and friends take on some of the risk burden when one chooses an Air Force career. The affinity seems strongest at reunion time, perhaps. But we have noted recently in AFA that the affinities are wider and deeper than we had previously thought. They crop up all over the place.

For example, Gen. "Dutch" Huyser, CINCMAC until July 1, recently was the featured speaker at the Connecticut State AFA Convention. Among those attending was a person he had gone through flight training with in 1943, and with whom he was posted to his first flying unit at Liberal, Kan., in 1944. Maj. Gen. Tom Sadler, Commander of Twenty-first Air Force, was also a guest at the convention, and renewed friendship with a fellow flying cadet from Class 49-C.

Another example of enduring affinity is shown by the 118th Tactical Fighter Squadron of the Connecticut Air National Guard. When it had a recent reunion, four of the attendees were original members of the unit when it was formed in 1923!

Reunion groups look for links with the active units, too. When the 56th Fighter Group announced its reunion in Louisville (June 27–28), it included a special invitation to the members of today's 56th Tactical Fighter Wing at MacDill AFB, Fla. There's a link between past and present, and building for the future as well.

The affinity concept need not be linked solely to reunions. Present-day associations show the affinity possibilities within the Air Force and AFA. For example, the 118th TFS mentioned above received a newly qualified active USAF second lieutenant pilot in June, fresh from A-10 crew training at Davis-Monthan. The 118th and other Air Guard units are receiving these pilots under "Project Season," aimed at seasoning the junior pilots by assignment to such units. After a tour with the Guard, they return to active units, having been seasoned by the experience. The obvious question is, will they get enough flying time of the type needed in tactical units?

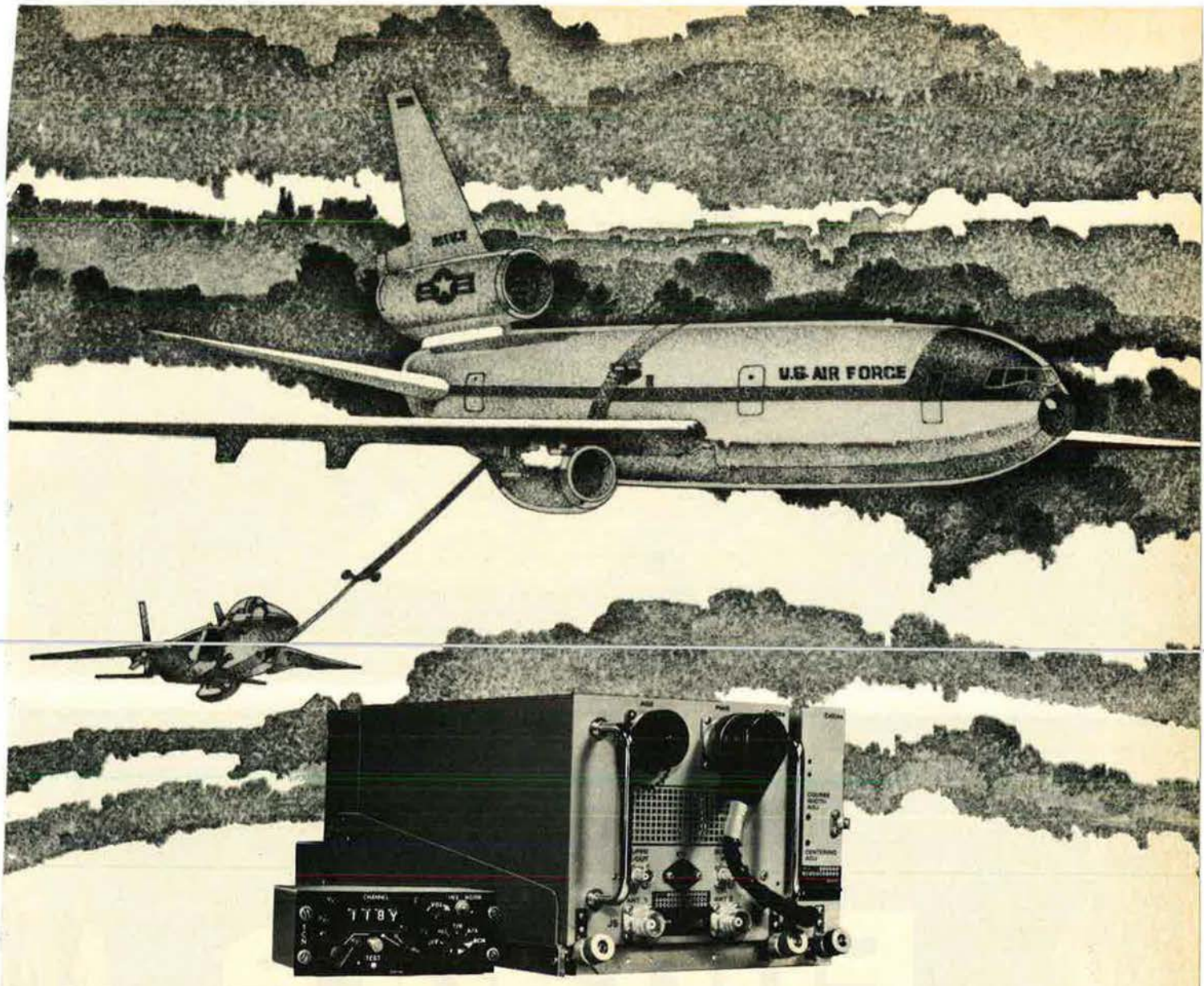
The answer is yes, because the Air Guard and Air Force Reserve flying units are performing the same missions to the same standards as their active counterparts. In some cases, the aircrews log *more* flying time in the reserve forces. The experiences of participants in "Project Season" will create new and durable links between the active and reserve forces.

So, too, do cases where AFA chapters reach out from their own membership to work with other groups in a community or on a base. The results are beneficial to AFA, the Air Force, and the entire community. That has been the case with the Aerospace Education Foundation, AFA's educational arm. By making USAF technical and vocational courses available to educational institutions nationwide, AEF helps build careers for young people that might not otherwise have been possible. At the same time, it creates an awareness of the capabilities of AFA and the Air Force, to the long-run benefit of all.

Finally, the renewed emphasis on Air Force families could well prove to build the strongest ties of all. The actions being taken by Chief of Staff Allen and embraced by Secretary Orr will help keep the individual families strong and motivated. In the process, those families will continue as strong elements in the larger Air Force family.

That is a strength that does not appear on a balance sheet, but it is the kind that led our forefathers to proclaim our independence on a July day in 1776, and that will keep our country strong in the late twentieth century.

—F. CLIFTON BERRY, JR., EDITOR IN CHIEF



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Bearing transmit and expanded ranging capabilities have been added to our widely used AN/ARN-118(V) TACAN. Result? The Collins AN/ARN-139(V) — designed to take the guesswork out of airborne rendezvous.

AN/ARN-139(V) bearing and range provide holding and approach capabilities similar to a ground station. An inverse function allows tankers to track flight leaders.

That's why McDonnell Douglas has selected the AN/ARN-139(V) for the U.S. Air Force KC-10A Advanced Tanker Cargo Aircraft (ATCA) program.

Other AN/ARN-139(V) benefits? It boasts the same size package as the AN/ARN-118(V), and utilizes a high percentage of common modules. A new solid-state power amplifier further enhances system reliability. Add the Collins AS-3508/A rotating antenna and you've got a complete system.

AN/ARN-139(V) is a derivative of the highly successful AN/ARN-118(V) — the U.S. Air Force, U.S. Coast Guard, and, now, a U.S. Navy standard. The AN/ARN-118(V) is also flying with over 30 international military customers, and far exceeding reliability guarantees.

The Collins AN/ARN-139(V). Like to put it to work on your tanker or pathfinder program? Get in touch. Collins Government Avionics Division, Rockwell International, Cedar Rapids, Iowa 52406. 319/395-2536.

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Every new military airlifter

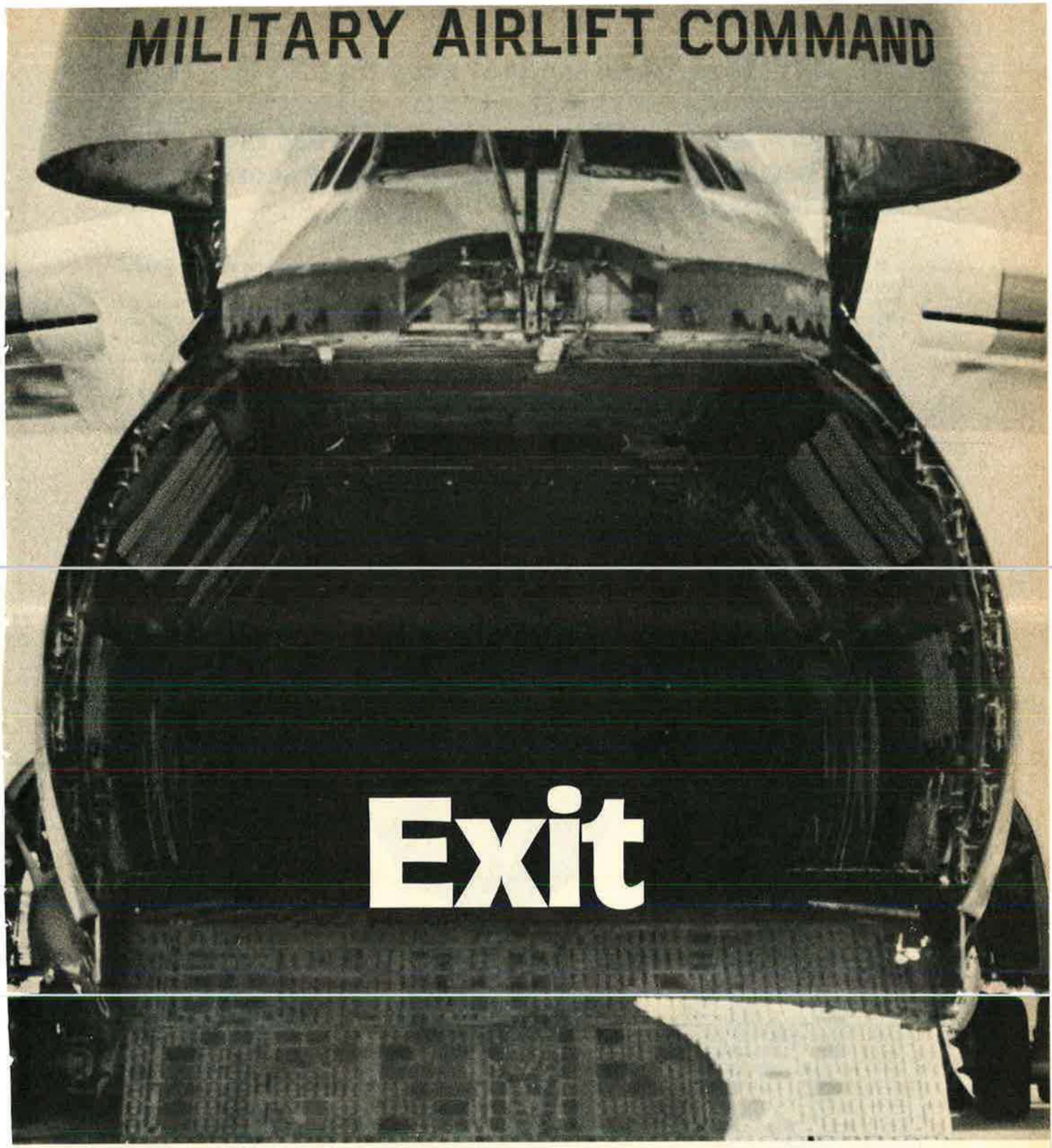
There are times when an airlifter can be loaded and unloaded at a normal pace. And then there are other times—crisis situations—when loading and unloading becomes a critical race, and every second counts.

That's when the drive-on, drive-off, straight-through capability of a great airlifter's cargo compartment pays off.

Once this was theory. Now it's fact, proved in actual operations.

But there's a lot more to a great airlifter's cargo compartment than driving cargo into the rear opening and out the front cargo opening.

The cargo openings must be low to the ground so that short ramps with low cresting angles can be used. And the openings must be high and wide. High enough to handle



needs fast, easy loading.

bridge launchers and other outsized cargo, wide enough to enable 5-ton trucks or M113 personnel carriers to be parked safely side by side. The dimensions that go with those requirements are: 1) cargo openings low to the ground, roughly five feet, so that the ramp angles are small; 2) cargo openings 13.5 feet high; 3) cargo openings 19 feet wide. The validity of these figures has also been confirmed in actual operations.

A high, wide entrance. A high, wide exit. Each low to the ground. They add up to a great airlifter's business ends—the cargo compartment.

Lockheed-Georgia

Winners, losers, and some who only broke even. With better information, how might the score have changed?

If better enemy-deployment information had been available, would General Lee have defeated General Meade at Gettysburg—possibly changing this country's history?

With the same kind of information in the Battle of Jutland, maybe Admiral Jellicoe could have turned a draw into a decisive win over Admiral Scheer—and shortened World War I.

Did Captain "Roy" Brown really down Baron von Richthofen in their controversial air duel? How might a better hazard detection system have affected the outcome?

Over the years, the lack of well-coordinated information has affected many such encounters. To cope with that problem today, IBM provides defense systems that benefit from a special skill: our ability to marshal many specialized systems to a common purpose.

We're applying this skill to C^3—command, control and communications. To antisubmarine warfare, avionics for space and aircraft, navigation, electronic countermeasures, space systems, plus a wide range of other fields.

In fact, the more complex the task and systems are, the more IBM can help.

These and other historic encounters are explored in a current series of IBM full-color advertisements.

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Meade

Jellicoe

Brown

Lee

Scheer

Richthofen

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Eye on the Eagle

I enjoyed your article in the May issue, "Flying in the Enhanced Eagle." The narrative and cockpit photos indicate an easy-to-use system with almost unlimited potential. The only aspect of the system not adequately covered was programming of the Tactical Situation Display. I would be very interested in a brief explanation of the preflight setup, available symbology, and in-flight capabilities of such a moving map display.

I feel that McDonnell Aircraft and its partners should be strongly commended for their development of the "Strike Eagle." While risking $40 to $50 million of their own funds (p. 49), they succeeded in procuring and integrating the hardware as well as flight testing this remarkable weapon system. This is an example of what private contractors can do when unencumbered by government overmanagement. It should also serve as an example to other contractors who will not move off dead center unless funded by the government.

In contrast to the accomplishments of McDonnell and associates, I see further down in your article (also p. 49) that Air Staff planners see the need to validate the "Strike Eagle" through engineering and operational testing to the tune of $200 million. Why should this cost $200 million when McDonnell can put the whole package together and test it for less than $50 million? Could this be an example of Air Force overmanagement?

Col. Andrew W. Kendall, USAFR
Columbus, Ohio

After flying F-111 aircraft for more than twelve years, it is certainly heartening to find out that there will be "a complete air-to-ground, night, all-weather attack system" proven out by "summer's end" ("Flying in the Enhanced Eagle," May '81).

The author writes that "the Air Force needs a night, all-weather ground-attack aircraft, and does not have one." As many F-111 pilots learned over the years, the F-111 does have problems when penetrating heavy thunderstorms during auto-terrain-following radar (TFR) operations, especially when lightning is a certainty. The author must be implying that the "Strike Eagle" will be able to overcome these problems.

I am sure all "Aardvark" pilots and WSOs are very interested to hear that we now will have an aircraft that will exceed the F-111's combat-proven capabilities. We are also willing to share our PAVE TACK system (operational in December '80) with the (operational in 1985) enhanced F-15.

In closing, we are very happy that we will now have company deep behind enemy lines during those black, rainy nights at 200 feet among SA-6s, SA-8s, and ZSU-23-4 AAA.

Maj. David B. Van Dyke, USAF
F-111 PAVE TACK
Project Manager
57th Fighter Weapons Wing
Nellis AFB, Nev.

Remembering Von Kármán

This letter is with regard to your most stimulating article in the May 1981 issue entitled "Von Kármán's Singular Contributions to US Aerospace Power" by T. F. Walkowicz.

On p. 69 the article mentions the NAS/ARDC study in 1956–57. Actually it was done during the summers of 1957–58.

The many interesting anecdotes in this article are certainly ones to share with us all, to better understand this great man. Thanks again for your continued excellence in reminding us of such notables and events in the evolution of the Air Force.

Kenneth S. McAlpine
Executive Secretary
Air Force Studies Board
National Research Council
Washington, D. C.

The Total AFRES Contribution

As a command pilot, I was impressed with the flying accomplishments of the Air Force Reserve (p. 134, May '81 issue). However, as an Air Force Reserve Mobilization Augmentee (MA), I feel like a second-class citizen. Paid MAs constitute about fourteen percent of the Air Force Reserve, and no mention was made of us in the article.

The Air Force Reserve medical service squadrons do an excellent job, as do the intelligence units. The thousands of dedicated Reservists working with Civil Air Patrol and Academy/ROTC as advisors and liaison officers in nonpay status certainly deserve recognition.

Readers should know of *total* Air Force Reserve contributions to the Total Force!

Col. Gilbert A. Robertson, USAFR
Bellevue, Neb.

Scaling Down Inflation

I would like to comment on the article "How Best Curb OER Inflation?" that appeared on p. 95 of the April 1981 issue. While the article was mainly about officer performance reports, you did touch on enlisted reports also.

You are very correct in reporting the heavy rating inflation going on. The problem, however, does not warrant scrapping the old system, and I realize you weren't suggesting that, but it does warrant a change in the system. There are many alternatives the big shots haven't even looked at yet.

The main reason APRs [Airman Performance Reports] are inflated is because there is no standard to guide the person filling out the APR. Yes, it's true; go look through the regulation. All they have is a scale of one through nine. What could be more subjective? Can you define what kind of person should get a nine and what kind of performance deserves an eight, and so on? Every supervisor has his own definition.

Unfortunately I have seen both extremes. I have seen a supervisor who would not give nines because he felt it left no room for improvement; the other extreme is a supervisor who told me that as long as you stay out of trouble you are guaranteed a nine.

What we need is a standard in the regulation describing the kind of performance that would indicate giving a

person a certain number. This would make the APRs more objective and uniform, and most of all more fair. As it stands now, most supervisors just give away nines because it's easier to write, and in today's Air Force if you get below an eight, your chance for promotion declines sharply.

The second alternative would be to lessen the amount of points APRs are worth on WAPS [Weighted Airman Promotion System]. Instead of 135 make it worth sixty or seventy. This would take the pressure off supervisors to give high APRs. They would be likely to rate more realistically because they won't feel they're ruining the person's career if they rate him a lower APR.

Of course, there are many more alternatives that I will not go into here. I just wanted to point out that the big shots are copping out by sticking with a rotten system because they say there are no workable alternatives. Hogwash!

Richard Saccone
Clearfield, Utah

Allied Air Forces

Please accept my belated congratulations for your unique articles on allied air forces and aircraft. Such thought-provoking pieces as Mark Berent's and General Milton's remind us that there are excellent aircraft and superb airmen in NATO standing ready to defend their freedom and sovereignty.

Sometimes, when we sum up the strategic balance, we forget our NATO allies, who have more at stake than the United States on the "Central Front." Certainly the NATO air forces have given a lot of thought to the conduct of defense and strike missions in Europe. It is helpful to learn something about their contribution.

I look forward to reading more on the subject.

George B. Berke
Reston, Va.

Memories of the Me 262

Your recent article on the Me 262 and other German planes that were evaluated at the end of World War II has had an interesting reply ["Watson's Whizzers," p. 54, April '81 issue]. I sent it on to a gentleman who was a top designer for Lockheed during the war, and for Republic afterwards. (He received a model of the F-105 from Republic for his efforts upon retirement.) He writes:

"I read the article with great interest, especially since in 1945 I became involved in the evaluation of captured enemy equipment. I studied

AIRMAIL

and evaluated armaments and turnaround efficiency.

"While we, at that time, equipped most of our aircraft with .50-caliber (12.5-mm) guns, and rarely a few 20-mm guns, we were astonished by the superb German 30-mm and 50-mm cannon. (At one time, as a curiosity, we equipped a few B-25 bombers with a 77-mm gun.)

"The biggest surprise, however, was the short turnaround time required by most German aircraft. Refueling, rearming, routine maintenance, and inspection not only required less time, but also fewer ground crews and less sophisticated ground equipment.

"Our conclusion: Assuming the same number of aircraft available to either side, the Germans were able to put twice the number of fighting machines in the air at a given time as we could."

Since the above was part of a personal letter, I am not including the author's name. I will be glad, however, to supply it to any reader who might wish to pursue it.

Daniel N. Ehart
Suburban Publications
134 North Wayne Ave.
Wayne, Pa. 19087

Your article on "Watson's Whizzers" in the April issue brought back memories when I read about the Me 262s, and seeing the pictures of 262s stirred up my memory even more.

I'll never forget that day on March 3, 1945, when I was piloting a B-24 of the 392d Bomb Group, 2d Air Division, Eighth Air Force, on our way to bomb Magdeburg, Germany. We had over 1,000 heavies from our division, plus the B-17s from the 1st and 3d Air Divisions out that day. All you could see ahead and behind us was a never-ending bomber stream.

About halfway to our target, Magdeburg, we saw something in the sky being chased by P-51s and P-47s that we had never seen before. It was a lonely Me 262. There were no other enemy fighters near our group except for this brave 262. He was lobbing shells into some bomber formation ahead of us, hoping to hit one and explode it to damage the other bombers around it.

As soon as our P-51s and P-47s spotted him, they were on him like a cat pouncing on a mouse. Unfortunately, when the Me 262 poured on his afterburners, it made our fighters look like they were standing still. The 262 must have gotten away, as we could not determine any hits by our fighters.

It made us feel a little uneasy when we got back to our field and discussed this mission during our debriefing. The Germans could have regained air superiority with this fighter, but fortunately for our side, they didn't have the petrol to fly them. I understand that there were several thousand of the 262s bordering the autobahns and fields of Germany, but no gas to fly them.

Maj. James G. Day,
USAFR (Ret.)
Hollis, N. Y.

Maintenance Training Author Replies

I note from the "Airmail" section of your April '81 issue that Mr. Thomas Walton takes exception to my article, "Tomorrow's Maintenance Training Programs" that appeared in the January '81 issue of AIR FORCE Magazine. Apparently, Mr. Walton feels that I said that the 3306th Test and Evaluation Squadron was the first to apply a systematic analysis to determine training requirements on an emerging weapon system. This is neither what I wrote nor what I believe.

I am well aware of the Minuteman program and its impact on the development of the Instructional System Development (ISD) process. When I said that there had been limited use of ISD on new weapon systems prior to 1973, I had the Minuteman experience in mind. However, the 3306th TES did pioneer the Air Training Command blue-suit capability to perform this analysis, utilizing system data derived from hands-on experience during the system test program.

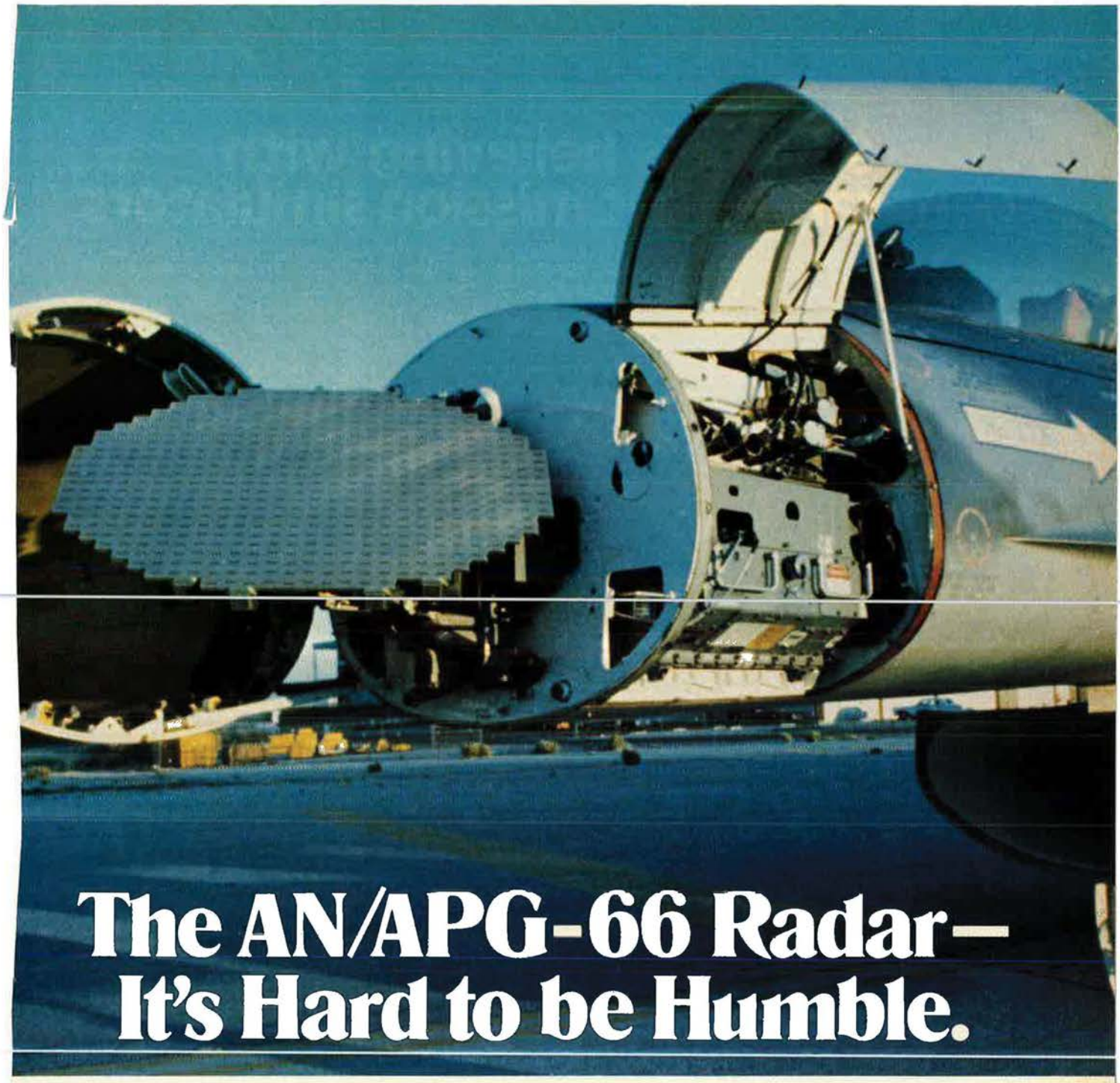
I think if Mr. Walton rereads my article he will realize that I was describing the origin and mission of an Air Training Command unit, not the origin of the ISD methodology.

Maj. James D. Clark, USAF
Universal City, Tex.

Thanks to "Rush"

Thank you for the article "Photographers Don't Count!" by Charles "Rush" Russhon in the April '81 issue. We at the Aerospace Audio-Visual Service (AAVS) celebrated our thirtieth anniversary on April 1, 1981, and Mr. Russhon's article was very timely.

As a second-generation Air Force officer I have always loved the Air



The AN/APG-66 Radar— It's Hard to be Humble.

The F-16's APG-66 fire control radar is getting high praise from pilots for its performance, operability, and availability. Operational experience is showing that this radar far exceeds previous systems in critical areas such as very low false alarm rate and reliable detection and tracking. The APG-66 is a perfect match for the F-16, and we're making sure it stays that way by developing radar modifications necessary to meet extended mission requirements. Incorporation of a Programmable Signal Processor (PSP) and Dual Mode Transmitter will enable the F-16 to fully exploit the capabilities of AMRAAM, as well as providing extensive software growth potential for both air-to-air and air-to-surface missions as new requirements are defined.

In development for over a year, these modifications have now been authorized by the U.S. Air Force for full-scale development by Westinghouse. The PSP, a fourth-generation design, offers an unmatched degree of modularity and software flexibility. The innovative transmitter design permits optimum waveform control for true multi-mode multirole performance. Together with the PSP, it significantly enhances detection range, provides unique electronic counter-countermeasures (ECCM) capabilities and greatly expanded multiple target engagement capability.

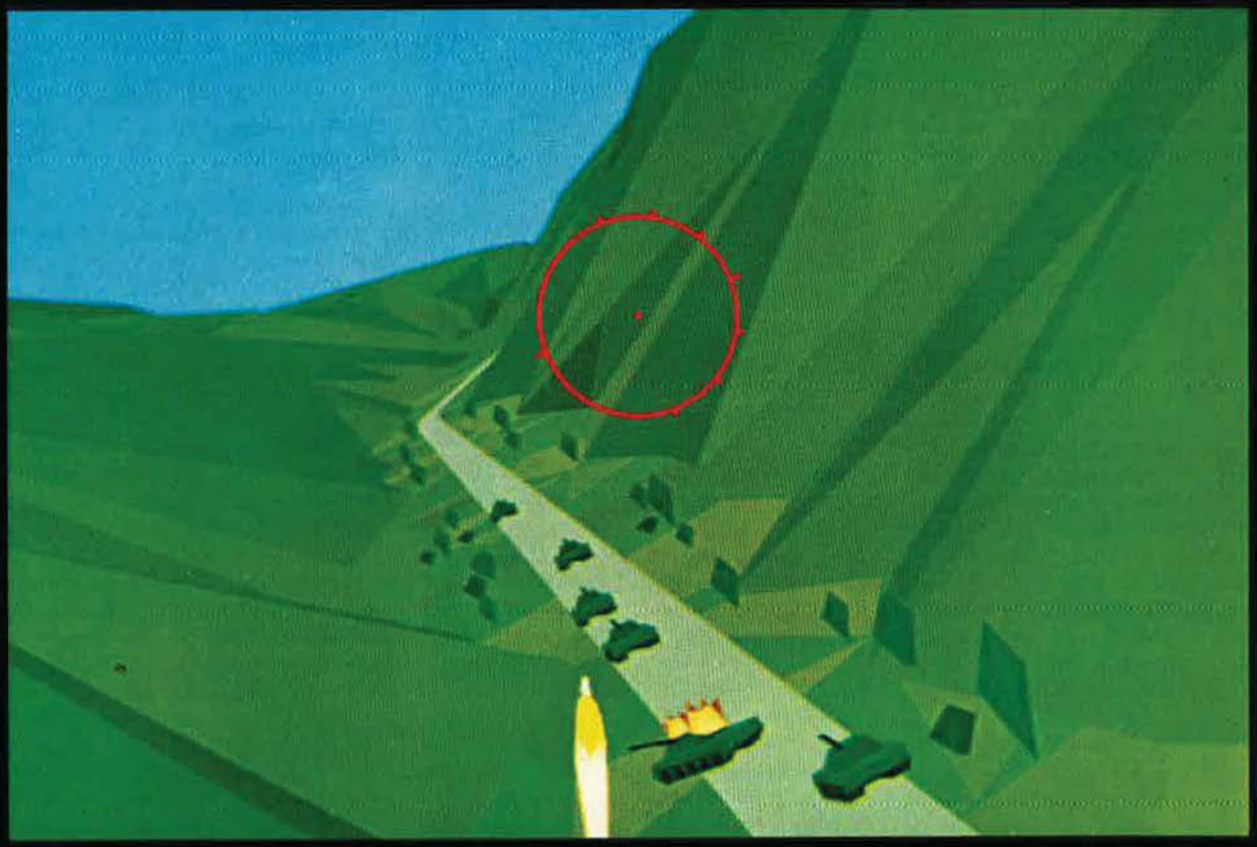
Thanks to the modular structure of the present radar, the new capability is available in the same form factor as present, resulting in earlier operational availability and easy retrofit.

The F-16 radar. The best is yet to come!

We design it. We produce it. We support it.

Westinghouse Defense

Seeing is believing with General Electric mission simulators



With simulator instruction, the eyes have it. What you see determines how far the illusion can go. Thus, the key to effective training is a good visual system.

Increasingly, aircrews must be supported on the ground by devices that not only provide transition and instrument training, but enable pilots to rehearse the fundamentals of weapons delivery tactics and formation flying. That's why you need the best high-fidelity visual system available.

General Electric (USA) demonstrates full mission capability with a computer-generated-image visual system that's been field-proven in extensive transition and mission training situations.

Mission simulator capability for today's fighter aircraft

- One on one air-to-air combat between two student pilots or between student pilot and instructor pilot
- Two on one air-to-air combat
- Combat air patrol
- Air-to-ground weapons delivery
- Armament orientation and operation
- Attack positioning
- Missile lock-on
- Tactical radar operation and visual hand-off
- Cross-country flight
- Weapons scoring
- Aircraft and weapon system malfunctions
- Cockpit orientation
- Takeoff and landing
- Taxi, brake and park operations
- IFR/VFR transition

For more information on GE mission simulators, write or call Bob Witsil, Manager, Simulation Marketing.

General Electric Company • Electronic Systems Division
Simulation and Control Systems Department • Daytona Beach, Florida 32015 • Tel. (904) 258-2141

GENERAL ELECTRIC

U.S.A.

151-21

Force (naturally some days more than others), and since my assignment to AAVS, I have been able to enjoy the pride of participating in many historic events.

For an officer who enjoys being where the action is, AAVS is an excellent assignment. Whenever something historic is occurring, AAVS photographers are there (as your fine magazine knows, since almost every edition contains photographs taken by AAVS photographers). AAVS cameramen document Air Force operations worldwide and the attitude is still "photographers don't count."

Well, we may not count, but our photographs are worth a thousand words! Thank you, Rush—we needed that article.

Capt. John T. Franklin III, USAF
Hq. Aerospace Audio-Visual Service
Norton AFB, Calif.

Great Expectations

Perhaps I expected too much when I read "What It's Like to Fly an FB-111A Mission" in the April '81 issue. How did you conjure up such an original title? Mr. Ford's photo essay transformed a relatively complex SAC training mission into a quaint little spin around the ol' airpatch.

I can only surmise that despite all of Mr. Ford's eagerness and zeal, the aircraft took off without him!

Richard E. Garr, Jr.
APO New York 09179

Thoughts on MX

Basing the MX has been slowed through interminable reviews by committees on committees, and the thoughtlessness of a recent administration. This course of events has been ably reported in AIR FORCE Magazine, thank goodness!

Whether technical barriers can be hurdled for basing MX in the oceans should not further delay events. If we can leap into space to the moon and return, we should have the technical and scientific competence to overcome the problems, real and imagined, of sea-launched, now-you-see-them, now-you-don't missiles, and the determination to get a system operational ASAP, in the same spirit as our answer to Sputnik.

At least at sea the political problems would not be as great as those created by taking land and giving the environmentalists a "field day."

Col. R. W. Dart, USAF (Ret.)
Urbana, Ill.

I am disappointed in the editors of AIR FORCE Magazine and heartily agree with the comments by Col. Peter Boyes in the May issue ["Airmail," p. 12], who feels that the MX is a terrible waste of the taxpayers' money and not practical to deter an enemy.

I agree with Colonel Boyes that restoring the draft and upgrading the personnel in our military, which hit a new low in the Iran hostage mission, would be a far greater deterrent and evidence of our "resolve" than pouring billions into a system that could be obsolete in a short time with the development of satellite warfare and scarring some of the most beautiful lands in our country—the magnificent wilderness of the West.

Whitney Cushing
Palm Beach, Fla.

AIRMAIL

Captain Reagan

The USAF Museum is currently preparing a display devoted to the military service of President Ronald Reagan in the USAAF during WW II. The basis for the display will be several items of memorabilia that President Reagan donated to us. While attempting to locate relevant still photos of Captain Reagan of the WW II era, we found that few exist in official repositories. Even though he loaned to us the few photos he possesses, we still need additional ones. We understand that it was not uncommon for servicemen to have their photos taken with Captain Reagan; we would like to borrow to copy any such personal photos that anyone would loan to us.

The USAF Museum also is attempting to expand its collection of photos pertaining to Maj. Glenn Miller and his AAF Band. We particularly need a photo of the UC-64A aircraft, s/n 44-70285, in which Major Miller disappeared in 1944.

We would be grateful to any readers who have photos relating to these topics. (Readers should indicate whether the photos are a donation or whether they prefer that we make copy prints and return their originals.)

Charles G. Worman
Chief, Research Division
USAF Museum
Wright-Patterson AFB, Ohio 45433

One of the Last B-29s

Fifteenth Air Force Headquarters is currently restoring one of the last B-29 Superfortresses, but we have run into problems that, perhaps, some readers can help resolve. The records for our B-29 (serial number 44-61669) have disappeared from the Simpson Historical Research Center, greatly hampering our efforts to learn its background.

This is what we do know about 44-61669. In 1952, it belonged to the 581st Air Resupply and Communications Wing at Mountain Home AFB; along with eleven other B-29s, it deployed to Clark AB, P. I., in May 1952. Its crew of seventeen included 1st Lt. Boren Green (AC), 2d Lt. Emil Gasparani (P), 1st Lt. Leroy Ohrt (CP), 1st Lt. James Lawler (N), and SSgt. James Gehring (FE). By 1956, -669 was still with the 581st, flying "Joss Stick" missions out of Kadena AB, Clark AB, and Singapore. In June 1956, -669 apparently was retired, and sent to China Lake Naval Weapons Center.

Everything else about -669 is a mystery. It carries remnants of a nose art design showing a map of the US and a flagpole; this apparently predates the all-black paint scheme of its Korean War days. Did -669 see action in World War II? What did it do from WW II until the formation of the 581st ARCW in 1952? Exactly what was its role during the Korean War?

If anyone can help answer these questions, or provide any information on 44-61669, please contact me at the address below. Any photos provided will be copied and returned.

Capt. Francis J. "Bud" Baker, USAF
15th AF/XP
March AFB, Calif. 92518

15th Tactical Reconnaissance Squadron

We're trying to assemble a complete history of our unit, the 15th Tactical Reconnaissance Squadron.

The squadron originated in 1917 as the 15th Aero Squadron, and before it was designated the 15th Tactical Reconnaissance Squadron in 1943, it was known as the 15th Observation Squadron and the 15th Reconnaissance Squadron (Fighter). The squadron was stationed throughout the midwestern United States prior to WW II, and then in England, France, and Germany. The 15th served in the Korean War and has been in the Far East since that time.

If anyone could help us with stories, yearbooks, rosters, or photos from any period of our history, it would really help us out.

Please contact:
1st Lt. William P. Brandt, USAF
PSC 2, Box 15396
APO San Francisco 96367

"The Fortieth Year"

We are seeking assistance in contacting those veterans who were in the Hawaiian and Philippine Islands during the Japanese attack on December 7, 1941, and those who were subsequently deployed to the South and Southwest Pacific areas to pursue the war to ultimate victory.

Our only purpose is to make available information about a reunion to be held in Hawaii commemorating the fortieth anniversary of the attack. This is not a commercial venture or a prelude to forming yet another veterans or service-oriented organization. We believe the present organizations more than fulfill the various needs and requirements of their members.

If by chance readers would care to join in the commemoration, they will be most welcome—they may join in Hawaii or, if they prefer, we can make arrangements for lodging and travel. Full information will be sent to those requesting it, using the mailing address below.

Charles J. Burns
1735 Kearney St.
Denver, Colo. 80220

Pacific War Veterans

Icare, the magazine of the French airline pilots' association, covers the history of aviation and is preparing twelve volumes regarding the air war in the Pacific during World War II.

We are looking for personal accounts from aircrews involved in the war from Pearl Harbor to the capitulation of Japan in August 1945, and would be very grateful for and appreciate any help from readers regarding their experiences.

Please contact:

Icare
Orly-Sud 213
94396 Orly Aérogare Cedex
France

Vultee P-66

The American Aviation Historical Society, a nonprofit group, wants to record the use of the Vultee P-66 in its limited World War II operations.

I am interested in corresponding with anyone possessing photos or information concerning this aircraft, especially while used in the CBI theater. No matter how limited the information, anything offered may assist in completing the picture of P-66 operations.

Sought-after items include firsthand experiences from ground and aircrew and any illustrations. All loaned material will be handled carefully, copied, and promptly returned.

Please contact:

Research Project 0124
c/o R. E. Martin
2309 Sabine Way
Rancho Cordova, Calif. 95670

Malmstrom AFB

Have you ever been stationed at Malmstrom AFB, Mont.? If so, you will want to be a part of the 341st Strategic Missile Wing's twentieth anniversary celebration on July 10–11, 1981.

The event will include the grand opening of our museum—a facility dedicated to fostering a greater awareness of our wing's heritage for present and future generations. If you were stationed at Malmstrom during the past twenty years, we would appreciate your loaning or donating memorabilia that could be housed in the museum.

Of course, we also encourage you to attend our wing's open house, "Big Sky Day," which will be on July 11. The Navy's Aerial Demonstration Team, the "Blue Angels," and the Air Force Academy's Jump Team will perform. In addition, we will feature base tours, static displays of many American and Canadian aircraft, a parade, a family fun run, and much more. Please come and help us cele-

UNIT REUNIONS

ATILO
The Air Technical Intelligence Liaison personnel will hold their reunion in Long Beach, Calif., on October 16–18, 1981. **Contact:** Vern Prentiss, 3607 Catamaran Dr., Corona del Mar, Calif. 92625.

Chitose AB
The fourth reunion for Chitose AB (Crawford, Japan) will be held in October 1981, in Panama City, Fla. **Contact:** Bob Reeves, 4519 Sunset Dr., Panama City, Fla. 32401.

Pampa Army Air Field
Members of the Pampa Army Air Field will hold their reunion August 7–9, 1981, at the Coronado Inn, Pampa, Tex. **Contact:** Bill Raney, P. O. Box 234, Westfield, N. J. 07091. Phone: (201) 232-9177.

USS *Gambier Bay* (CVE-73)
A reunion for the USS *Gambier Bay* will be held August 12–15, 1981, in Oklahoma City, Okla. **Contact:** Tony Potochniak, Historian, 1100 Holly Lane, Endicott, N. Y. 13760.

USS *Savannah* (CL42)
The twelfth annual reunion will be held September 11–13, 1981, for the USS *Savannah.*The reunion will take place in San Diego, Calif. **Contact:** Murray C. Flanders, Rte. 1, Box 179, Spanish Fort, Ala. 36527.

1st Air Division
Members of the 1st Air Division will meet on October 15–18, 1981, in St. Paul, Minn. **Contact:** Lt. Col. Henry C. Gelula, USAF (Ret.), Box 1876, Atlantic City, N. J. 08404.

1st Combat Evaluation Group
A reunion for the 1st Combat Evaluation Gp. will be held October 2–4, 1981, in Bossier City, La. **Contact:** Cecil M. Thomson, 3407 Pinehaven Cir., Haughton, La. 71037. CMSgt. J. M. Smart, 3229 Thunderbird Lane, Bossier City, La. 71110.

3d Staff Sqdn.
The Sherman Field 3d Staff Sqdn. will hold its reunion on September 12–13, 1981, at the Ramada Inn, Fort Leavenworth, Kan. **Contact:** Roscoe Swenson, 109 N. Fifth, Salina, Kan. 67401. Phone: (913) 823-2722 (day); or (913) 827-2577 (evening).

4th Air Depot Group
The 4th Air Depot Group will hold its reunion on September 6, 1981. **Contact:** Andy Stifel, 1236 Kirk St., Maumee, Ohio 43537. Phone: (419) 893-6913.

4th Strategic Air Depot, 8th AF
The 4th Strategic Air Depot Association will hold its third mini-reunion with the 8th Air Force Historical Society on October 15–18, 1981, St. Paul, Minn. **Contact:** Col. Paul P. Gerhardt, USAFR (Ret.), 2602 S. Union, Apt. B-307, Tacoma, Wash. 98405.

7th Photo Group, 8th AF
Annual reunion October 15–18, 1981, St. Paul, Minn. **Contact:** Claude Murray, 1933 E. Marshall, Phoenix, Ariz. 85016.

17th Bomb Group (M)
A reunion for the 17th Bomb Group will be held on October 28–31, 1981, in Orlando, Fla. **Contact:** 17th Bomb Group Reunion Association, 200 King La., Suite 209, Garland, Tex. 75042. Phone: (214) 272-1591.

22d Bomb Group
The thirty-second annual reunion of the 22d Bomb Group, 5th AF, will be held at the Antlers Hotel, downtown Colorado Springs, Colo., September 10–12, 1981. **Contact:** Robert E. Jones, 308 Jersey St., Denver, Colo. 80220. Phone: (303) 388-3765.

37th Fighter Sqdn.
The 37th Fighter Squadron will hold its reunion during September 25–27, 1981, in Lake Charles, La. **Contact:** W. A. Goodman, 521 N. Goodman Rd., Lake Charles, La. 70601.

40th Bomb Group, 20th AF
A second reunion for the 40th Bomb Group will be held on October 2–4, 1981, at the Dallas/Fort Worth, Tex., metroplex. **Contact:** Bob Shanks, 1833 Esquire Pl., Grand Prairie, Tex. 75050. Phone: (214) 262-0100.

brate our twentieth anniversary.

For more information, contact:

Capt. Byron Gold, USAF
341st SMW/CCE
Malmstrom AFB, Mont. 59402
Phone: (406) 731-3413
AUTOVON: 632-3413

AFROTC Detachment 160

The AFROTC Cadet Group of Detachment 160 is proud to announce the celebration of its thirty-fifth anniversary at the University of Georgia on September 25–26, 1981.

In recognition of thirty-five years of Air Force service, Detachment 160 has planned a full weekend of festivities including a military band, prominent guest speaker, brunch before the Georgia–South Carolina football game, and a military ball that evening. Plan to join us on this weekend for a great time!

For further information or reservations, contact:

Charles L. Kinney
AFROTC Det. 160
University of Georgia
Athens, Ga. 30602

9th Bombardment Squadron

I am doing a research project for the 9th Bombardment Squadron (H) to discover if the squadron has ever had a nickname since its inception in WW I.

If anyone is aware of a nickname, please send it along with the time frame involved to:

1st Lt. Paul E. Pirog, USAF
c/o 9th Bomb Squadron
Carswell AFB, Tex. 76127

AIRMAIL

Model Info Needed

I am a scale model builder. I am working on getting pictures and info on the following aircraft: A-36, P-51, P-51D (in olive and gray camouflage), and A-24 (any variant).

If you have anything on any of these aircraft, please send to:

Stephen F. Kastory
854 Bolling Dr.
Goldsboro, N. C. 27530

Lost ID Bracelet

My family found in either the New York or Boston areas a sterling silver Air Force identification bracelet with pilot's wings, and bearing the initials on the front left of "O.M.N." and "J.S.N." on the front right.

This may be of great sentimental value to the owner or his relatives. I'll be happy to forward it to anyone responding who can identify the date that is engraved on the reverse side of the ID bracelet.

Mrs. G. Thaw
220-02 67th Ave.
Bayside, N. Y. 11364

Completing History

I need a few items to complete a framed area containing my Air Force history.

I need a pair of navigator wings made of silver woven cloth (I purchased a pair at Langley AFB, Va., in 1952), a pair of captain's bars made of the same material, a Fifth Air Force shoulder patch, and small color photos (approximately three inches by five inches) of B-24s and B-26s during the Korean War period.

Can any readers help me in obtaining these items?

Fred Justice, Jr.
Rte. 6
Mount Vernon, Ill. 62864

5th Fighter Group Reunion Change

In the "Unit Reunions" section of the May '81 issue of AIR FORCE

Class 40-F

The Flying Cadet Class 40-F is holding its second reunion on October 2–4, 1981, San Antonio, Tex. **Contact:** Lt. Col. Leland C. Schubert, USAF (Ret.), 236 Webb St., Warner Robins, Ga. 31093. Phone: (912) 953-3740.

55th Military Airlift Sqdn.

Officers of the 55th Military Airlift Squadron who were stationed at Rhein-Main AB, Germany, during 1965–68, will hold their reunion in Orlando, Fla., on September 25–27, 1981. **Contact:** Lt. Col. Don Flanders, USAF (Ret.), 81 Carolwood Blvd., Fern Park, Fla. 32730. Phone: (305) 830-8093.

75th Air Depot Wing

All squadrons stationed in Texas, Korea, and Japan during 1952–55. Reunion will be held October 15–18, 1981, in Oklahoma City, Okla. **Contact:** Kenneth M. Brunmeier, P. O. Box 181, Onida, S. D. 57564. Phone: (605) 258-2325.

98th Bomb Group (H)

The 98th Bomb Group Veterans Association will hold its reunion in Albany, N. Y., at the Best Western Turf Inn, October 5–9, 1981. **Contact:** W. H. Bolling, Jr., Route 8, Box 203, Gonzales, La. 70737.

305th Bomb Group, 8th AF

The 305th Bomb Group Association will hold its reunion on October 1–3, 1981, in San Antonio, Tex. **Contact:** Abe Millar, Box 757, Sanger, Tex. 76266.

351st Bomb Group (H), 8th AF

Members of the 351st Bomb Group, including the 508th, 509th, 510th, and 511th Bomb Squadrons, stationed at Polebrook, England, during WW II, will be holding their annual reunion in conjunction with the 8th AFHS on October 15–18, 1981, in St. Paul, Minn. **Contact:** Ben Schohan, 398 Catawba Ave., Westerville, Ohio 43081.

391st Bomb Group

A reunion for the 391st Bomb Group will be held in September 1981, at Matching Green, England. **Contact:** Bob Holliday, 1515 Oakwood Dr., Pittsburgh, Pa. 15234.

398th Bomb Group (H), 8th AF

The 398th Bomb Group stationed at Nuthamstead, England, during WW II will be holding its seventh annual reunion in conjunction with the 8th AFHS, on October 15–18, 1981, in St. Paul, Minn. **Contact:** George R. Hilliard, 7841 Quartermaine Ave., Cincinnati, Ohio 45236.

451st Bomb Sqdn., 322d Bomb Gp., 9th AF

Annual reunion will be held September 25–27, 1981, in South Bend, Ind. **Contact:** James J. Crumbliss, 2014 Shady Grove Dr., Bossier City, La. 71112. Phone: (318) 742-1225.

457th Bomb Group

Members of the 457th Bomb Group and attached units will hold their reunion in September 1981, in Colorado Springs, Colo. **Contact:** Homer L. Briggs, 811 Northwest B St., Bentonville, Ark. 72712. Phone: (501) 273-3908.

459th Fighter Squadron

Members of the 459th Fighter Squadron, 10th AF, China-Burma-India, will hold their reunion on October 8–11, 1981, in Brownsville, Tex. **Contact:** Wayne Sneddon, P. O. Box 447, Pilot Hill, Calif. 95664.

461st Fighter Sqdn.

All members of the 461st Fighter Squadron "Deadly Jesters" are invited to attend a reunion on September 10–13, 1981. (Please contact whether attending or not so that names may be added to roster.) **Contact:** Creighton "Hamp" Hampton, 4408 W. Echo Lane, Glendale, Ariz. 85302. Phone: (602) 937-8369.

482d Bomb Group

Members of the 482d Bomb Group (Alconbury, England, Station 102, WW II), including the 36th, 812th, 813th, and 814th Bomb Squadrons and attached units, will be holding a unit rendezvous October 15–18, 1981, in St. Paul, Minn., during the 8th Air Force Historical Society reunion. **Contact:** Denny Scanlan, One Scanlan Plaza, St. Paul, Minn. 55107.

483d Bomb Group (H)

Members of the 483d Bomb Group, based in Italy during WW II, will hold their reunion on October 30–November 1, 1981, in Tampa, Fla. **Contact:** Lt. Col. Bill Haskins, USAF (Ret.), 700 Cedar St., Alexandria, Minn. 56308.

PORTABLE C^3 Satellite · Line-of-Sight · Manpack/Portable Radio

The AN/URC-100 and 101 (formerly PRT-250) operationally proven for voice, data, UHF/VHF, AM/FM, secure, and satellite communications.

Satcom Terminal

Satellite communications with line-of-sight benefits. Also the latest options for our "ready radios" make them securable in the AM and FM mode for your critical messages. All in one very portable package.

New 30-88 MHz Option

With this option, forward units have both air-to-ground UHF AM, SATCOM UHF-FM, and tactical VHF low band for point-to-point C^3 in one small manpack transceiver for the first time.

Fully Synthesized for flexibility

The Motorola AN/URC-100 and 101 portable transceivers combine broad frequency selection . . . 8360 fully synthesized channels . . . with modulation methods to accommodate rapid mission changes in command and control networks including air, mobile, and ground units.

Installs Almost Anywhere

This advanced, rugged portable radio can be easily mounted in helicopters, jeeps, armored personnel carriers, ships, aircraft, communication centers, and also is a manpack transceiver. The multimode operation includes a scanning function that makes it easy to set up back-to-back translator/repeater links. Frequency coverage from 30-88 MHz and 225-400 MHz or 116-150 MHz and 225-400 MHz.

More Exciting Details

If you'd like to learn more about the AN/URC-100 and 101 and how the new frequency option of 30-88 MHz lets you set up command communications almost anywhere, call 602/949-2798. Or write Motorola, Government Electronics Division, P.O. Box 2606, Scottsdale, AZ 85252. Our brochure will give you the exciting details on its lightweight versatility.

MOTOROLA

Making electronics history.

AIRMAIL

Magazine, it was reported that the 5th Fighter Group of the Chinese-American Composite Wing (WW II) would hold its first reunion in August 1981, in Atlanta, Ga.

The date of the reunion has been changed to September 20–22, 1981, to be held in conjunction with the Fourteenth Air Force Association reunion in Atlanta.

If there are any questions, please contact:

Joseph T. Millington
1633 Colonial Way
Frederick, Md. 21701

Carswell AFB History

Attention retired Air Force personnel: Carswell AFB, Tex., is putting together a base history and is in need of old photos, memorabilia, or general information you may have about Carswell AFB. All items received will be returned.

Please contact:

SrA. David M. Sanchez, USAF
Wing Historian
7 BMW/HO
Carswell AFB, Tex. 76127

404th Bomb Squadron

I would like to hear from any of my old crew who flew B-24s with me from Shemya (Aleutian Islands) to the northern Japanese islands during 1944–45. We were attached to the 404th Bomb Squadron, 28th Bomb Group (Composite).

Col. Richard Korpanty,
USAF (Ret.)
Rte. 2, Hudson Dr.
New Fairfield, Conn. 06810

John K. Jouett

I would like to locate John K. Jouett, or know if he is deceased.

Lt. John K. Jouett served in World War II in the Burma area with General Stillwell's forces. He was born approximately 1922.

I am writing a book about John K. Jouett's father, Col. John H. Jouett, and need any information readers may be able to provide.

Mrs. Dede DeArmas
RR2 9 Bayberry Dr.
Ormond Beach, Fla. 32074

AAS Yeager Squadron Alumni

The Charles E. Yeager Squadron of Arnold Air Society would like to maintain contact and good relations with

Air Force Association Balance Sheet

December 31, 1980

Assets	Total	General Fund	Life Membership Fund
Current Assets			
Investments at cost	$5,439,633	$5,028,089	$411,544
Cash, receivables, prepaid expenses, etc.	1,543,838	1,405,594	138,244
Other Assets (including fixed assets, funds on deposit, etc.)	1,356,440	1,356,440	—
Total Assets	$8,339,911	$7,790,123	$549,788
Liabilities and Principal			
Current Liabilities (including accounts payable, accrued expenses, etc.)	$2,379,045	$2,379,045	$ —
Deferred Credits (including advance dues and subscription income)	1,196,824	1,196,824	—
Principal	4,764,042	4,214,254	549,788
Total Liabilities and Principal	$8,339,911	$7,790,123	$549,788

Air Force Association Statement of Income and Expenses

Fiscal Year 1980

General Fund	Departmental Income	Departmental Expenses	Net Income or (Loss)
Departmental			
Membership	$1,273,225	$1,423,502	$(150,277)
Patronship	114,900	107,247	7,653
Magazine	1,628,922	1,220,107	408,815
Industrial Associate Program	57,155	62,406	(5,251)
Data Processing Services	146,037	223,480	(77,443)
Insurance Programs—Administration	1,241,664	1,437,931	(196,267)
Annual Convention	220,861	243,729	(22,868)
Aerospace Development Briefings	481,770	235,426	246,344
Total—Departmental	$5,164,534	$4,953,828	$210,706
General Operating and Administrative Expense			922,600
Net (Loss)—Departmental			$(711,894)
Other Income (commissions, royalties, misc. sales, etc.)			26,997
Net (Loss) from Operations			$(684,897)
Non-Operating Income			
Investments—Interest, Dividends, Gains and Losses on Sales			550,809
Insurance Programs—Premium Refund Retention and Interest on Reserves			445,977
Net Income—General Fund			$311,889

Life Membership Fund	
Income from investments	$ 48,734
Less: Transfer to General Fund for annual dues	21,730
Net Income—Life Membership Fund	$ 27,004

Treasurer's Note

The figures reflected herein have been extracted from the certified financial report of Alevy and Cantor, independent auditors, previously submitted to the Board of Directors of the Air Force Association.

Under Current Assets in the Balance Sheet, the item of Investments at cost of $5,439,633 should be noted. Income from these investments is utilized to partially fund Association losses from operations and to provide an essential reserve against future contingencies.

AIRMAIL

our alumni. We need some information from you, such as present address, AFSC [Air Force Specialty Code], and if you are still in the Air Force. This information, plus any other pertinent information, will be appreciated.

Please contact:

Public Affairs Officer
Arnold Air Society
Charles E. Yeager Squadron
WVU, AFROTC Det. 915
Morgantown, W. Va. 26505

Looking For. . .

I would appreciate the help of readers in my attempt to determine the whereabouts of an individual who, in my estimation, was the personification of the airman of World War II.

This individual's name was TSgt. Louis "Joe" Snyder, one of the first B-29ers who served at the Alamogordo Army Air Force Base in New Mexico during the 1944–45 period.

After the war, Joe served with Eastern Air Lines as a flight engineer on "Connies" and later with Lockheed as a flight test engineer.

Since there is a reunion pending I would appreciate any help readers may be able to offer.

Maj. Otto K. Mueller, USAF (Ret.)
95 Franklin St.
Cedar Grove, N. J. 07009

345th Bomb Gp., 501st Bomb Sqdn.

I would like to hear from former members with regard to a reunion in 1982 at Colorado Springs, Colo.

I would also like to hear from families or wives of Clancy Damron, Williamson, W. Va.; Joaquin C. Carillo, Jr., Tucson, Ariz.; and John McRowen, Shreveport, La.

Sandy Cortesio
906 Drake
Centerville, Iowa 52544

Leather Flying Jacket

When I was a cadet at the Air Force Academy, my father gave me his World War II leather flying jacket. It's pretty beat up and I'd like to have it repaired and restored.

I understand that there is someone, somewhere, who specializes in fixing up these jackets. Can anyone tell me how to get in touch with them?

David A. Ochmanek
1018 D St., N. E.
Washington, D. C. 20002

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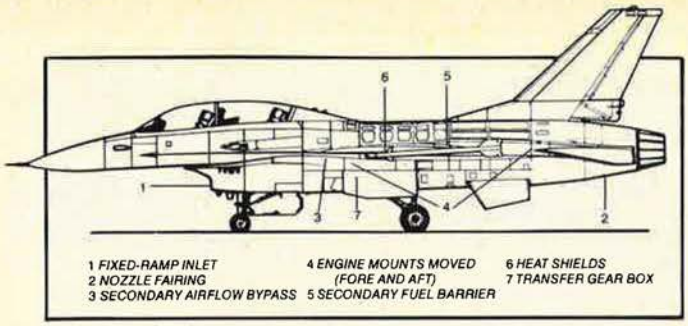

On February 15, 1980, a team of 80 engineers began work on the design of General Dynamics' new intermediate export fighter.

On January 9, 1981, the F-16/79 completed demonstration flight testing.

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"Our job was to take the basic F-16 and, as simply as possible, modify it to accommodate a General Electric J79 turbojet engine. Because of the excellence and maturity of the airplane's design, it turned out to be a straightforward task.

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"What made this assignment so satisfying for everyone involved was the 'hands-on' engineering — the chance to see something through from beginning to end in a relatively short period of time.

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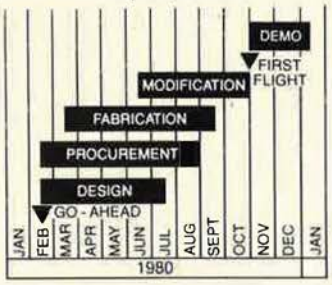


F-16/79: Design to demonstrated performance in less than a year.

GENERAL DYNAMICS

IN FOCUS...

By Edgar Ulsamer, SENIOR EDITOR (POLICY & TECHNOLOGY)

Washington, D. C., June 1

MX Program Still Zigzagging

Early this summer—most probably around July 1, 1981—the Defense Department and the White House are expected to decide on how and where to deploy the MX missile. Whatever the decision—possibly some form of mobile and concealed basing of a limited number of MX missiles in concert with other forms of modern land-based ICBMs—a series of recent events presumably will have helped shape it.

Clearly on the minus side was an official statement by the Mormon Church asserting that "our fathers came to this Western area to establish the base from which to carry the gospel of peace to the peoples of the earth. It is ironic, and a denial of the very essence of the gospel, that in this same area there should be constructed a mammoth weapon system potentially capable of destroying much of civilization."

The statement, which is generally critical of what the Mormon Church termed the "terrifying arms race" and especially the "vast arsenals of nuclear weapons," culminated in the appeal "to marshal the genius of the nation to find viable alternatives [to MX in the multiple protective shelters, or MPS basing mode] which will secure at an earlier date and with fewer hazards the protection from possible enemy aggression which is our common concern."

USAF's Deputy Chief of Staff for Research, Development and Acquisition, Lt. Gen. Kelly Burke, responding to the Mormon Church's comments on behalf of the Air Force, shared the former's concerns "regarding the nuclear arms buildup," but pointed out that "past unilateral constraint on our part has not been matched by the Soviets, nor is there any reason to believe that further US restraint will produce a corresponding Soviet response."

Success in negotiations concerning nuclear arms limits, the Air Force statement warned, depends on convincing the Soviets that "we are determined to match them at whatever level force is necessary. It is improbable that unilateral cancellation . . . of a major strategic program such as MX would encourage the Soviets to pursue balanced reductions through negotiations."

General Burke rejected the Mormon Church's contention that MX/MPS singled out Nevada and Utah to bear unfair and unique burdens: "On the contrary, twenty-nine other states today contain facilities for US strategic forces," that range from bomber bases to submarine pens. The Air Force statement countered the Church's claim that MX/MPS would make Utah and Nevada high-priority targets of Soviet nuclear weapons by pointing out that the system was configured in a way to make it the "least attractive target for attack." With the same "twenty-three warheads that would be required to attack one MX shelter cluster, an enemy would have the potential to destroy twenty-three bomber bases, twenty-three army depots, twenty-three US cities, or a single MX missile," General Burke asserted.

In sharp contrast with the Mormon Church's criticism, the House Armed Services Committee issued a special memorandum on MX, signed by its chairman, Rep. Melvin Price (D-Ill.), and its ranking minority member, Rep. William L. Dickinson (R-Ala.). The committee specifically ordered that the money authorized for the system "shall be available only for the MX missile in the MPS basing mode and that development and procurement of the system in the MPS basing mode shall proceed on schedule unless and until such time as the President certifies to the Congress that he believes an alternative system is in the national interest, and the Congress, within a sixty-day period, has approved that alternative system as a substitute for the MX or its basing mode."

Warning that the momentum for modernizing US strategic forces "might be lost" if Congress fails to halt the executive branch's preference for studying rather than building MX/MPS, the memorandum pointed out, "we are not concerned if the mobility aspect of the system is referred to as a racetrack, a dragstrip, or a figure eight, or if the various racetracks or dragstrips are interconnected, as long as the essential element of preservation of location uncertainty is maintained." And, the committee's leaders added pointedly: "We should leave that technical decision to the military experts."

The memorandum stressed that "until such time as substantial evidence is presented that an alternative approach is more effective in terms of cost and military utility," Congress expects the MX/MPS program to proceed as mandated. To do any less, the memorandum asserts, "would make a mockery of the Congress's place in defense decision-making."

The memorandum warned that if the US fails to deploy MX on "our own sovereign soil"—because doing so might cause environmental inconveniences—the Soviets, unavoidably, would have to conclude that this country is lacking in resolve. At the same time, "we cannot expect our NATO allies to accept basing of ground-launched cruise missiles and Pershing IIs on their soil if we are not willing to put the modernized ICBMs on ours," the committee memorandum pointed out.

The memorandum scoffed at the naïveté of those "who say that if we put the missiles out to sea, we would somehow keep the threat of war from our homeland. Such shallow thinking requires one to believe that the Soviets would refrain from sending nuclear missiles against the United States, even while our own nuclear missiles are firing at the heart of the Russian homeland."

Those who attack the MX on the basis of cost, like those who attacked the B-1 before them, the committee memorandum explained, invariably cite the total cost of the system: "Everybody hears that the MX is going to cost $33 billion (in 1980 dollars). Admittedly, $33 billion is a lot of

money. But it should be remembered that this represents the total cost to buy missiles, shelters, transporters, launching equipment, research and development, everything to be procured through the Department of Defense, over a roughly nine-year period until the system is fully operational.

"It is curious that the cost of tactical systems is never stated the same way. You might ask yourself, for example, what is the cost of the F-18 aircraft over the planned total buy of hundreds of aircraft, a buy normally achieved over a seven-year period? It is $37 billion. That is for all the R&D, and all the procurement of aircraft and related equipment. It does not include the pay of the pilots, the training of the pilots, or the cost of the fuel for the aircraft, or the cost of the weapons that the aircraft would carry."

Rejecting as sophistry the contention that MX fails to meet required survivability standards if the Soviet threat increases at accelerated rates, the committee document pointed out that a "series of response options have been developed, both to maintain the effectiveness of the system, and equally important, to make clear our readiness to employ additional options so that the Soviets would know in advance that they would be denied an advantage by enlarging their forces; it is part of the essential deterrent role of the system.

"These options include additional shelters, deploying more missiles, or a combination of both, and—in the case of a very large Soviet threat expansion—the possibility of deploying a ballistic missile defense system that would be combined with the MPS.

"An expansion of the Soviet threat of the magnitude contemplated by those who see it as a threat to the survivability of the MX system would require some major adjustment in the aggregate US strategic force posture in any case in order to preserve deterrence and strategic parity. Should the Soviets elect to greatly expand their ICBM forces, we will have to take measures to respond that will necessarily entail great additional expense, whether or not we have the MX system."

The Senate, meanwhile, took a stance diametrically opposed to that of the House on MX/MPS, by providing a sixty-day period—following the Administration's submission of its MX/MPS deployment plan—during which Congress has the option to discontinue the program. *(See "Capitol Hill," p. 104.)*

In the same vein, Sens. Harrison Schmitt (R-N. M.) and William Roth Jr. (R-Del.) presented a "sense of the Senate" resolution that sought termination of all funding of the MPS basing mode of MX. (The resolution was not voted on because the two Senators withdrew it, *after* they held a press conference announcing this "Schmitt-Roth Amendment" to the Defense Authorization Bill.) The two Senators suggested that instead of deploying MX in an MPS mode, the new ICBM should be placed in existing Titan and Minuteman silos and defended by a variety of Ballistic Missile Defense systems, "including the Low Altitude Defense System, exoatmospheric systems, and space- and airborne systems."

Senators Schmitt and Roth did not deal with the vast costs, enormous lead times, technological uncertainty, and questionable effectiveness of multitiered ABM systems, especially their spaceborne components.

IN FOCUS...

Washington Observations

★ One of the basing modes studied—but rejected for a variety of reasons—as part of the Air Force's MX program involved an orbital system, patterned after the Soviet FOBS (fractional orbital bombardment system). Basic concept of this approach involves emplacing large and powerful missiles in existing Minuteman silos and providing these missiles with a dual capability to either fly a fractional orbit, thus approaching the Soviet Union from the south, or injection of warheads into space orbit.

In the latter circumstance, the warheads can be de-orbited on command to descend on their targets or, once the crisis is past, brought down into the ocean and retrieved. A missile of this type would nearly fill the available space in existing silos and could deliver about 10,000 pounds into a 100-mile-altitude orbit or 1,200 pounds into geosynchronous orbit 22,300 statute miles above the earth.

Such a system would lack hard-target kill capability, could trigger instant Soviet strikes, and is subject to false alarms and deliberate Soviet spoofing.

An option that is being looked at with some favor by several influential defense experts active in the political realm is the so-called "Midgetman," a single-warhead ICBM, weighing about 25,000 pounds. Between 3,000 and 4,000 of these fifty-foot-tall, single-warhead missiles could be deployed in the areas presently occupied by two or three Minuteman wings. Spaced about a mile apart, the fixed silos of "Midgetman" would require a total deployment area of about 4,500 square miles. Even with a relatively simple single-warhead missile and small vertical shelters, the cost of such a system exceeds that of MX/MPS, according to Air Force and DoD studies. Thus, this approach was not pursued by the Air Force beyond the study stage.

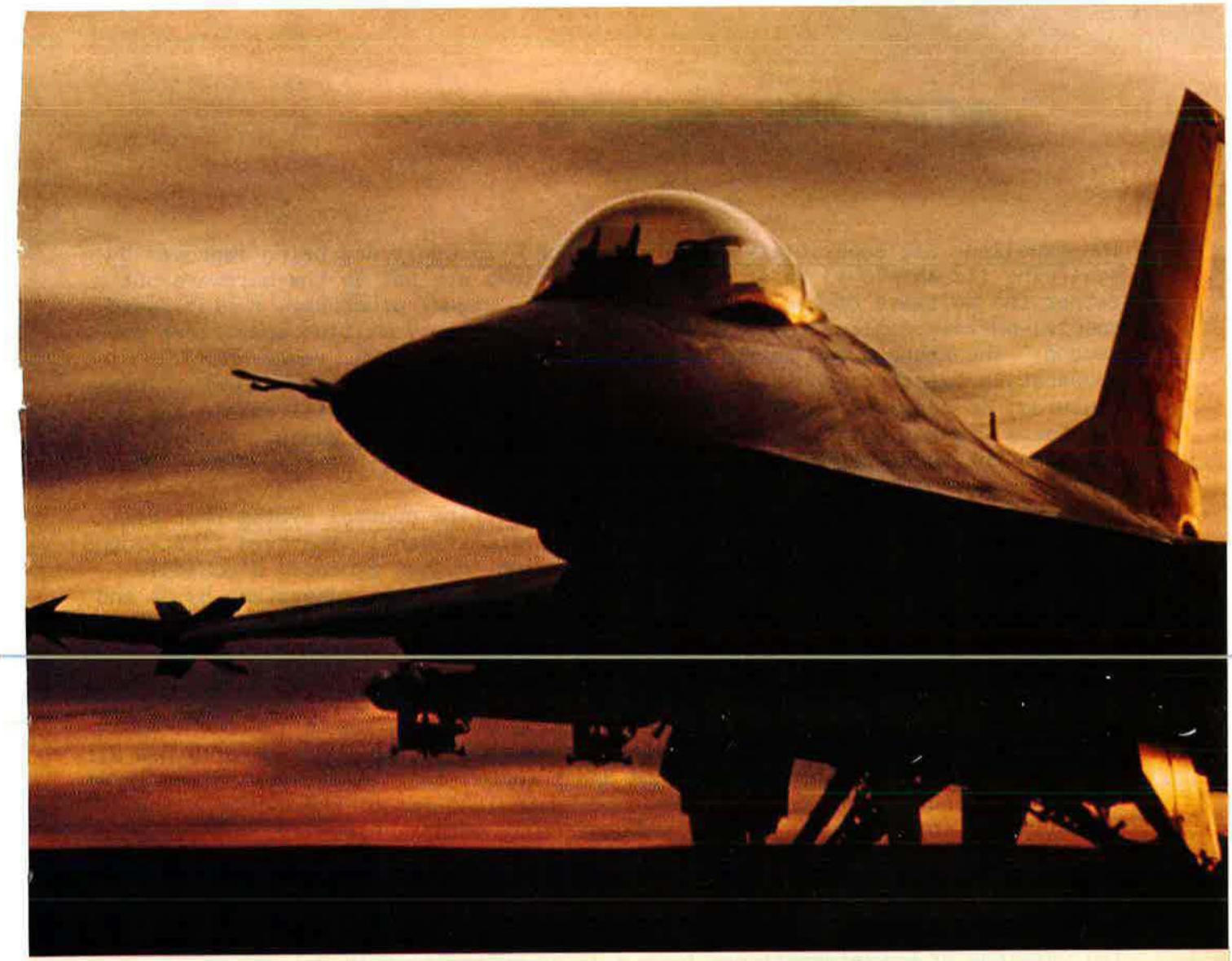
★ Latest Defense Department deadline for submitting to the White House a decision on what kind of multirole bomber (or bombers) to put into production was set for June 15 of this year. To date, two meetings have been held between OSD officials headed up by Defense Secretary Caspar Weinberger, JCS Chairman Gen. David C. Jones, and senior Air Force leaders.

Reportedly no conclusions were reached because of unresolved questions concerning costs and schedule of various competing designs and the Secretary's desire to discuss personally certain details with relevant aerospace industry executives.

The Air Force continues to recommend immediate go-ahead on a B-1 derivative known as the B-1V to be followed by ATB (for advanced technology bomber, popularly known as the "Stealth" bomber) when the technologies associated with such low observable designs have reached sufficient maturity.

Development of Stealth bombers probably will entail a competitive prototype approach since two basic design options are available, one involving a flying wing configuration and the other using an empennage. There are conflicting views among various experts on how soon and at what cost and risk Stealth bombers could be put into production even though a number of small aircraft utilizing these technologies reportedly have been in flight test for some time.

★ Sen. Gary Hart (D-Colo.), often sage and sometimes iconoclastic in his thinking on defense matters, appended a philosophical critique of recent defense trends to the FY '82 defense authorization bill. Although avoiding blame in any specific direction, Senator Hart was exasperated by the traditional intellectual shortcut of largely focusing the defense de-



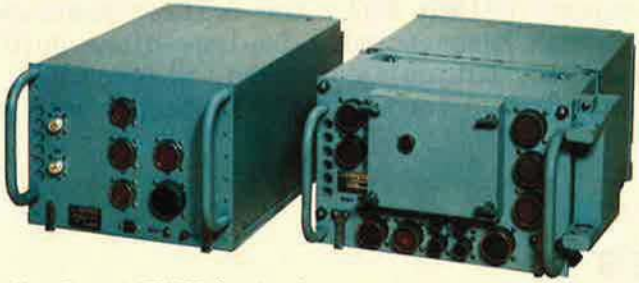
The USAF's JTIDS Class 2 terminals are about to take off at Singer.

The U.S. Air Force has awarded the Singer Kearfott Division and its project partner, Collins Government Avionics Division of Rockwell International, the full-scale development contract for 20 TDMA JTIDS Class 2 terminals.

Singer previously furnished 16 advanced development models of JTIDS Class 2 terminals to the U.S. Air Force and U.S. Navy, and to the United Kingdom Royal Air Force Establishment.

Singer's JTIDS terminals have undergone strenuous flight testing at Eglin Air Force Base and simulation tests by the U.S. Navy and by the RAE, Farnborough.

In addition, Singer is under contract to the U.S. Navy to examine the design concepts for a Distributed Time Division Multiple Access Terminal (DTDMA).



Singer-Rockwell JTIDS FSD Class 2 terminal.

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SCIENCE/SCOPE

The excellent air superiority features of the F-15 Eagle are being improved by modifying its AN/APG-63 radar. The modifications are not to the hardware but rather the software of the radar's programmable signal processor, a high-speed, special-purpose digital computer capable of more than 7 million operations per second. The changes add capabilities like track-while-scan, radar non-cooperative target recognition, and advanced electronic countermeasures. These features, in combination with advanced air-to-air missiles, will enable the U.S. Air Force fighter to attack many targets from beyond visual range. Hughes supplies the radar to McDonnell Douglas Corp., builder of the F-15.

High-rate production continues on the laser tank fire control system that will give the U.S. Army's M60A3 main battle tank a significantly improved first-round "hit" capability. In one recent 14-month period, Hughes exceeded a schedule that called for the delivery of 596 laser and 626 computer subsystems by 84 and 60 subsystems respectively. The sight unit for the fire control system contains a laser rangefinder that accurately and instantaneously determines the distance to a target. The computer processes the range with other data to send azimuth and elevation firing commands to the tank turret and main gun.

Norway's NATO air defense system will be improved with the addition of a new air defense radar. The Hughes Air Defense Radar (HADR) is a remote-controlled radar designed to provide air defense commanders with long-range, three-dimensional surveillance information. It will automatically detect, classify, and report on all targets in its area of coverage. HADR has extremely low sidelobes, which make it virtually jam-resistant. The system also has automatic troubleshooting and fault isolation to substantially reduce maintenance costs.

Two versions of F-5 aircraft now have a laser system to help deliver weapons with pinpoint precision. The system is called the Laser Target Designator Set (LTDS). A crewman sights a target through an optical telescope and fires the laser designator. The beam passes through the aircraft canopy to the target and is reflected like a beacon. Laser-homing weapons guide themselves to the target by homing on this spot. Hughes delivered the final designators ahead of schedule to prime contractor Northrop Corp. The LTDS is being installed in F-5B and F-5F aircraft for foreign military sales.

The 1000th airborne TOW missile system has been delivered by Hughes to the U.S. Army for installation in a Cobra attack helicopter. The system incorporates a telescopic sight unit that enables gunners to accurately fire TOW missiles from standoff ranges against tanks, trucks, and ground installations. Besides being the tank-stopper for the AH-1 Cobra series used by the Army, Marine Corps, and several other nations, the system has been installed on the Hughes Helicopters 500 MD, the Bell Helicopter TEXTRON 206L, the British Westland Lynx, the Italian Agusta A-109, and the German Messerschmitt-Boelkow-Blohm BO105. The Hughes-developed TOW (Tube-launched, Optically tracked, Wire-guided) missile has been deployed with the air and ground forces of 32 foreign countries.

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bate on "how much to spend and very little on what to spend it for. The deficiency is that there is not much correlation between the action recommended here and what history suggests is important in winning wars."

The emphasis should be on change in kind, not just change at the margin, he suggested, adding: "We need to focus on change which creates a whole new situation, change which makes many of the opponent's assets, forces, and tactics obsolete."

A growing number of people, he said, grouped loosely under the rubric of military reformers, are seeking to change the terms of the defense debate by focusing "less on management, funding levels, and on what the services want, and more on the art of war itself."

The debate, Senator Hart believes, "will be driven by those who ask in the area of defense what President Reagan asked the Congress in his recent address on the economy: 'Isn't it time we tried something new?' "

While there is no arguing with the proposition that to obsolete one's adversary's hardware and tactics is laudable, there remains a pivotal question: Where are the breakthroughs in tactics and weaponry that make this possible?

IN FOCUS...

★ Early this year, the Pentagon informed Congress that "Soviet phased-array radars, which may be designed to improve impact predictions and target-handling capabilities for ABM [anti-ballistic missile] battle management, are under construction at various locations throughout the USSR. These radars could perform some battle management functions as well as provide redundant ballistic missile early warning coverage. The first of these radars is expected to become operational in the early 1980s."

This official statement corroborated earlier reports on this matter that had appeared in this space and raised serious questions about Soviet compliance with the terms of SALT I ABM Treaty. Based on this and complementary information Sens. Jake Garn (R-Utah) and Ted Stevens (R-Alaska), along with twenty-one cosigning Senators, urged President Reagan to "take a strong stance with respect to the issue of Soviet compliance" at the next meeting of the Standing Consultative Commission (SCC), a bilateral mechanism for enforcing SALT's terms.

Failure to protest Soviet actions skirting or violating the provisions of the treaty, the twenty-three Senators told the President, would "send a dangerous signal of complacency to the Soviets, and provide undesirable incentives for the Soviets to continue with a standard of practice which contradicts the very spirit of SALT."

Terming the new large radars suitable for ABM battle management "the basis of a Soviet breakout capability from the ABM treaty," the twenty-three Senators charged that the USSR recently appears "to have engaged in upgrade experiments involving the SA-10, an advanced high-performance [surface-to-air] system" by boosting the ABM battle management capability of the associated radars. The group also cited reports concerning development of high-performance interceptor missiles and possible deployment of a new ABM radar and interceptor system around Moscow.

★ Senior USAF leaders express delight and gratitude over the key role Sen. William Proxmire (D-Wis.) is playing in amending the Senate versions of the FY '82 appropriations and authorization bills to increase the PCS mileage allowance from 10¢ to 16¢ per mile and to increase the maximum SGLI (Servicemen's Group Life Insurance) coverage from $20,000 to $35,000. Senator Proxmire, in the past, has come across as an implacable defense critic. In a laudable volte-face, the Wisconsin lawmaker recently acted as the champion of several constructive measures in the military manpower sector as well as of a major hardware program, the reengining of the KC-135.

★ The Air Force considers it imperative to lay the groundwork for a new tactical fighter program. With a lead time of about ten and a half years from program launch to fielding of the first production aircraft, the Air Force informed Congress "we must begin now" with the development of an advanced tactical fighter for the mid-1990s and beyond.

The requirement for a new fighter stems from the need to counter performance gains in new Soviet fighters—which tend to negate the current qualitative edge of US fighters—and increasing related Soviet capabilities, which reduce the survivability of the current generation of US combat aircraft.

USAF's FY '82 budget request includes two R&D initiatives relating to advanced fighters. The Advanced Tactical Fighter (ATF) program will provide for industry participation in developing and formulating basic concepts for the Air Force's next tactical fighter. This conceptual effort prepares the ground for the development—under the Combat Aircraft Prototype (CAP) program—of flight-test aircraft to evaluate promising ideas germinated by ATF.

With a suitable engine the key to any new fighter, the Air Force and the Navy have launched in-depth studies of new-generation engines and of technology gaps that might have to be filled. One of the more innovative features of the Air Force's next tactical fighter could be some form of voice control.

★ Nineteen members of the House Armed Services Committee—most of them considered staunch supporters of a strong national defense—recently appealed to Secretary of Defense Caspar W. Weinberger "to make every defense dollar count and to root out inefficiency, waste, and fraud" in defense spending.

Professing their commitment to a "revitalized national defense that is second to none," the committee members warned that "extravagances in defense programs will not be tolerated—not by the public and not by members of the House Armed Services Committee [who] have heard many examples of waste. We have also listened to suggestions for improvement that are wide-ranging, numerous, and obtainable."

The public, the nineteen members of the House Armed Services Committee asserted in a joint letter to Defense Secretary Weinberger, "is willing to make personal and national sacrifices to ensure a strong defense [provided] the philosophy of efficiency and getting the most for our tax dollars. . . permeates all levels of defense procurement and spending."

Stressing the desperate urgency of a "priority system which evaluates our national need for procurement, research and development, and every other aspect of defense policy," the committee members pledged their support to Defense Department efforts "to make certain that tax dollars appropriated for defense are spent wisely and with the same tight fist we use in all areas of the federal budget." ■

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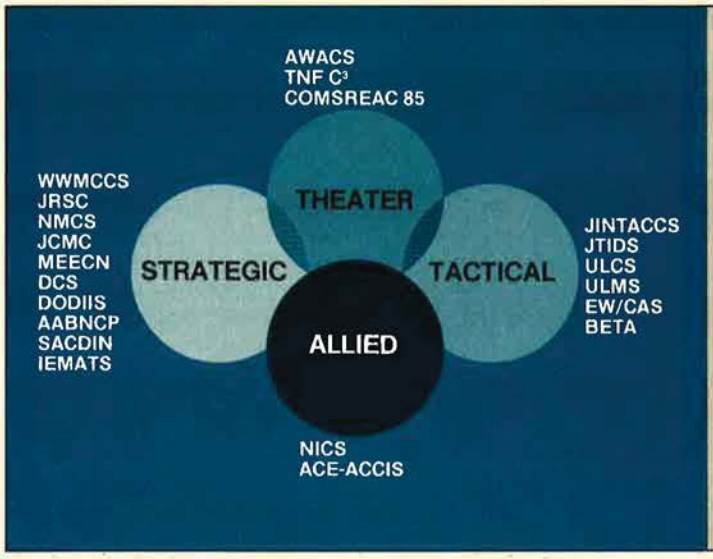

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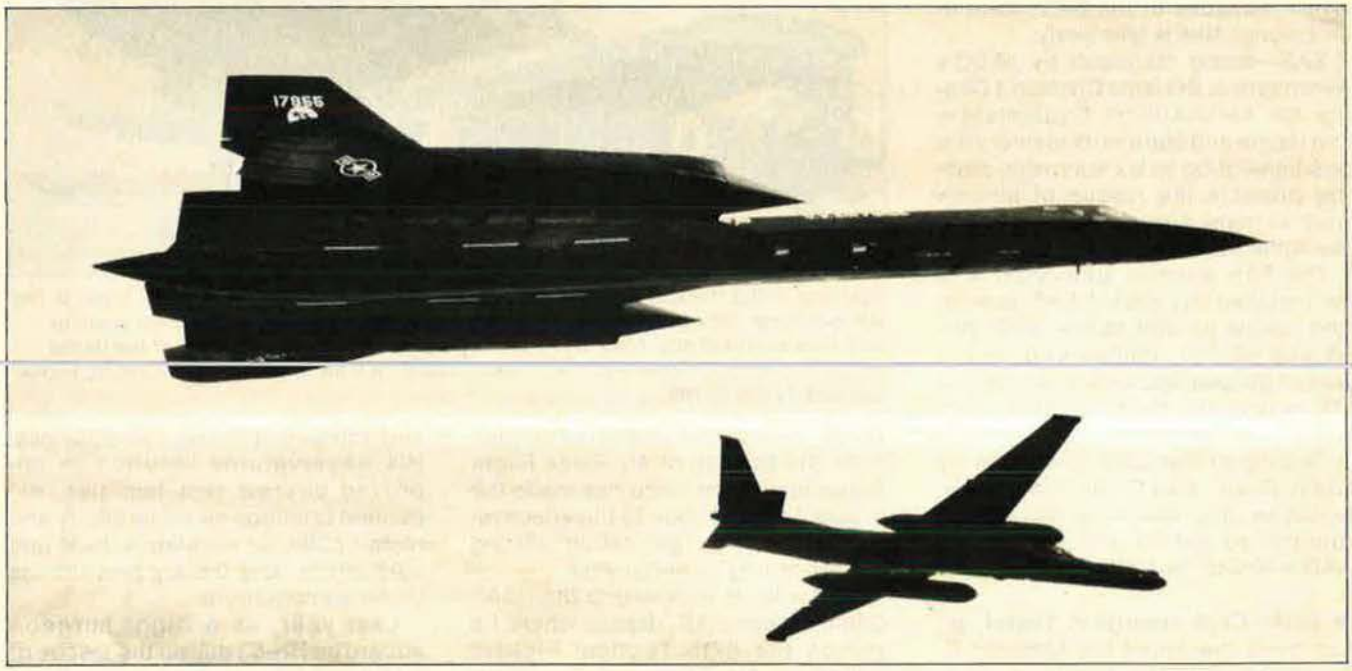
AEROSPACE WORLD
News, Views & Comments

By William P. Schlitz, SENIOR EDITOR



Photographed together in flight for the first time, an SR-71 and U-2 fly in formation above the Mojave Desert in California. Both reconnaissance-type aircraft are products of Lockheed-California Co.'s famed "Skunk Works." The Air Force has ordered twenty-five TR-1 tactical reconnaissance versions of the U-2R shown here.

Washington, D. C., June 4

★ Secretary of Defense Caspar W. Weinberger announced that during a period of three to five years the Rapid Deployment Joint Task Force (RDJTF) should evolve into a separate unified command—with its own geographic responsibilities, service components, forces, intelligence, communications, logistics facilities, and other support elements.

The Pentagon communiqué added that during the short time of the RDJTF's existence, considerable progress has been made in improving the US's strategic posture in Southwest Asia: detailed, joint contingency planning has been undertaken; service force and support requirements have been identified; joint exercises of rapid deployment forces of all four of the military services have been conducted—some in combination with the forces of other nations in the region; and significant equipment has been prepositioned to increase the speed with which forces can be deployed.

But more is needed to increase its power projection capability, including enhanced sealift and airlift, further prepositioning, improved facilities, and greater sustaining capability. The Administration's recent force structuring initiatives represent significant steps toward speeding progress, the Secretary's message declared.

As US capabilities grow, however, the structure of the RDJTF must grow to keep pace. The first change the Secretary will direct in the RDJTF's organization will be the assignment of XVIII Airborne Corps, and, shortly, other units to strengthen the RDJTF, its service components, and combat units. This will permit better deployability and sustainability of forces in Southwest Asia. Other changes will come later as additional resources become available for the command.

For the time being, the message said, relationships among the present unified commands will not change, and the RDJTF headquarters will continue to be located at MacDill AFB in Florida. Nor will its mission change. The RDJTF will continue to have a potential for worldwide deployment, but its major focus will remain on Southwest Asia.

Further details concerning evolution of the RDJTF—such as specifics and timing of changes, other forces assigned, headquarters size, and functional responsibilities—will be announced in the future as political and military developments permit.

★ The Air Force is developing a system to more accurately—and securely—search for and rescue downed aircrews.

The survival avionics system (SAS)—jointly funded by USAF, Army, and the Navy—is designed to pinpoint survivors at distances up to 115 miles (185 km) and operate in all weather, day or night, and over all types of terrain.

The SAS is to consist of two kinds of equipment—the avionics subsystem installed in the search-and-rescue aircraft, and a hand-held survivor

radio that automatically responds to interrogation signals initiated by the subsystem. Each of the radio units will have a unique identification code to which it alone responds.

In the use of prior search-and-rescue devices, there was a constant transmission of signals between the rescue aircraft and the survivor. In some instances in Southeast Asia enemy forces were also able to determine the location of the survivor, and to capture him before rescuers could arrive. Because of the SAS intermittent signal, this is less likely.

SAS—being managed by AFSC's Aeronautical Systems Division's Deputy for Aeronautical Equipment—can locate and store in its memory the positions of up to six survivors, making possible the rescue of aircrew from as many downed aircraft during the same mission.

The SAS avionics subsystem is to be installed on such USAF search-and-rescue aircraft as the HH-3, HH-53, and HC-130, officials said, and as part of the planned equipment for the HX helicopter modernization program.

Testing of the SAS, produced by Cubic Corp., San Diego, Calif., is to begin in July following installation aboard an HH-53 and HC-130 by ASD's 4950th Test Wing.

AEROSPACE WORLD

Restored under the sponsorship of Aermacchi S.p.A. of Italy is this Macchi C 205 V, the last and most distinguished of the "200" fighter series produced on a large scale by Italy between 1940 and 1943. The Veltro fighter provided the backbone of the Italian fighter arm during World War II and was classed on a par with such outstanding earlier warriors as the Bf 109.

★ USAF **Capt. George P. Taylor, Jr.,** has been presented the Malcolm C. Grow Award as the Air Force Flight Surgeon of the Year. Named for the first Surgeon General of the Air Force, the award is presented annually by the Society of Air Force Flight Surgeons to one "who has made the greatest contribution to the effectiveness of a flying organization" during the preceding calendar year.

Dr. Taylor is assigned to the USAF Clinic, Kadena AB, Japan, where he serves the 67th Tactical Fighter Squadron. Dr. Taylor has accompanied the squadron on many deployments during which he immediately sets up a flight-line clinic to meet the unit's medical needs.

Dr. Taylor was instrumental in developing a program whereby a physiological training officer was assigned to each PACAF flying squadron. He revised and upgraded medications and equipment in crash ambulances. His observations resulted in improved aircrew rest facilities, expanded briefings on visual acuity and midair collision avoidance, heat and cold stress, and dietary precautions under all conditions.

Last year, as a flight surgeon aboard an HH-53 during the rescue of a stricken US merchant seaman, Dr. Taylor earned the Sikorsky Helicopter Award, and this year was named the Pacific Air Forces Command Flight Surgeon of the Year.

A native Alabaman, Dr. Taylor received his B.A. (with majors in physics and Russian) magna cum laude from Rice University in 1975 and was a member of Phi Beta Kappa. He received his M.D. with honors from Baylor College in 1978.

Lt. Col. Betty K. M. Green, USAF, NC, has been presented the 1981 E. Ann Hoefly Award, named for a former Chief of the Air Force Nurse Corps and sponsored annually by the Aerospace Medical Association.

Colonel Green was cited for her exceptional accomplishments as Environmental Health Nurse, USAF Hospital, Bitburg AB, Germany, where she established an Environmental Medicine program used as a model throughout USAFE.

As a flight nurse, Colonel Green logged 2,000 hours during medevacs to Pacific and US bases, for which she was awarded the Air Force Commendation Medal and Air Medal.

From Buffalo, Wyo., Colonel Green received her nursing diploma from

The USS Intrepid *in the Gulf of Tonkin in September 1966. Built at a cost of $44 million, she was manned by 360 officers and 3,008 enlisted ranks and served for thirty-one years.* Intrepid *is to be a sea, air, and space museum.* *See item, pp. 31 and 33.*

Smiths Industries Electronic Instrument System - the *logical* choice

These rugged, multi-color, high resolution shadow mask displays are backed by 20 years' electronic display systems experience.

Manufactured to ARINC 725 requirements, the displays employ new optical filtering techniques which provide maximum brightness and color contrast with outstanding definition and resolution.

All flight, navigation, weather radar, systems and warning data can be displayed using stroke or hybrid techniques. Information may be switched from one display head to another in high integrity aircraft systems and hardware commonality minimises spares holding and cost of ownership.

Symbol Generator

Designed to ARINC 600 standards as required by ARINC 725 characteristics. The generator is housed in a 6 MCU package and contains display processors, symbol generators for stroke/hybrid displays, ARINC 429 digital interfaces and display unit interfaces.

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E-A-R INTERVIEW: DON GASAWAY

A noted military hearing conservationist speaks candidly about hearing protection and noise.

E-A-R: What do you feel are some of the most significant breakthroughs in hearing conservation in the past 25 years?

GASAWAY: Instrumentation and trained personnel that allow early detection of noise-induced hearing loss. Plus, effective hearing protection.

E-A-R: How does one know when they are encountering a potentially dangerous noise?

GASAWAY: If one must shout at three feet to communicate or use a loud voice at a one-foot distance, they are in a potentially hazardous noise area.

E-A-R: Obviously, noise-induced losses that you observed over the years must have presented a challenge to you, so what did you do about it?

GASAWAY: Education was my route. I tried to better educate medical personnel who were responsible for the health and welfare of Air Force, military and civilian personnel.

E-A-R: Have things changed? I mean, do people more readily accept noise as a real threat today – more so than when you first got involved with the Air Force program?

GASAWAY: Yes. All military and other education programs are more dynamic today than they were in the past. Both public and private sectors are more aware and are initiating hearing conservation programs.

E-A-R: What led you to get involved with the area of hearing conservation?

GASAWAY: Seeing hundreds of Air Force personnel who had lost hearing due to excessive noise was the ultimate challenge. Something had to be done. I was truly motivated.

We will never achieve a noise-safe environment.

E-A-R: Do you believe that we will ever achieve a noise-safe environment?

GASAWAY: No!

E-A-R: Why not?

GASAWAY: The by-product of advanced society is noise. We readily accept it.

E-A-R: Is there a solution?

GASAWAY: Yes! Hearing protectors that are effective, easy-to-use, and comfortable. Protectors like E-A-R™ Plugs. In my years of experience, they were the most accepted and readily worn of the various hearing protectors available. They attenuate noise remarkably well, and they do prevent noise-induced hearing loss for one simple reason, they are worn.

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"If one must shout at three feet to communicate... they are in a potentially hazardous noise area."

"I tried to better educate medical personnel..."

"There have been breakthroughs... E-A-R Plugs."

the Presentation School of Miles City, Mont., and her B.A. in nursing from Incarnate Word College, San Antonio, Tex. She came on active duty in 1961.

★ Flying safety records kept by the Air Force Reserve show that thirteen AFRES squadrons have achieved mishap-free flying records of twenty years or more. The squadron with the longest accident-free span is the 64th Tactical Airlift Squadron based at Chicago-O'Hare IAP, which has flown without a mishap since April 5, 1947. In the process, the squadron has amassed 120,056 flying hours. It presently flies the C-130A Hercules.

The AFRES squadron with the most mishap-free flying hours is the 704th Tactical Airlift Squadron, Bergstrom AFB, Tex., which since May 25, 1955, has flown 155,107 hours. It flies the C-130B.

★ The first reunion of USAF's airborne communicators is scheduled for July 10–12 at Offutt AFB, Neb.

AEROSPACE WORLD

The reunion is timed to celebrate twenty years of the airborne command post Looking Glass program, during which the highly skilled technicians have provided the airborne battle staff with a global communications capability justifying the term Worldwide Airborne Command Posts (WWABNCP).

The communicators are known by such handles as RO (radio operator), CTO (crypto operator), RM (radio maintenance), and CCO (communications controller). They are authorized to wear enlisted crew member wings, and a select few the Air Force missile badge.

In Southeast Asia, the airborne communicators during a project dubbed Combat Lightning never had a commissioned officer assigned to them. The project was headed at all times by a senior NCO who scheduled the staffing, pulled alert, and flew his share of the communications command and control missions.

During the reunion, past and current crew members and their families will have the opportunity to tour the EC-135 ABNCP and the new E-4 series ABNCP.

Contact CMSgt. Wayne Buhr, AUTOVON 271-6233 or (402) 734-5738, or SMSgt. Harry Roller, AUTOVON 271-2618 or (402) 291-6479 for details.

★ On April 16, 1945, a Japanese aircraft plunged through the flight deck of the USS *Intrepid* off the coast of Okinawa, causing damage that took the carrier out of the final months of the war.

In 1962, *Intrepid* was redesignated an antisubmarine carrier and subsequently served twice as the Prime Recovery Ship during the Mercury and Gemini space programs. She served

Vietnam Veterans Memorial Design Announced

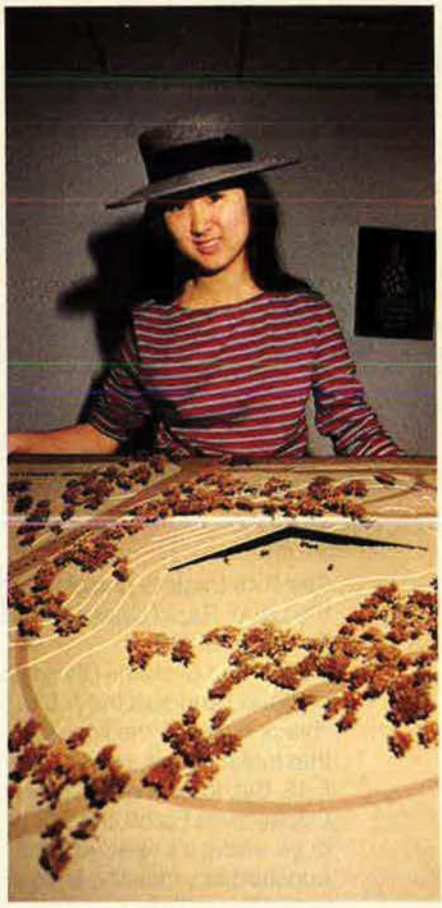
In May, judges for the Vietnam Veterans Memorial Fund announced the winning entry in the nationwide Vietnam Veterans Memorial design competition. *(Also see p. 106.)* The memorial, created by twenty-one-year-old Yale architectural student Maya Ying Lin, is to be two long, low walls emerging from a rift in the earth and meeting in a "V." It will be sited on a two-acre park on the Mall in Washington, D. C. On the walls will be inscribed the names of the 57,692 Americans killed in the war.

Following is the designer's description of the war memorial design.

"Walking through this park-like area, the memorial appears as a rift in the earth—a long, polished black stone wall, emerging from and receding into the earth. Approaching the memorial, the ground slopes gently downward and the low walls emerging on either side, growing out of the earth, extend and converge at a point below and ahead. Walking into the grassy site contained by the walls . . . we can . . . make out the carved names upon the memorial walls. These names, seemingly infinite in number, convey the sense of overwhelming numbers, while unifying those individuals into a whole. For this memorial is meant not as a memorial to the individual, but rather as a memorial to the men and women who died during the war, as a whole.

"The memorial is composed not as an unchanging monument, but as a moving composition, to be understood as we move into and out of it; the passage itself is gradual, the descent to the origin slow, but it is at the origin that the meaning of this memorial is to be fully understood. At the intersection of these walls, on the right side, at the wall's top, is carved the date of the first death. It is followed by the names of those who have died in the war, in chronological order. These names continue on this wall, appearing to recede into the earth at the wall's end. The names resume on the left wall, as the wall emerges from the earth, back to the origin, where the date of the last death is carved, at the bottom of this wall. Thus the war's beginning and end meet; the war is 'complete,' coming full circle, yet broken by the earth that bounds the angle's open side, and contained within the earth itself. As we turn to leave, we see these walls stretching into the distance, directing us to the Washington Monument, to the left, and the Lincoln Memorial, to the right, thus bringing the Vietnam memorial into historical context. We the living are brought to a concrete realization of these deaths.

"Brought to a sharp awareness of such a loss, it is up to each individual to resolve or come to terms with this loss. For death is in the end a personal and private matter and the area contained within this memorial is a quiet place, meant for personal reflection and private reckoning. The thick granite walls, each 200 feet long and ten feet below the ground at their lowest point (gradually ascending toward ground level) effectively act as a sound barrier, yet are of such a height and length so as not to appear threatening or enclosing. The actual area is wide and shallow, allowing for a sense of privacy, and the sunlight from the memorial's southern exposure along with the grassy park surrounding and within its wall contribute to the serenity of the area. Thus, this memorial is for those who have died, and for us to remember them. . . ."



—Photo by Brad Markel

Architectural student Maya Ying Lin and her winning design for the proposed Vietnam Veterans Memorial to be built on the Mall in Washington, D. C.

We travel with the Eagles!

The Bendix F-15 Avionics Intermediate Shop

The F-15 Eagle is one of the mainstays of the USAF Rapid Deployment Force. So is the Bendix F-15 AIS.

The Test Systems Division of Bendix designed and built the AIS to test all of the "black boxes"...the line replaceable units that make up the avionics system of the F-15. But, to be a working part of the Rapid Deployment Force, the AIS has to be able to go where it's needed. That means rugged construction, mobility, ease of setting up... in addition to highly precise test capabilities.

In operations Red Flag and Coronet Eagle, it has been established that the F-15 AIS will be where it is needed to maintain the Eagles...and can be set up, checked out, and operated by Air Force personnel.

The F-15 AIS is an outstanding illustration of the Bendix approach to creating test systems. More than testing expertise and experience, Bendix brings innovative thinking to every challenge.

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three tours in the Gulf of Tonkin as a front-line carrier during the war in Southeast Asia.

This year, *Intrepid* will be permanently berthed at Pier 86 South on the Hudson River in New York City, where she will provide a home for the new Sea-Air-Space Museum to be opened to the public by the year's end.

Some of the exhibits planned for an eventual 300,000 square feet of display space:

- An array of aircraft on the flight deck tracing the evolution of aviation through the years.
- A theater meant to recapture the sensations of flight and portray carrier activity through visuals and sound.
- Pioneers Hall, featuring a recreation of the first shipborne landing by an aircraft in 1911.
- Space Hall, to include reproductions of the Lunar Landing Module and the Space Shuttle.

Of the twenty-four Essex class carriers built, only *Intrepid* and *Yorktown,* on display in Charleston, S. C., as a memorial, will survive the scrap heap.

★ In an application combining the Defense Mapping Agency's digitized terrain data base and the latest computer-generated imagery (CGI) for aircraft simulators, realistic terrain scenes can be produced for use in mission planning, strike operations, or other applications. The software has been developed by General Electric's Simulation and Control Systems Department at Daytona Beach, Fla.

AEROSPACE WORLD

A typical result is shown in the accompanying photograph. Generated in a few seconds from the DMA terrain data base, the GE system portrays friendly and enemy force data, sensor and threat coverages, and topographic data such as snow coverage, tree lines, rivers, and the like.

As now constituted, the scene requires a few seconds to generate. Future work will reduce the generation time to near-instantaneous.

★ A recently modified C-141B "stretched" StarLifter has hauled 67,000 pounds of cargo nonstop from McGuire AFB, N. J., to Dhahran, Saudi Arabia.

The historic flight required the aid of three SAC KC-135 Stratotankers in what became the first triple in-flight refueling of a C-141B during an assigned airlift mission. It was also the longest operational C-141B mission with maximum cargo load.

The 6,440-nautical-mile flight, which usually takes two days in a C-141A because of the requirement for refueling stops and crew rest, took only 13½ hours. In-flight refuelings took place over the Canadian coast, west of France, and over Sicily.

To date, Lockheed-Georgia Co., Marietta, has delivered 127 stretched C-141s to MAC bases. The program should be concluded by the middle of next year.

★ In another step toward the modernization of North American Air Defense Command radar coverage in the western US and Canada, TAC is transferring Air Defense TAC's day-to-day management of air defense resources from Colorado to Langley AFB, Va.

Langley is to gain about 300 people, plus their families.

Events leading to the transfer began in 1979 with USAF's decision to deactivate Aerospace Defense Command as a major command. TAC subsequently became responsible for organizing, training, and equipping strategic air defense forces for NORAD. Air Defense TAC was established as Detachment 1, TAC, at Colorado Springs, Colo., on October 1, 1979.

ADTAC has some 14,000 people at six air division/control centers, seventy-five radar sites, and a number of active-duty and ANG facilities ranging over CONUS, Alaska, Canada, Greenland, and Iceland.

★ A major milestone was passed in DoD's Assault Breaker Demonstration Program with the first successful launch of a Vought T-22 missile at the White Sands Missile Range, N. M., this past spring.

The flight initiated a twelve-missile flight test program conducted under direction of the Defense Advanced Research Projects Agency with joint Air Force and Army participation.

The program is aimed at integrat-

GE's Simulation and Control Systems Department, Daytona Beach, Fla., has developed computer-generated terrain imagery for use in mission planning, strike operations, and other applications. See item.

The first successful launch of a missile in the joint USAF/Army Assault Breaker Demonstration Program at White Sands Missile Range. See item above for details.

ing the emerging technologies of missile-borne munitions dispensers, advanced targeting radars, and precision-guided munitions into a system to defeat enemy armored forces far to the rear of the main battle area.

The Vought missile, fired from a lightweight Lance launcher, dispersed inert Terminally Guided Sub-Missiles (TGSM) over a circular target area, closely matching preflight predictions.

Hughes and a Grumman/Norden team are developing the radars to be flown aboard an F-111 for the Assault Breaker tests. General Dynamics/Pomona and Avco are developing two separate submunitions that use infrared terminal guidance systems for target acquisition and homing.

Future flights in the program are to evaluate the Vought missile and a Martin Marietta T-16. The tests are to become more complex and will include precision weapon delivery with radar-assisted guidance and dispersal of live submunitions that will terminally guide themselves to moving tank targets, officials said.

★ Under a $2.7 million Air Force contract, Goodyear Aerospace Corp., Akron, Ohio, is to build F-16 canopies that can withstand the impact of collision with a four-pound bird while aircraft are flying at 400 mph.

Bird impacts have caused pilot injuries and even crashes.

Because of the F-16's tactics of flying low and fast to escape enemy radar detection, the canopy has also been designed to contend with the extreme temperatures to which high-speed aircraft are subjected, up to 270 degrees Fahrenheit, or about seventy degrees more than most military types.

The F-16 canopy is ten feet long, about a third longer than most military aircraft canopies, and has an extreme wraparound bubble shape that allows maximum visibility.

Seven layers of material will be used in construction. Inner and outer surfaces are acrylic to protect inner polycarbonate layers against ultraviolet rays, which would degrade impact resistance. The canopy will weigh only 106 pounds, or about twenty pounds less than others of comparable size.

Deliveries are scheduled to begin to AFSC's Aeronautical Systems Division, Wright-Patterson AFB, Ohio, in September and continue through August 1982.

★ NASA plans to launch into orbit in August 1982 the first infrared telescope to operate in space.

AEROSPACE WORLD

The space telescope will be able to "see" infrared emissions from stars heretofore denied ground telescopes because they're filtered out by the earth's atmosphere.

The twenty-four-inch telescope, known as IRAS (Infrared Astronomical Satellite), is being managed by NASA's Ames Research Center, Mountain View, Calif., and built by Ball Aerospace Systems, Boulder, Colo.

According to officials, the orbiting device will, among other things, survey the entire sky, mapping "perhaps a million infrared sources. It will almost certainly find some strange new kinds of stars, and entire infrared galaxies. . . . It may well change our concepts of the energy sources in the universe."

An international venture, IRAS is to be mated to its Dutch-built spacecraft and then launched from the Western Test Range at Lompoc, Calif. Subsequent operations will be run from a control center in England during its expected one-year lifespan.

★ A test of long-distance communications involving the use of an E-3A airborne warning and control system aircraft was successfully conducted recently.

The test used two TFC-102 satellite communications vans from the 3d Combat Communications Group at Tinker AFB, Okla., one of which was deployed to Holloman AFB, N. M.

During the test, the E-3A established communications with the van at Holloman, which then relayed a retransmission via satellite to Tinker. Also, message traffic transmitted by the aircraft to a ground station at Holloman was relayed via a wire hookup to the Tinker van.

Besides the antenna systems and interface cabling, used in the test were UHF satellite radios, a teletype,

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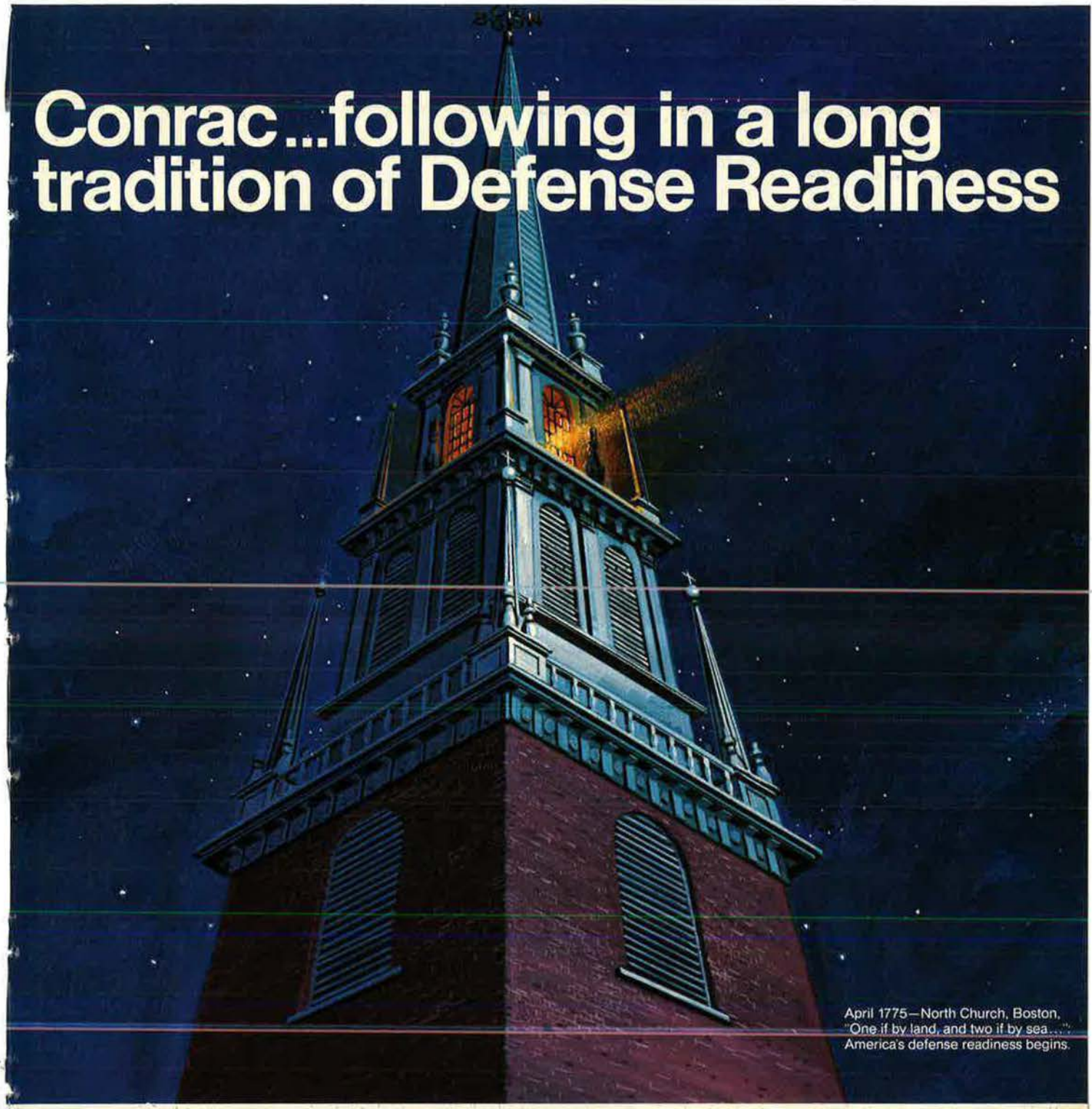
Conrac...following in a long tradition of Defense Readiness



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voice and data crypto equipment, and generators.

★ ITT Avionics Division, Nutley, N. J., has been awarded an Air Force contract to define an integrated architecture for an advanced airborne radio system that combines the functions of communication, navigation, and identification.

The objective is to greatly reduce the size of future airborne radio equipment. Currently, various types of radios aboard tactical aircraft perform the comm, nav, and ident functions. The ITT concept visualizes use of advanced devices and processor-controlled time sharing.

ITT has demonstrated that many components in aircraft radios are duplicated and could be eliminated or made multifunctional.

★ The US Postal Service in May began distribution of a new issue of eight stamps commemorating America's achievements in space.

The center four of the block of eighteen-cent stamps depicts the Space Shuttle being launched, jettisoning its boosters, unloading a satellite in orbit, and circling the earth prior to reentry. Central to the four stamps is the planet earth, and each bears the legend "Benefiting Mankind." On either side of the block of four is a vertically oriented pair highlighting such other US space activities as lunar exploration and probing the planets.

The space achievement stamps were designed by Robert McCall of Paradise Valley, Ariz., a space artist closely associated with the US space program since 1958. He designed the twin eight-cent stamps issued in 1971 to salute the first decade of US space ventures, as well as the 1974 Skylab commemorative, the Pioneer Jupiter and Apollo/Soyuz stamps of 1975, and the Viking missions stamp of 1978.

★ **NEWS NOTES**—Aerospace industry executive **James M. Beggs** has been named **NASA Administrator.** A Naval Academy graduate, he served in the Navy and then spent thirteen years with Westinghouse Electric Corp. Joining General Dynamics Corp. in 1974, he was responsible for the Convair, Electronics, Fort Worth, and Pomona divisions. In government, Mr. Beggs was NASA Associate Administrator from 1968–69 and Under Secretary of Transportation 1969–73.

Named **NASA Deputy Administrator** is **Dr. Hans Mark,** former Air Force Secretary and former Director of NASA's Ames Research Center, Mountain View, Calif.

A **Center for Naval Warfare** is being established at the Naval War College, Newport, R. I., "to serve as a **focal point, stimulus, and major source** of Navy strategic thinking." The Center is to "draw on the intellectual resources of the Navy, other US government activities, the academic world, and foreign countries to promote the highest-quality naval strategic thought."

The US will sell Japan **an additional four E-2C Hawkeye airborne early warning aircraft,** the Pentagon announced. This will bring to eight the Grumman-built E-2Cs on order, with the first two to be delivered in January 1983.

AFRES will assume a new mission with the activation, at Brooks AFB, Tex., of the first of a **planned five** electronic security squadrons. ■

Electronics Trends and Challenges

In electronics, as in other areas, the technology can move ahead faster than the organization's ability to master it, unless collared early. Thus, before electronics problems gallop ahead of the solutions, it is worthwhile to consider the challenges facing the Air Force today, and evaluate the possibilities for mastering them.

BY GEN. ROBERT T. MARSH, USAF
COMMANDER, AIR FORCE SYSTEMS COMMAND

THE spinning of the magneto on the Wright brothers' first airplane at Kitty Hawk marked the beginning of a long and happy marriage between electronics and the world of flight. The Air Force and the electronics industry have come light years since that historic day. In fact, they have grown up together, frequently depending on each other. Our young service looked to electronics for the capabilities needed to meet constantly evolving requirements; and, in turn, the Air Force sponsored electronic research that advanced the leading edge of technology, often resulting in profitable spin-offs for the commercial marketplace.

Today, we in the Air Force rely on electronics to an astonishing degree, one that could not have been envisioned in 1903. In the areas of avionics and communications, we have come to rely heavily on advances in electronics components and digital computers. In addition, the weapons we are capable of delivering on enemy targets have progressed from 20-mm cannon shells and iron bombs to "smart" missiles relying heavily on electronics.

Avionics and "smart" munitions merely head the list. Our administrative, supply, and personnel activities use optical scanning and word-processing equipment as a routine matter. In short, we rely heavily on electronics in every one of our primary and support mission areas.

A few statistics quickly illustrate the scope of electronics systems in today's Air Force. They represent about a third of the total value of Air Force weapons and equipment. Counting spares, we own and maintain more than a quarter million "black boxes," and Air Force Logistics Command will soon be supporting more than 40,000 computers.

Pound for pound, the most expensive parts of an airplane are the electronics; by themselves, avionics subsystems alone now account for about thirty percent of the flyaway costs. Over the lifetime of the aircraft, avionics support costs as a percentage are even higher than that.

. . . we own and maintain more than a quarter million "black boxes," and Air Force Logistics Command will soon be supporting more than 40,000 computers.

Within the total Fiscal 1982 requested funding of $960 million for Air Force RDT&E technology base activities, approximately $270 million is for electronics and electronic-related efforts—more than for weaponry. . . more than for flight vehicles. . . more than for propulsion and power.

Electronics Trends

The Air Force is engaged in an extensive array of significant electronic activities. Therefore, I believe it is important to concentrate on the trends and thrust of these activities.

While the technological problems facing us are many and formidable, their solutions are moving ahead, if not always at a gallop. The pace and volume of developments are one of the largest problems we face. The toughest challenges in the Air Force's electronic future are, in fact, managerial.

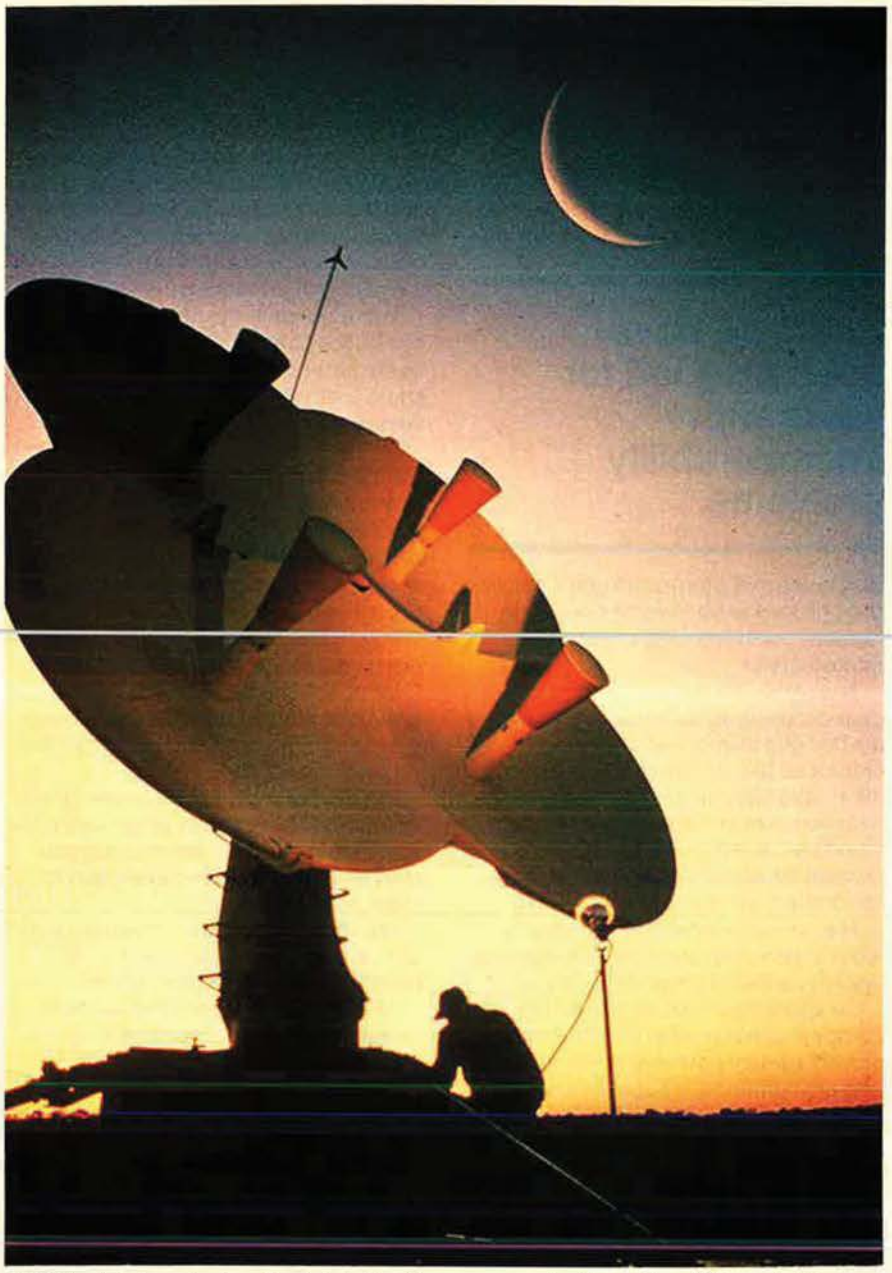
I want to elaborate on our Air Force's electronic management issues by posing, and then expanding on, what I judge to be some of the key questions facing us:

- How do we properly assimilate and direct the tremendous explosion of new electronic technology?
- How do we impose structure—architecture and interoperability—on our equipment and systems that make extensive use of electronics?
- How do we address the effects of the technology in human terms? For example, how do we make the complex electronic systems usable and maintainable by today's and tomorrow's airmen? And how do we make the vast amount of information we get from these systems usable by human decision-makers?
- How do we reduce the vulnerability of our electronic systems?
- And finally, how do we do all of these things without the cost eating us alive?

The foremost phenomenon in electronics today—military or otherwise—is rapid change. New developments come along at a mind-boggling rate. The typical advanced component stays out in front for only a few years before becoming obsolete. And the interval between major developments is decreasing—thus my first question.

At the heart of this galloping technology, of course, are the dramatic improvements in large-scale integrated (LSI) and very large-scale integrated (VLSI) microprocessors, which give us all sorts of advantages in weight,

Gen. Robert T. Marsh assumed the top post at Air Force Systems Command on February 1 of this year.



AFSC technicians declare that global military communications via orbiting satellites, while not yet commonplace, can be expected to be so in the near future. Above, a satellite downline antenna at a ground station.

volume, power, and reliability. The end is nowhere in sight.

This new technology enables us to meet some of our longstanding electronics needs such as jam-resistant and secure tactical communications, precision-guided munitions, and high-energy multimode airborne radars.

We have known for years that we needed such systems, but until recently did not have the technology to develop them within reasonable constraints of size, weight, and power consumption.

In spite of all the good things the new electronics technology can do for us, there are important limitations in our ability to use it.

It's a mixed blessing.

One of the toughest limitations to overcome is the high cost of the relatively few specialized systems we buy. When we can steer technology and the electronics industry to respond to our needs instead of the more lucrative, larger commercial markets, it costs us quite a bit. One response to this problem is the triservice very-high-speed integrated circuit (VHSIC) program, which will produce widely applicable integrated circuit chips for the military in quantities large enough to keep the commercial vendors interested.

Other limitations of electronics are the complexity and sophistication the technology brings to military systems. Equipment must be maintained throughout the world under the most difficult conditions, and there is always the need to standardize military equipment for supportability and interoperability.

The magnitude and rate of improvement in electronics technology have confronted us with huge problems in comprehending and selecting available technologies. We are much more concerned with this problem than are commercial users because the regulations under which we operate make our acquisition cycle a long one. The commercial world operates with considerably more flexibility and can react, almost overnight, to economic pressures and technological changes.

DoD has been working on reducing the length of the cycle; and, while it is being shortened, it still takes a number of years to acquire most of our electronic systems.

This makes us vulnerable to the possibility that while we are in the process of acquiring a system, newer technology will make it obsolete before we can field it. Many of those aspects that cause our systems to become obsolete—changing threat, improved operational procedures, and the lack of economic incentive to continue production of obsolete components—are seldom under our control. Our systems must then be able to evolve as requirements change and as technology advances.

In contrast to commercial systems, Air Force systems usually have much longer life spans. This makes the factors of growth capability and maintainability much more important to us; hence, our continuing emphasis on life-cycle costs and our constant concern with the progress of technology.

Providing the Architecture

Fortunately there is an approach that can help us assimilate new technology and cure some other problems as well. That approach has come to be known in the engineering world as architecture—a comprehensive planning framework within which systems can be conceived, designed, developed, and fielded. How to impose this kind of structure on Air Force electronics systems is another key question.

If you back off and look at our past

Gen. Robert T. Marsh is Commander, Air Force Systems Command, having assumed the post in February 1981 after nearly four years in command of AFSC's Electronic Systems Division. A World War II veteran (aerial gunner and aircraft mechanic on B-17s and B-24s), he graduated from the US Military Academy in 1949. His career has included stints as special weapons officer, project officer for weapon system development, ballistic missiles, and reconnaissance and electronic warfare.

development activities in perspective, you see a definite pattern of solving specific problems with *ad hoc* measures.

This lack of overall structure has manifested itself in several ways. In avionics, for example, we've seen an undisciplined proliferation of equipment performing essentially the same function. In other words, every new aircraft gets a set of new, unique radios, radars, reference systems, and displays. We can't afford this! As a step toward the solution to this problem, we established an organization called the Deputy for Avionics Control to ride herd on our avionics acquisition and support activities to impose reasoned standardization (*see "The Current Avionics Approach: Rational Standardization at Work," p. 62, July '80* AIR FORCE).

In C³I we have been plagued for years with interoperability problems. We tended to develop our systems piecemeal, designing them to perform specific missions, but without any controlling influence to make sure they would be able to work well together.

It has become painfully clear to us that we must put the nation's electronics developmental ability to better use. That is, we must come up with overall, long-range architectures and standards to prescribe how we want our systems to interoperate. These architectures must have the ability to accommodate both existing as well as new systems and also to provide for the incorporation of new electronics technology as it appears.

Increasing sophistication and complexity create another problem. We must bring our technology to bear in aiding the young airmen responsible for field maintenance of these systems. A major push is now under way to provide built-in test and trouble-shooting features in those complex systems that are being developed. We also have much work ahead of us in matching our electronic data-gathering capability to the actual information needs of our top decision-makers, aircrews, ground troops, and everybody in between.

From the top down, then, each decision-maker must have the specific information he needs, interpreted and displayed in a way he can use it quickly enough for it to be of some benefit. In modern conflict or crisis, that means immediately!

In C³I we have been plagued for years with interoperability problems.

The same modern electronic data-processing techniques that create this glut of information are being employed to correlate and interpret the information actually forwarded to the decision-maker. Other proposed techniques will even make it possible to present the commander with decision options in near real time.

The Air Force's need to continually reduce the vulnerability of its electronic systems is the next key issue on my list.

Consider this in the context of the European theater, where we are deployed against potential adversaries who are numerically superior and electronically sophisticated. Our forces would be extremely dependent on electronics, especially communications, as they go into battle. Many of our C³ assets, on which we would be relying heavily, are in fixed, forward locations.

One way to reduce vulnerability is with mobility. We're also looking at ways to increase the survivability of our fixed radar sites on the ground—reduce their vulnerability to antiradiation missiles, direct attack, and electronic countermeasures. We are also making our electronic systems more jam-resistant. There is a variety of ways to enhance survivability—the use of fiber optics to harden our communications and data busses, for example, as well as shielding and other passive measures.

In addition to these means to survivability, we are examining the possibilities of distributed systems: systems with segmented functions and equipment that can be separated physically and geographically, either in movable shelters or more permanent, remote fixed sites.

A big consideration in decreasing our vulnerability, though, is that the enemy, like us, would also be dependent on electronics in both defensive and offensive roles. To the extent that we can destroy, degrade, or deceive his electronics, we are that much further along in protecting our own.

There is a growing appreciation of this on the part of the Air Force, as well as the other services, and we have some promising electronic warfare developments under way.

Controlling Costs

Another area we must look at is the question of how to control costs. As I said earlier, a major portion of our total system costs is for electronics. If we are to keep our systems affordable, it naturally follows that we must attack the cost of buying and maintaining electronics in these systems. Part of the answer is just old-fashioned good program management—but we've got to do more than that.

We've got to capitalize on electronic component technology advances in the commercial arena—such as ruggedized microprocessors developed for the automotive industry.

We've got to cut down on what it costs us to maintain electronics—this requires better system component reliability and demands that we take greater advantage of built-in diagnostics.

We've got to get a better handle on developing and supporting weapon system software. While the cost of computer hardware has been decreasing, the proportion of system development cost for software has been increasing. We must bring more automation aboard to aid the software engineers and computer programmers.

I am convinced that many of the answers to our cost problems lie in the very things I just outlined—more structure and greater use of architecture leading to interoperability, standardization, standard interfaces, and information transfer.

The task before us in electronics is too complex to address by charging off in all directions without some overall roadmap to guide us. We must figure out what the pieces of the task are, how they fit together, and then systematically manage the pieces.

What are some specific things we might do? We have identified a number of areas in avionics where we can standardize. This is especially true of core

Command control and communications (C^3) has become as important to the US's defense posture as the weaponry that supports that posture. C^3 relies on advanced—and improving—electronic equipment such as radarscopes, a key element of the tactical forces (top), and the equipment at a SAC command post (above).

avionics—equipment and elements such as communications and navigation gear that are used in more than one aircraft.

Standard interfaces will help, too. They will allow us to retrofit our systems to incorporate new technology without excessive modification costs. We will also be able to mix and match products from different manufacturers and further reduce costs.

Modern electronics technology offers us the tools to design more reliability and maintainability into our systems. Integrated circuits can replace whole "black boxes" along with their unreliable cable and card connectors. Test and fault isolation circuitry can finally be built into systems at low enough costs that they won't be traded during system design. This promises tremendous potential to reduce maintenance and support costs.

We are imposing more structure on

We've got to get a better handle on developing and supporting weapon system software.

the computer hardware and software built into our weapon systems. This structure centers on the use of standard instruction set architectures and programming languages. Here again, we expect a significant reduction in development and support costs.

If we want to reduce our electronics manufacturing costs, we need still more emphasis on "front end" thinking and planning in the acquisition cycle. Here again is that recurring theme of more structure, of charting our course before we start out. The decisions with the most impact on cost come early in a program, when the system is under design. One of the biggest cost drivers in the manufacture of ground-based electronics is an interface gap between design and manufacture. We are looking at ways to apply integrated computer-aided design and manufacturing to electronics to bridge that gap and help bring costs down.

We in the Air Force clearly rely on electronics to a degree unparalleled in the past. This reliance has been and will continue to be driven hard by the critical need for technological superiority in our modern weapon systems.

We are fortunate that our need for electronics coincides with a continuing boom in electronic technology. Hopefully, the electronics industry will steer its technology thrust more in the direction of military applications, remembering the many successful spinoffs derived in the past.

With industry's help and cooperation, I am certain we will do even more to adapt the possibilities of electronics to our system needs and to the use of human operators, and still keep the cost of future systems under control. That's the kind of happy marriage we look forward to. ■

The Promise of Fiber Optics

Jamproof, using little power, and capable of transmitting enormous masses of data, fiber optics promise to alter the shape of communications systems in a few short years as the technology matures.

BY BILL WALSH

This fiber-optics digital transmitter module operates at a data range up to 50 megabits per second, in a temperature range from −55° C to 100° C. The module is ¾" by 1" by ⅜". (Sperry Univac photo by Joe Giannetti)

EMERGING from defense laboratories is a technology capable of improving the overall utility of weapon systems—especially when operating in severe, hazardous military environments. After more than a decade of development, technologists have perfected thread-like optical fibers as replacements for one of the weakest elements in electronic systems—the metallic transmission lines over which electrical signals are carried. Although these advancements may seem esoteric or difficult to understand, over the next few years the technology will inundate your everyday life.

To understand the magnitude of what's coming and how it will transform military systems, consider these estimates: The military services will spend more than $1.5 billion on fiber-optics hardware through the remainder of this decade. The amount will grow to more than $10 billion by the year 2000.

What types of systems will use the new technology? Virtually every hard-wired weapon system and equipment that currently uses copper wire or co-axial cable for point-to-point and network interconnections will make the switch to fiber-optics transmission lines. Initially, this will include hardware for communications, surveillance, collecting intelligence, and command and control systems.

Following closely behind will be high data rate transmission lines for local area networks and bussing architectures for such information transfer applications as inter- and intra-computer data processing, computer-aided decision-making, video conferencing, electronic warfare, and ultra-reliable fly-by-light control and guidance subsystems for aircraft and missiles.

The three services have prototype fiber-optic programs under way. The Navy is concentrating on using the technology in undersea cables, tethering torpedoes, towed underwater platforms, and for cabling on-board submarines and surface ships. The Army is working on fiber-optic tethers for anti-armor missiles, similar to the wire-guided TOW missile, combat command and control systems, and digital fly-by-light flight controls for helicopters. Air Force developers are concentrating on developing fiber-optic cables for land tactical and support systems. One lead program is aimed at replacing twenty-six-pair copper-wire cables and coaxial cables used in TAC's 407L system. Other programs encompass several transmission lines used in command and control communications and intelligence systems and replacements for metal cables used in aerospace vehicles.

Although many prototype designs are proving that the technology can enhance electronic system performance and capabilities, many new weapon system programs in development are not using the fibers. Program managers claim the lack of standards and the high cost of production hardware are the main reasons. They are indeed correct, and it is because development and acquisition agencies responsible

for standards have a myopic attitude towards ameliorating these factors.

Fiber-optics technology is the linchpin for major advances in related optical technologies. Already in basic development are new optical circuit designs that depend on the broad-scale implementation of fiber-optic transmission lines to achieve system-level figures of merit ten to 1,000 times greater than are possible with digital electronic circuits and conventional wiring. Sensors, such as FLIR thermal imagers and computer-managed systems and equipments could improve their operation by using optical circuits and fiber-optic transmission lines to remote infrared sensors and displays more efficiently, reliably, and economically. Optical-digital computers could be used to enhance the performance of radar, communications, guidance and control, surveillance, and electronic-warfare equipments.

Why Fiber Optics?

Understanding the properties and fundamental capabilities of fiber optics is essential to realizing the advantages of the technology and why it should be used. Since the mid-1970s, military labs have been evaluating fiber technology to determine its essential benefits. They have found that optical fibers are much more capable of meeting technical system requirements than copper wire or coaxial transmission lines, especially when operating in hazardous military environments. The fibers can transmit greater amounts of data over longer distances, are impervious to electromagnetic interferences, and are physically much smaller, lighter, and less cumbersome.

Optical transmission lines use light waves, which have no electrical charge, to transmit signals. Since they do not rely on electron charge, electrical interferences caused by high voltages, radio frequency waves, large magnetic fields, lightning, or electromagnetic pulse generated by nuclear blasts do not affect signals transmitted over optical fibers.

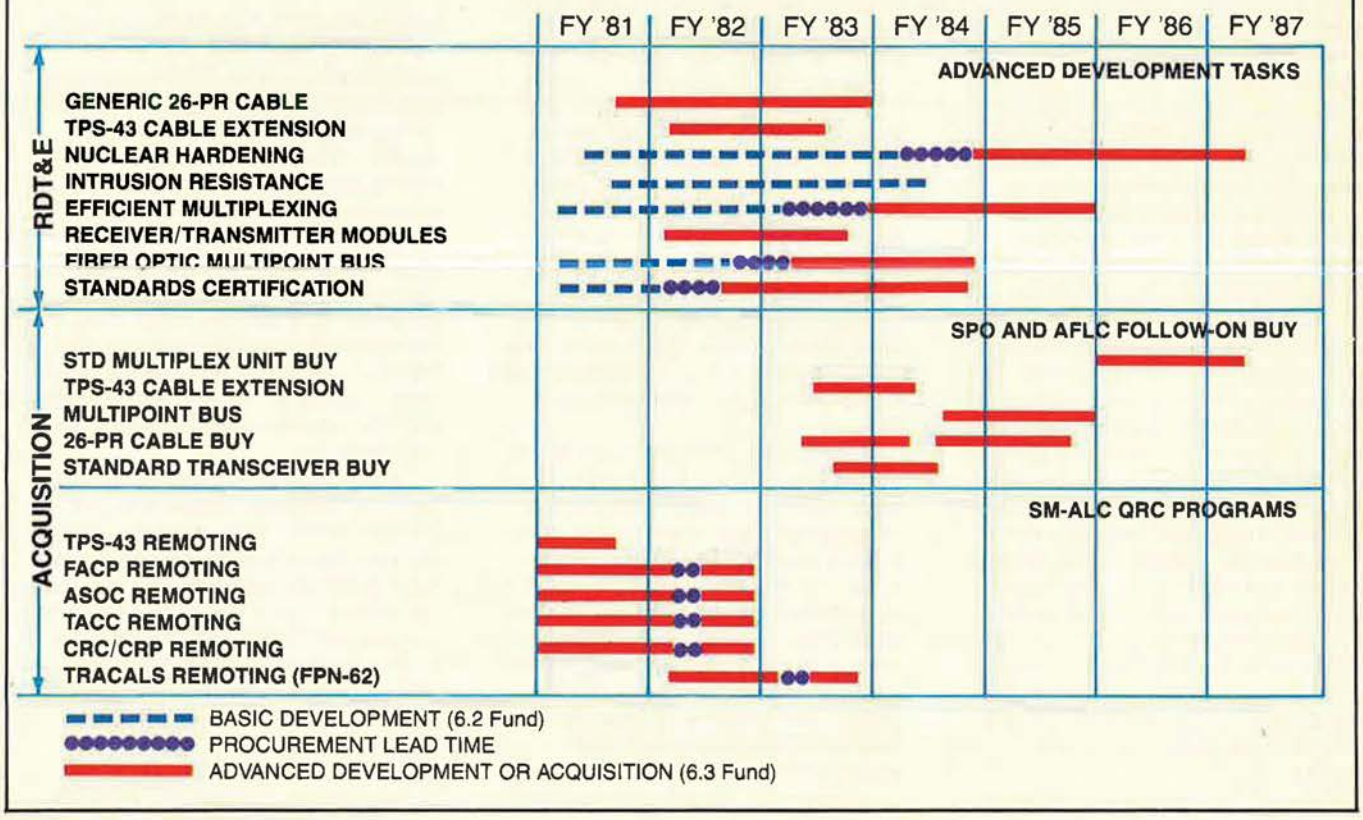
Conversely, since the fibers are coated with an opaque cladding (sheathing) to prevent light from escaping, signal-bearing fibers do not interfere with other sensitive electronic equipments. This nonradiating feature also improves the inherent security of information transmitted over fibers. Further, they are safer to operate in explosive environments. Escaping light from a damaged or broken fiber is harmless, where a spark from a broken electrical cable could be disastrous near fuel cells.

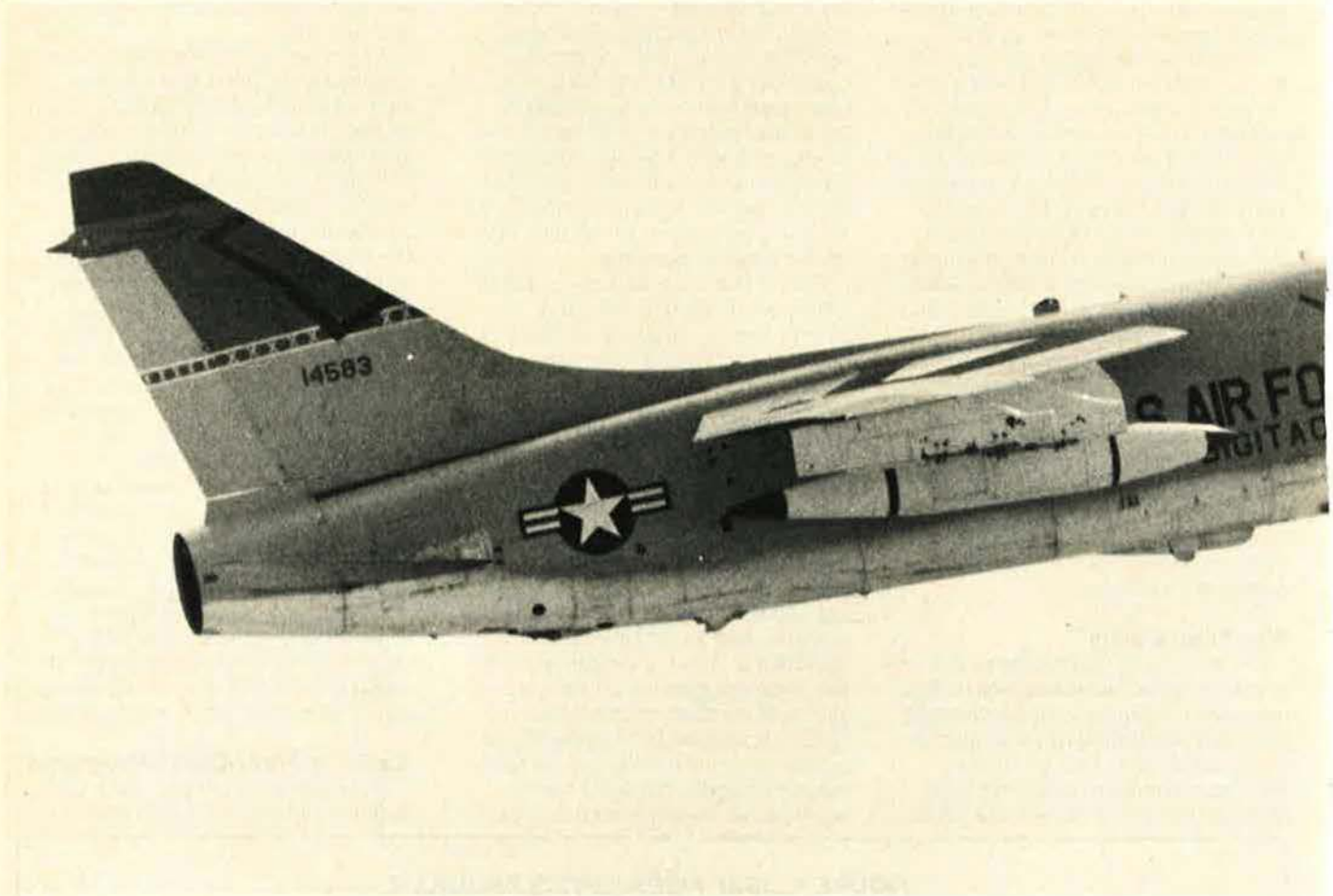
From a performance standpoint, the bandwidth of a fiber greatly exceeds the 1-MHz limit established for copper twisted shielded wire and the 20-MHz limit imposed on most coaxial cables. A digitally multiplexed electrical transmission line provides the greatest bandwidth and lowest noise potential. The major factors limiting bandwidth and noise are crosstalk, electromagnetic interference (EMI), and the impedance-matching networks. These are not limiting factors for fibers. The frequency response of optical sources, detectors, or the dispersion characteristics of the fibers determine bandwidth. Light Emitting Diode (LED) sources can operate at bandwidths up to 100-MHz (10^6 cycles per second) and Injection Laser Diodes (ILDs) up to a few GHz (10^9 cycles per second). Typically, multimode graded index fibers and monomode step index fibers achieve bandwidths of a few GHz, while multimode step index fibers, depending on fiber length, can achieve bandwidths in the range of 20 to 60-MHz.

Air Force Fiber-Optics Programs

In December of last year, Brig. Gen. Ralph H. Jacobson of the Air Staff au-

FIGURE 1: USAF FIBER OPTICS PROGRAM





The A-7D research aircraft is using fiber links to reduce electromagnetic interference (EMI) effects on flight control signals. The fibers are immune to crosstalk, coupling, ground loops, lightning, and other induced voltages that could cause distortion if wire links were used.

thorized a new initiative that accelerated the pace of fiber-optics hardware use in USAF communications and transmission systems. His program management directive designated AFSC and AFLC as joint implementing commands for a six-year, multimillion-dollar development and acquisition effort that calls for integrating the technology into command control communications and intelligence (C^3I) systems. Basically, the new initiative adds additional tasks to some earlier fiber-optic programs and compresses their schedules from eight to six years. The new program will expedite the integration of the technology into land tactical and support systems, satellite ground control facilities, and several elements of the Strategic Air Command Digital Network (SACDIN). The accompanying box summarizes the RDT&E and acquisition phases of the program and the major tasks to be accomplished.

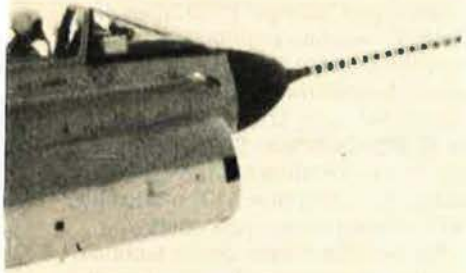
Initially, fiber transmission lines are slated to replace the CX4566 copper cables and CX11230 coaxial cables used in the 407L Tactical Air Control System. Replacement fibers will also be installed on the FPN-62 Air Traffic Control radar and at satellite earth terminals linked to technical facilities through high data rate transmission lines. More sophisticated optical data bus networks are also being developed for the GYQ-21(V) intershelter operations.

Mobility and survivability are two important reasons why fibers are being retrofitted into the 407L system. The widespread use of coaxial and twenty-six-pair cables in the system creates major mobility and weight problems. It would take thirteen C-130 aircraft to airlift all of the existing cable needed to deploy a fully operational 407L system. Using fiber cables reduces the physical size and weight and requires only one aircraft for deployment of an equivalent amount of cable.

Additionally, the massive amount of cable required to operate the system's Control and Reporting Center (CRC) in the field makes an eight-hour set-up or tear-down virtually impossible with existing cables. The smaller size and weight of fibers alleviate this concern. From a survivability standpoint, the proximity of the radar to the CRC (120 meters or less using coaxial cable) exposes the control center to collateral damage from antiradiation missiles aimed at the radar. This threat is reduced or eliminated when using optical fibers, because the radar can be remoted more than five kilometers. There are other operational advantages to using fibers.

"The way to figure the benefits you get from fiber-optic cables is to use my 10^3 and 100^2 formula," said Maj. Bob Warren, the Air Staff's program coordinator and fiber-optics expert. "You can expect a 10:1 cost, weight, and volume savings with fibers; and, in most cases, a 100:1 increase in bandwidth and a 100:1 increase in the distance you can transmit using fiber transmission lines."

Field trials of a fiberized radar were completed last April at Eglin AFB, Fla.



Sixteen channels of a TPS-43E radar were connected to a TSQ-91 operations center over two-km multiplexed links. According to Major Warren, the radar performed as expected, with no difficulties. Another field test of a fully operational TSQ-91 CRC with nine emitters linked over optical fibers will be demonstrated later this year for NATO allies during Reforger '81 exercises in Europe.

"Although the joint command program has only been under way for a short while," said Major Warren, "we've been able to accomplish a lot. I attribute this to the unique joint command management team we organized for the program and the tremendous support we've been getting from the top down."

Beside top leaders' support, both AFSC and AFLC are backing the program with the needed funds. By overlaying the new program on the earlier, slower-paced efforts, existing funding will be used to cover a number of the new efforts in FY '81 and FY '82. As the program shifts into high gear in FY '83, it will probably require about $8 million to sustain the development and acquisition efforts.

Management of the development and acquisition is divided between Systems Command and Logistics Command. AFSC's Rome Air Development Center (RADC), Griffiss AFB, N. Y., is managing basic and advanced

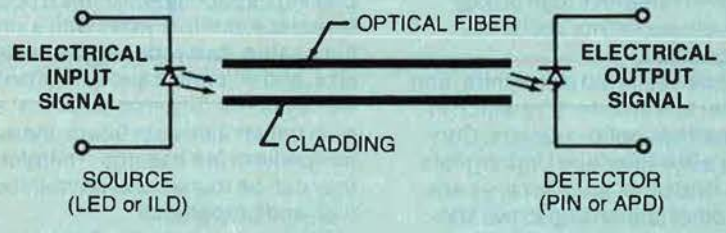
Fiber-Optics Technology

The idea of transmitting signals by light waves is not new. A century ago, Alexander Graham Bell invented the "photophone" to carry voice messages on a beam of light soon after he built his first telephone. The concept was never perfected because there were no practical transmitters or light guides available. But with the advent of the laser in 1960 and breakthroughs in efficient transmission of light waves through optical fibers in the mid-1960s, the technological barriers holding back the technology's use were overcome. By the early 1970s, industry had developed the required transmitters, receivers, and low-loss optical fiber light guides that are technically competitive with metallic wires.

These achievements set in motion the commercial exploitation of fiber-optics transmission lines for long-distance communication, with telephone companies first to capitalize on the technology. They found optical fibers could carry signals over longer distances with fewer expensive repeaters. As the various components needed to transmit and receive light signals became widely available, other users began experimenting with the technology. Today, fiber optics is used in cable television, process and machine control, building wiring, medical instruments, and other commercial uses.

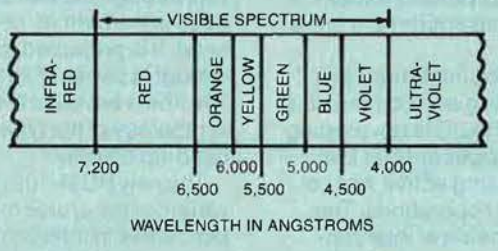
The accompanying Figure 1 illustrates a simplified fiber-optic transmission line. An electro-optic transducer, or source, converts the input signal to packets of photons capable of propagating through the optical fiber. At the other end, an optoelectronic transducer, or detector, reconverts the photons to a signal that resembles the original input signal. Both types of transducers are no more complex than solid-state electronic transmitters and receivers used with conventional transmission lines.

FIGURE 1: SIMPLIFIED FIBER-OPTIC TRANSMISSION LINE FOR POINT-TO-POINT LINKS



Sources are either Light-Emitting Diodes (LEDs) or Injection Laser Diodes (ILDs), which convert the electrons of the input signal to photon energy, a form of radiation found in the infrared portion of the electromagnetic spectrum (see Figure 2) that behave like light waves of the visible region.

FIGURE 2: ELECTROMAGNETIC SPECTRUM SHOWING INFRARED AND VISIBLE REGIONS



Detectors in common use today are photodiodes capable of converting the photon energy to electron energy and are either PIN (Positive Intrinsic Negative) diodes or APDs (Avalanche Photo-Diodes). Wavelength is used to specify the instantaneous light wave signal carrier.

Sources and detectors widely used today operate in the near-infrared region, about 800 to 900 nanometers (or 0.8 to 0.9 microns) and 1.0 to 1.1 microns. Similar functional devices, operating about 1.3 and 1.55 microns, are expected to be available in production quantities beginning next year. Other research under way will extend operation of fiber-optics technology into the mid- and far-infrared regions.

Over the last six years, Bill Walsh has written extensively on a broad range of technical subjects having military applications. His engineering and management career spans sixteen years in aerospace and defense. He is a military analyst at Gnostic Concepts in Menlo Park, Calif.

development, and the Sacramento Air Logistics Center is handling the acquisition of production equipment. "We believe the close cooperation between both commands on this program will allow us to go directly into production from advanced development, without going through engineering development," Major Warren said. "This cooperative agreement will shave two years off the development program and several years for the hardware-acquisition phase, saving millions of dollars in the out years and getting the hardware into the field sooner."

RADC has developed fiber-optic hardware for other C^3I equipment earmarked for upgrade in the future. The AN/GYQ-21(V), which is used in the 407L system and strategic information distribution networks operated by SAC and other commands is a likely candidate for new fiber-optic bus networks. Currently, the system is limited to data transmission rates less than 50 kbs (kilobits per second) for shelter-to-shelter operation.

RADC has designed a new intra- and intershelter bus architecture which incorporates fiber-optic couplers. Controlled by a Bus Interface Unit, signals from the UNIBUS in a shelter are transmitted to other shelters up to two kilometers away at data rates of 60 Mbs (megabits per second), without repeaters. A demonstration type model has been built using transmissive star couplers and 50-micron fiber transmission lines. The coupler can interconnect up to thirty-two users to the bus. The hardware eliminates ground loops, crosstalk, and other EMI problems experienced by operational equipment in the field.

To overcome these limitations in other data processing and communications equipments, RADC is developing a general-purpose optical-fiber bus transmission line using active star couplers for intershelter operations. The new bus will be capable of interconnecting multiple shelters up to eight kilometers apart and operating at 60 to 180 Mbs data rates.

Other Applications

Besides remoting radar or communications emitters and data-processing equipments, developers are evaluating the technology for other applications. Engineers at the Flight Dynamics Laboratory at Wright-Patterson AFB, Ohio, have installed optical fibers in an A-7D research aircraft to demonstrate the feasibility of fly-by-light controls. Digital computers programmed to provide precise maneuvering signals during air-to-air and air-to-surface engagements have been interconnected to flight controls and sensors with 125-micron fibers.

The research aircraft was flown earlier this year at Edwards AFB, Calif., to demonstrate that fibers can be used to transfer flight-control signals and sensor information. The prototype digital system has demonstrated a twenty to forty percent reduction in air-to-air gunnery tracking error and a thirty percent improvement in air-to-ground gunnery.

Developers think the fibers will reduce the digital flight controls susceptibility to EMI, which can distort flight control signals over wire. They are also finding the large bandwidth and multiplexing capability will make it possible to replace multiple wires with a single fiber cable, thus reducing the weight, size, and volume of aircraft transmission systems. Since no electrical energy is transmitted over fibers, there are no sparks or fire hazards. Therefore, they can be routed near ammunition, fuel, and propellants.

For several years, the Aerospace Medical Research Laboratory has been looking for a practical way to produce images on a pilot's helmet visor. They have devised a way to project a remote cathode ray tube (CRT) display onto the visor using a bundle of 75,000 fibers, each five microns thick. The image is sent through the bundle to the front edge of the helmet, near the pilot's forehead. It is projected in front of one eye through a series of lenses and mirrors. The fibers are capable of transmitting symbology of the type displayed on a head-up display.

The new BGM-109 ground-launch variant of the cruise missile will use fiber cables to interconnect the control center van to the launch platform. All voice, prelaunch data control signals, and firing commands will be transmitted optically. Signal distortion caused by EMI and EMP are eliminated.

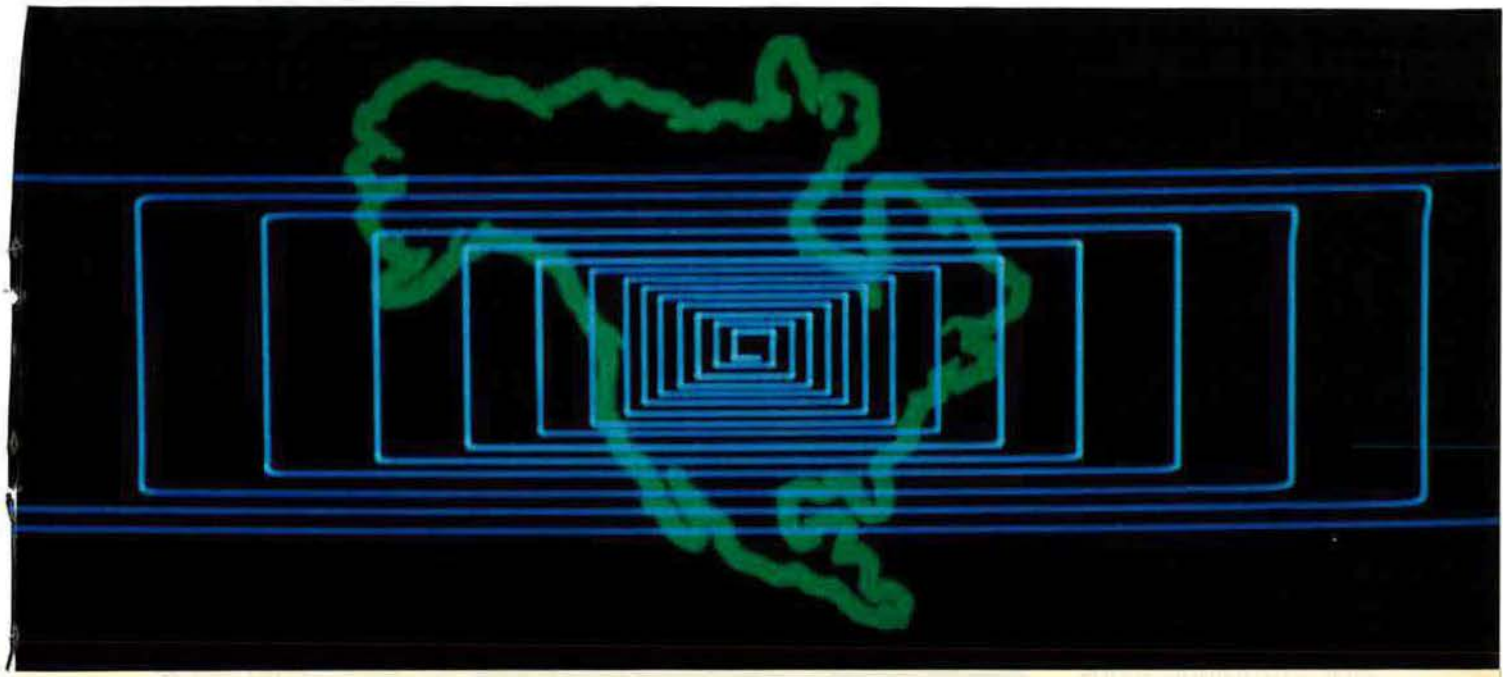
Electronic warfare subsystems will use fibers to enhance performance of warning receivers, jammers, ESM (electronic support measures), and other equipments. The signals transmitted between a warning receiver and a signal processor, for example, can be enhanced by eliminating EMI- and RFI-induced (electromagnetic and radio frequency interference) distortions. Also, increasing link bandwidth while reducing the size, weight, and number of cables can be accomplished. These same benefits can be applied to most high data-rate transmission lines between other types of electronic warfare equipments. A study completed on the B-1 defensive electronics suite several years ago concluded that using fiber-optic cables in the 40 Mbs Defensive Subsystem Group would reduce aircraft weight by 380 pounds, and save $101 million (in 1977 dollars) in life-cycle costs.

The benefits of fiber-optics technology cannot be ignored. It is only a matter of time before it is used in new systems entering development and for retrofit into equipments undergoing refurbishments and performance enhancements. Assuming the switch to fibers is plausible for high-performance applications, miniaturization and integration of optical and electrical components will be needed to meet technical and environmental requirements.

Summary

If we could leap forward to the next century for a look back at the 1980s, it would be apparent that in that era optoelectronics emerged from the military laboratories. The major turning point began shortly after fiber-optics standardization was completed and resulted in broad-scale implementation of low-cost optical-fiber transmission lines. That made it feasible to incorporate optical circuits into high-performance electronic systems, which increased bandwidth and throughput, significantly reduced the damaging effects of EMI and EMP, and resulted in quantum jumps in performance. Subsequent developments of hybrid opto-digital computers led to system-level improvements in reliability, safety, life-cycle costs, and overall performance amounting to factors of 100 to 1,000 times greater than 1980 state-of-the-art systems.

This process is about to begin. While we are at the threshold of broad-scale implementation of fiber optics, it is not yet economically feasible for weapon-systems managers to design fibers into equipments. When connector standardization is achieved, hardware costs will drop dramatically and the fiber-optics threshold will be breached. ■



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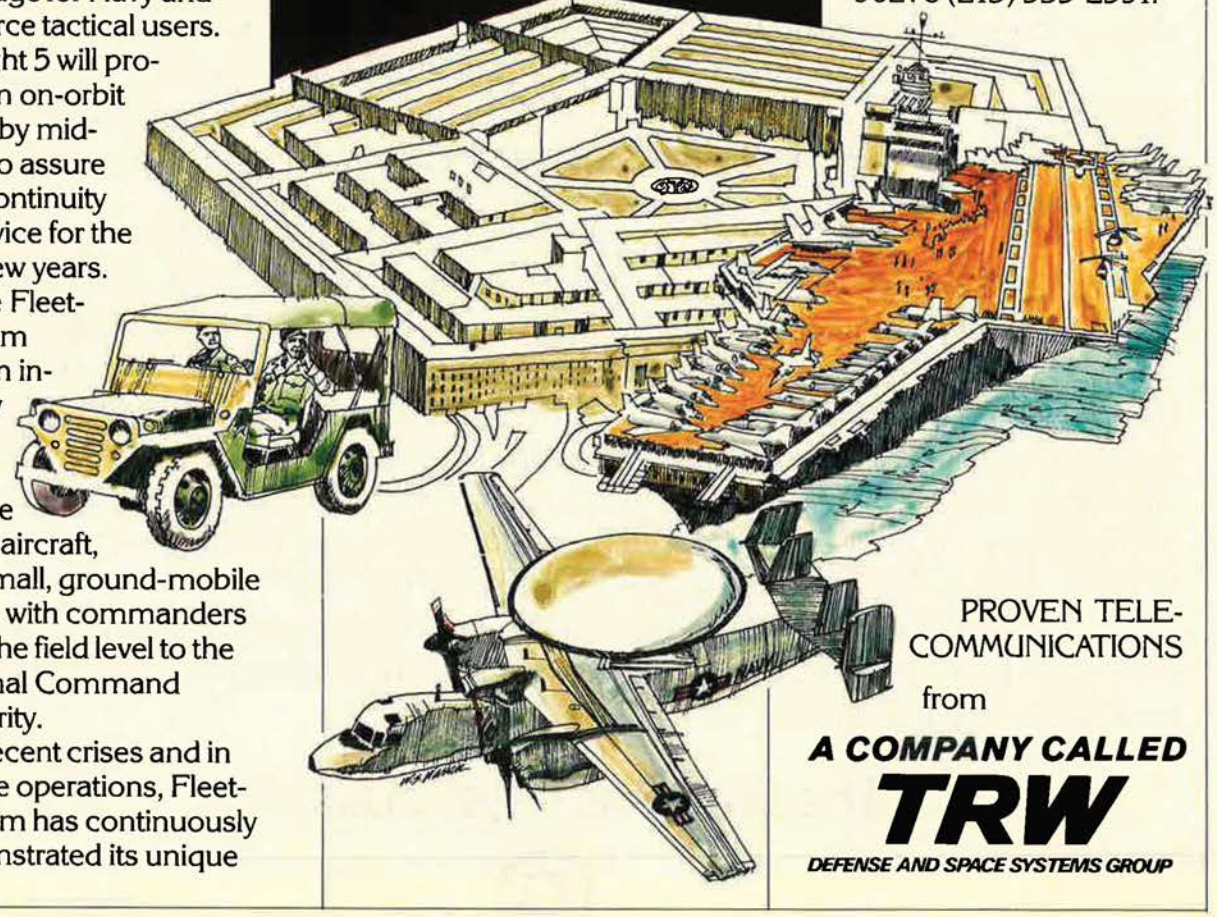

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LASERCOM: The Green Dragon Awakens

Death rays and blaster beams get all the laser publicity, but the urgent and growing need for secure, high-volume communications is driving successful research and testing of the Air Force space laser communications program.

BY STEVEN L. THOMPSON

ATOP Lt. Col. Thomas E. Simondi's desk is a small green dragon. Hardly a priceless *objet d'art*, it has been broken and carefully glued back together, the pieces fitted well enough to reconstitute the dragon shape but not so well as to hide the cracks.

Were it not for the desk it commands in its scaly way, it could be a casual trinket, a testimonial to miracle glue and some men's fascination for oddball objects. If its owner were not Colonel Simondi, if he were not program manager for USAF Space Division's LaserCom Program, and if his desk were not in the midst of the deceptively calm Los Angeles AFS—where everyone in uniform seems to be either a lieutenant or lieutenant colonel—the plaster dragon might not have any particular significance. But it is in this office, an office graced with a clock Simondi has modified to run counterclockwise. And a man with a backwards-running clock isn't likely to clutter his desk with meaningless pottery.

And, of course, the dragon is significant. "That dragon," states Colonel Simondi, "is a perfect symbol for the LaserCom Project. It has been broken up and put back together again." But unlike the plaster dragon, the LaserCom program is not fantasy, although until recently the reality of LaserCom was not demonstrable except perhaps to those who had been with it since the beginning.

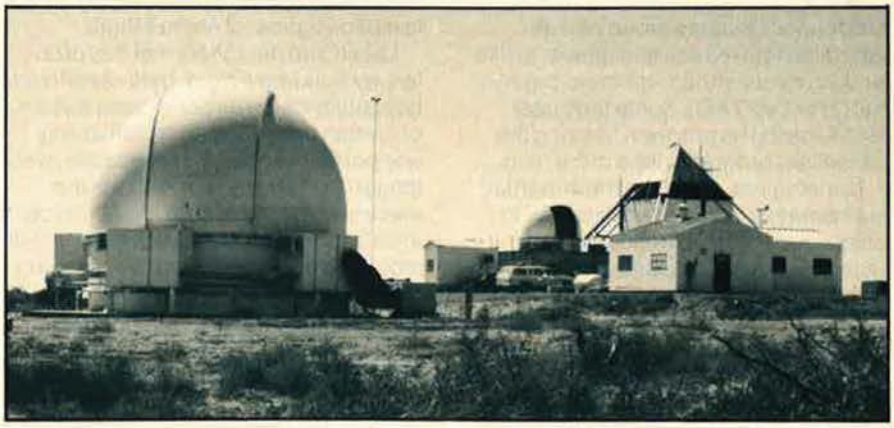
The beginning for the Air Force Space Laser Communications Program was in 1969, as the Avionics Laboratory's Project 405B at Wright-Patterson AFB, Ohio. When progress on 405B indicated that using laser beams to transmit information in space might be possible, McDonnell Douglas Astronautics Co.-East—which had been investigating the same concepts since 1966—was given initial R&D money to meet a goal easily stated then and which has remained unchanged: "To develop a state-of-the-art satellite laser communications system."

By 1972, preliminary component and system design had been completed by the Avionics Lab and McDonnell Douglas, and, in 1973, both Mac-Dac and Lockheed Missiles and Space Co. were chosen to build a laboratory laser transmitter and receiver capable of transmitting the required data stream—one "gigabit," or one billion bits of information per second, the equivalent of the entire Encyclopedia Britannica. (With its usual avoidance of superlatives, the electronics-engineering community refers to this staggering feat of information delivery simply as "HDR"—high data rate.)

McDonnell Douglas won the ensuing competition for prime contractor, and in 1975 assembled an engineering feasibility model to turn the brassboard lab hardware into space-qualifiable equipment. This model was the prototype of the laser transmitter/receiver to be tested aboard a dedicated LaserCom satellite.

Promising Young Dragon

In six years, LaserCom had thus grown from an embryo to a promising



Top: USAF EC-135 LaserCom test-bed aircraft, part of the Airborne Flight Test System (AFTS). Lower photo: the ground site at White Sands Missile Range. Open dome at the rear is where the AFTS receiver was, and where the transmitter for the LaserCom Space Measurement Unit (LSMU) will be operating during tests in 1983.

young dragon. The USAF Avionics Lab transferred responsibility for the project to Space and Missile Systems Organization in Los Angeles. The LaserCom demonstration launch and flight were scheduled for 1979, with McDonnell Douglas contracted to "build, launch, and demonstrate laser communications between a satellite and a ground station at Cloudcroft, N. M." The project was, in other words, steaming toward taking communication on a beam of light out of the science-fiction magazines and putting it into Air Force tech manuals. And then, after about eighteen months under SAMSO's purview, high-level budgeteers chopped it off at the knees; the space demonstration was canceled.

Colonel Simondi's written history of LaserCom describes the cuts as occurring "even though no technological or financial problems existed within the LaserCom program." He adds, "In November 1977, the program was directed to conduct an aircraft-to-ground demonstration by 1980. The redirection was to perform ground and airborne demonstrations of a gigabit-per-second laser communications system; continue the development of selected components for future space applications; demonstrate the inherent system characteristics (high data rate, private and jam resistant); define the necessary interfaces to make the LaserCom system interoperable with radio frequency communications; and provide for the transition of the developed LaserCom technology to operational systems."

It is fruitless to speculate on the cause for the cuts and redirection, but well to remember that only NASA was pursuing a program with goals at all like LaserCom's—attempting to develop a similar high-data-rate capability with a gas (CO_2) laser. The USAF-McDonnell Douglas group had decided, for that reason and others, to use a neodymium-yttrium-aluminum-garnet laser (Nd:YAG). Some time later NASA folded its program, leaving the LaserCom program alone in the field.

Nonetheless, because the impartial mathematics of the laser showed it to possess at least theoretical advantages over radio frequency (RF) communications for some applications, the LaserCom program was not killed off completely.

Those advantages mainly derive from the coherence and carrying capacity of the light beam itself. Whereas, for instance, a conventional RF satellite transmitting its tightest-focus signal at an earth station from a geosynchronous orbit (22,300 miles altitude) produces a "footprint" some 200 miles in diameter on the earth, LaserCom's footprint from the same altitude is less than 0.1 mile across.

Further, there are no sidelobe emissions associated with laser transmissions, easing the problem of eluding hostile hunter-killers. And, finally, because the capacity of an electromagnetic wave to carry information increases as its frequency increases, the Nd:YAG laser (frequency: 532.0 nanometers, or 5,320 Angstroms, in the green zone of the visible spectrum) is naturally capable of a higher data rate than RF transmissions (which vary from EHF, or about one millimeter, to VLF, bottoming out at 1,000 km).

The program controllers therefore had formidable theoretical and lab-proven reasons for continuing the project, and kept the requirement for space-qualifiable hardware in the contract, even though the only slated demonstrations were for aircraft-to-ground and ground-to-ground events.

Successful Demonstration

The ground experiments began at Cowan Site on the Army's White Sands Missile Range in September 1978. A two-kilometer transmission path was used, approximating the "worst-case" air-to-ground atmospheric track to be encountered in later testing, both air-to-ground and satellite-to-air/ground. It was "immediately successful," in Colonel Simondi's words, and "demonstrated conclusively that high-data-rate laser communication systems can in fact operate outside the laboratory in a 'real' environment."

It's one thing, however, to lock a laser in place in a ground station and quite another to make two lasers find each other and transfer data when one is in motion—especially the vibrating, erratic motion typical of aircraft flight.

LaserCom designers met this problem by building a rigid, gyro-stabilized baseplate for the airborne laser assembly which mated to the aircraft at only one point. This was done because even though the test-bed aircraft was the electronics workhorse of the Air Force, an EC-135, it was thought that any other mounting system would allow too many bad vibrations to impinge on laser pointing and tracking capabilities.

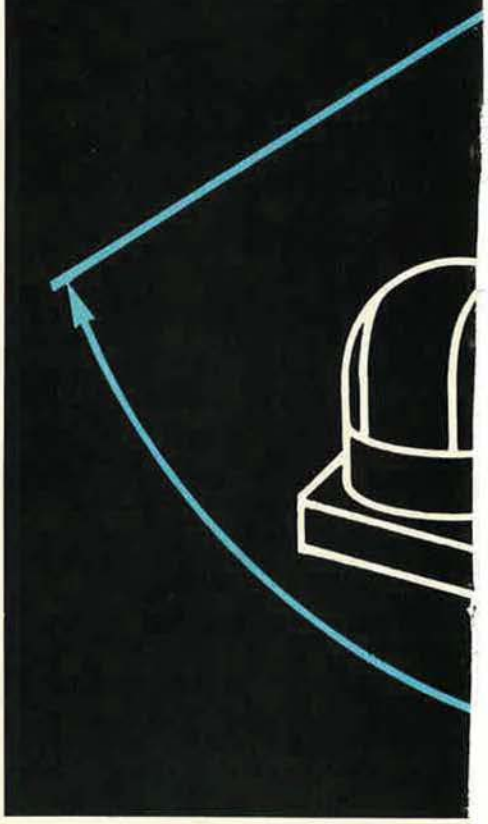
It is this need for literal pinpoint accuracy that is the Achilles's heel of the laser's biggest asset, its narrow beamwidth. Because the various laser transmitters and receivers all operate through optical elements—prisms, telescopes, and mirrors—the required precision of beam alignment had to be maintained by ingenious use of torque-motor mirrors in the system and a large mirror gimballed in two axes, called the gimballed flat.

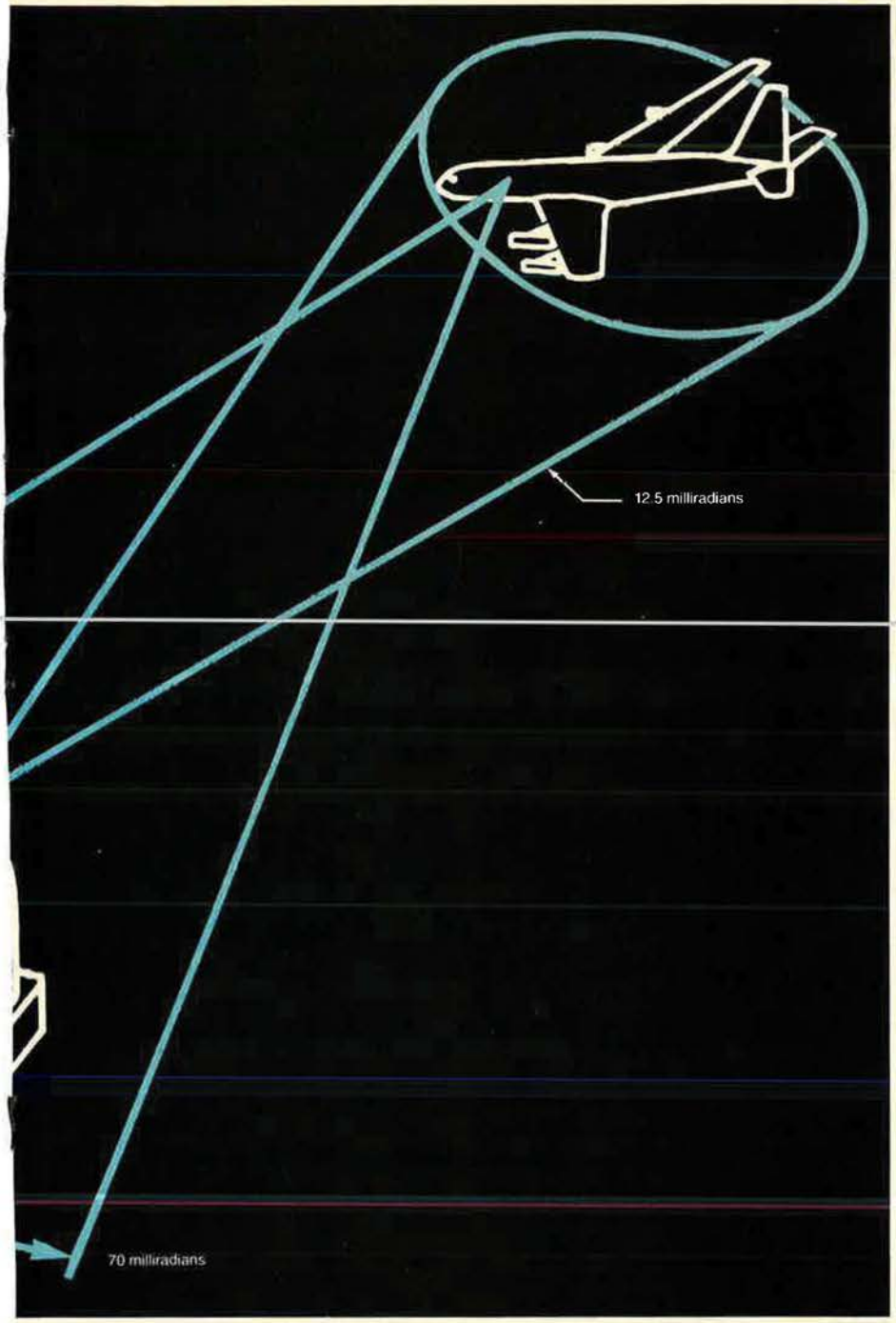
The airborne flight tests consisted of the EC-135 making circular orbits over the ground station, at altitudes varying from 33,000 to 37,000 feet, and ground ranges up to 100 kilometers. The ground station was equipped with two lasers; one for "call-up" of the airborne receiver, and the other to act as a "beacon" for the aircraft's system. Both

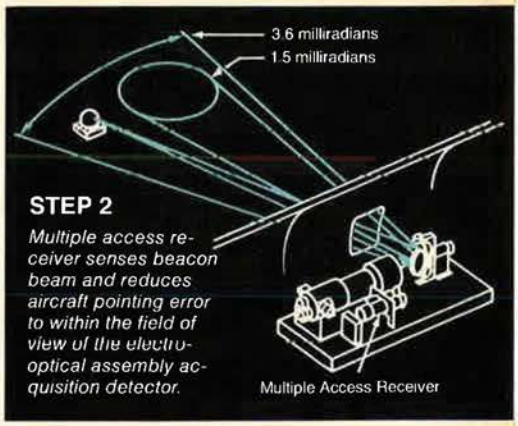
LASERCOM AIRCRAFT TO GROUND ACQUISITION SEQUENCE

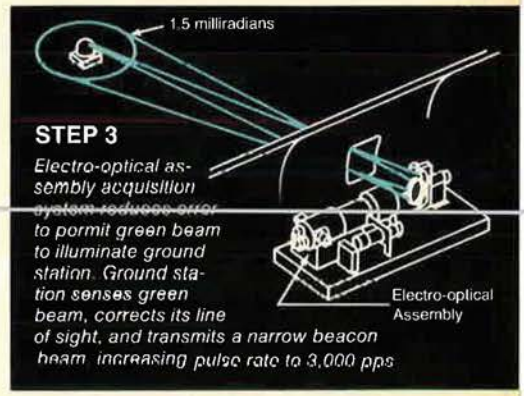
STEP 1

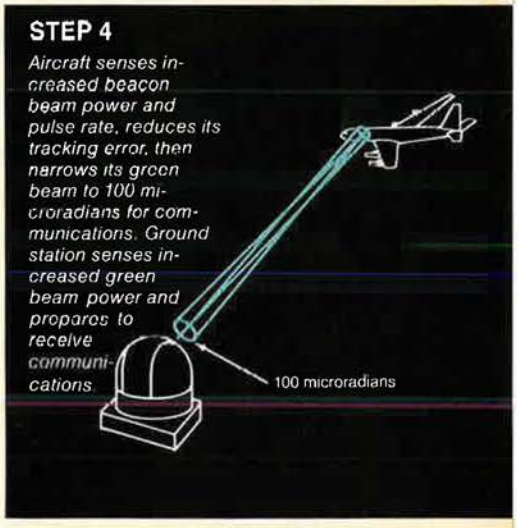
Multiple access receiver views uncertainty region around ground station. Ground station beacon beam illuminates uncertainty region around aircraft location with coded 10 pulses per second (pps).











were Nd:YAG lasers operating in the infrared (10,600 Angstroms), but they had differing data transmission rates keyed to their roles. The call-up laser transmitted at only 100 bits per second, while the beacon emitted at 20,000 bits/second, a rate high enough to feed vital tracking data to the airborne receiver.

Once the beacon had made contact with the receiver, the process of narrowing both fields of view began. It was designed to be an automatic process, each laser feeding data to the other, but some light was split off the "uplink" to a viewing station, where manual, joystick control could be had. *(See accompanying illustrations.)*

Grand Finale

The flight tests began in October 1979 and ended a year later, in December 1980. In the grand finale, LaserCom controllers broadcast both live video and a videotape from the EC-135; the tape was retaped on the ground, taken up again in the aircraft and again beamed down, where it was compared with the original. The result: "With the naked eye," says Colonel Simondi, "you couldn't tell the difference." In this test, and others, LaserCom had demonstrated for the first time "free-beam" (through-the-atmosphere) data transmission and open-loop, or one-way, laser pointing and target acquisition.

Average time required for the LaserCom system to go from coarse, radar-directed open-loop pointing to final lock by the Fine Tracking Detector was 10.3 seconds. Once the system had gone to closed-loop, or two-way, tracking, ninety-five percent of the

beam energy was directed to data transmission and only five percent required for maintaining tracking. And even though an unanticipated atmospheric distortion of the laser path caused some early problems by way of high bit error rates (that is, "lost" bits of information), eventually the bit error rate dropped to one lost in a million. As Colonel Simondi puts it, "We were able to solve all the problems."

The laconic nature of his summary masks a remarkable rate of progress. During the lifetime of the project, LaserCom engineers had gone through four whole generations of hardware, refining the bulky original brassboard laser to a solid-state cylinder the size of three stacked pocket watches. And developments in the laser itself were matched by work done to put information on the light beam, modulate it usefully, and pull it out again at the receptor.

In Colonel Simondi's words, "The LaserCom high data rate system uses an external electro-optical $LiTaO_3$ (lithium tantalate) modulator. Using pulse quaternary modulation, the modulator imposes two bits of information on each pulse, thereby creating a data rate capability of one gigabit per second. Pulse quaternary modulation combines pulse position and pulse polarization modulation. Higher rate modulation schemes and higher speed modulators are being investigated. . . . The development of high-speed and control electronics has been perhaps the least heralded of the LaserCom development efforts."

Another understatement: What LaserCom's eight people in Los Angeles and McDonnell Douglas's eighty in St. Louis have done is cause a beam of light to pulse at exactly the rate they want, split the beam, fold it back on itself to double its carrying capacity, polarize it horizontally and vertically, load it with information, fire it out the window of an aircraft, depolarize and decode the photonic energy at the receiver far below, and, in the process, deliver more of the original input information in one second than the US Postal Service manages in a week.

The Stuff of Science Fiction

When it's taken out of engineer jargon, LaserCom's flight test results seem like the stuff of science fiction. And, indeed, flight test engineer Lt. Bob Mason comments, "Just because lasers are a new technology and may be portrayed in science fiction as something that's going to occur years ahead, it's ready to go *now*. It's not a science of the future." Colonel Simondi agrees: "I'll second that," adding, "It's something new and, as something radically different, people tend to want to go slowly in accepting it. That's a problem."

Another acknowledged problem is the public image of lasers. Recent exposure of several DoD projects tends to underscore the death ray–blaster beam aspect of lasers. And, while the image of Luke Skywalker zapping Imperial fighters as the *Millennium Falcon's* waist gunner has instant and understandable public appeal, there's no doubt that program managers like Colonel Simondi have had to counter the resulting "laser-equals-weapon" mentality. Holding up LaserCom's tiny heart, he says, "This is *not* a weapon. Its output is 200 milliWatts—*milli*Watts. That's some nine orders of magnitude less than anything you might consider a potential weapon."

LaserCom's chance to disassociate itself from death rays in the arena it was originally designed for—space—is on the horizon. In 1978, an experiment dropped out of the P80-1 (Teal Ruby) DoD satellite, and LaserCom managed to climb aboard, as the LSMU—LaserCom Space Measurement Unit. In this configuration, the system will be altered slightly (but not too much, thanks to the planners' foresight in keeping the flight-test hardware space-qualifiable) to provide only low and intermediate data-rate communications.

Inside the eighteen-inch by thirty-inch, 145-pound canister that houses the LSMU, the flight test's Nd:YAG laser will be replaced by a gallium arsenide diode laser whose job will be relaying telemetry sent up by the White Sands, N. M., ground station. The tasks set forth for the LSMU are expanding the results already achieved by the flight tests, and adding those that can demonstrate the system's antijamming characteristics.

The LSMU is expected to point, track, and acquire its ground station in an open-loop mode, and to probe atmospheric effects on space-to-ground laser communications. An optional "uplink" from an airborne laser to the LSMU is possible, to check the potential of aircraft-to-satellite relays. A particularly vital test for the LSMU will be its decoding electronics' ability to accommodate 100 users, with "considerable" jamming immunity. If the electro-optics' ability to swallow, digest, separate, and correctly decode the real energy while disregarding the bogus signals is proven, a long step will have been taken toward a jamproof or at least jam-resistant communications satellite.

The P80-1 satellite is scheduled to launch in the cavernous belly of the Space Transportation System (Shuttle) in late 1983. As currently planned, the satellite will be inserted into a 400-nautical-mile orbit inclined 72.5 degrees, which will provide the White Sands ground station with a ten-minute view of the LSMU on each pass, twice a day. Colonel Simondi notes that the LaserCom black boxes are now being wrung out, and that the unit will be delivered on time to Rockwell International, the P80-1's prime contractor, in August 1981.

After its orbital work, LaserCom's status is undetermined. If problems arise, no doubt Space Division will continue to hammer them out—it is, after all, a development agency. But if LaserCom is successful, it seems likely that such potential users as the Defense Communications Agency will be ready and waiting to integrate the lessons learned by LaserCom into future communications systems.

Indeed, given the impressive qualities of laser communications, it seems at first glance slightly surprising that the only other project similar to LaserCom is the Navy's so-called blue-green laser program. And, as Colonel Simondi points out, the mission for the Navy satellite laser is much different from LaserCom's; the blue-green system needs to punch through atmosphere and hydrosphere as well as with a low-data-rate capability, while LaserCom is, of course, primarily a space-to-space operation.

It would be wise, however, in trying to get a clear view of the whole laser-communications research field, to keep in mind that much of it simply isn't *in* view, being classified. That's why we only see programs like Colonel Simondi's and the Navy's. This gives the appearance of a lack of overall planning. Colonel Simondi's answer is telling: "Appearances," he smiles, "may be deceiving." ■

*Steven L. Thompson, the son of a USAF bomber pilot, is himself a pilot, roadracer, journalist, editor, artist, and author of two aerospace action adventure novels—*Recovery *(Warner, 1980) and* Samson *(to be published next year, also by Warner). He is currently working on his third novel—*Dancer*—and flying aerial photography missions. He makes his home in San Pedro, Calif.*

C³: Modern Warfare's Nervous System

That abstract yet also very real entity known as command control and communications (C^3) can and does serve as both a shield as well as a sword on the modern battlefield.

BY EDGAR ULSAMER
SENIOR EDITOR (POLICY & TECHNOLOGY)

COMMAND control communications and intelligence (C^3I) systems, as defined by DoD prose, must "support the command functions at all echelons, have flexibility to cope with evolving threats, and be consistent with planned force composition and employment. Further, these systems must facilitate conduct of US joint operations worldwide and combined operations with allied forces."

In the context of US history, the importance of C^3I was demonstrated early on and poetically by the lanterns—"one if by land, two if by sea"—hung in the tower of the Old North Church to signal the start of Paul Revere's midnight ride from Boston to Lexington on April 18–19, 1775, to warn the colonists that the Redcoats were coming. It is a case of historical serendipity that the principal Air Force organization responsible for C^3I, the Air Force Systems Command's Electronic Systems Division, is located near the end of the intrepid Boston silversmith's ride, at Hanscom AFB, Mass., and along the route of the Minutemen between Lexington and Concord.

In cooperation with the affiliated Rome Air Development Center (RADC), and two Federal Contract Research Centers—the MITRE Corp. and the Massachusetts Institute of Technology's Lincoln Laboratory—ESD acts as the key architect, systems manager, and coordinator of C^3 research, development, and acquisition for the Air Force, and other DoD elements, and allied air forces.

Lt. Gen. James W. Stansberry, the Commander of the Electronic Systems Division and its staff of some 3,500 military and civilian members, is a pragmatist. Asked by AIR FORCE Magazine what he considers the prime function of ESD, he unhesitatingly replied: "We are here to beat Russia." ESD's means for doing so is the ability to "attack his nervous system, his C^3 capabilities." The incentives for going after an adversary's military "nervous system" are vast. The Soviets, over the past ten years, outspent the US by about $350 billion in the area of "muscle," meaning missiles, aircraft, and other weapons.

General Stansberry contends that a pivotal countermove is to maintain US superiority in terms of command and control capabilities in general, and to develop the capabilities to destroy, disrupt, deceive, or jam his C^3 systems—thus keeping him from using his "hardware muscle"—in particular. The latter function, called C^3CM, for command control and communications countermeasures, has emerged as one of ESD's principal areas of endeavor. The Pentagon's official definition of C^3CM is "the integrated use of operations security, military deception, jamming, and physical destruction . . . to influence, degrade, or destroy adversary C^3 capabilities and protect friendly C^3 against such actions."

ESD, on the basis of a recent internal AFSC reorganization that cuts across the conventional line of demarcation between various product divisions, has been given central responsibility for all Air Force C^3CM programs, according to General Stansberry. He explained that in a practical sense this means that ESD will be in charge of the overall planning and architecture of this function regardless of where within AFSC individual component systems are being developed.

Another functional area that ESD is becoming involved in at an increasing rate is tactical warning and attack assessment, according to General Stansberry. The Division, he said, will play an important role ranging from acting in the manner of a prime contractor in some of these areas to that of an associate or subcontractor in others.

One of ESD's key concerns in the field of tactical warning and attack assessment is "survivability" in the pre-, trans-, and postattack phases of nuclear war, according to the ESD Commander. Key requirements in this context, according to General Stansberry, are replacement of "soft landlines" by survivable communications links and more detail and greater resolution in missile impact prediction information. An equally critical concern is that there is no room for ambiguity as to when a Soviet attack is under way, as to its nature and scope, and as to the specific US targets involved. It follows, General Stansberry pointed out, that false alarms concerning Soviet missile launches—of the sort that plagued the US warning system last year—are intolerable and that a multiplicity of sensors operating in various ranges of the electro-optical spectrum are required to mutually reinforce and confirm their individual findings.

General Stansberry, who took over ESD's reins last fall, plans to focus on two traits of the products of the Division. One centers on the ability of C^3I systems to report to relevant command authorities as rapidly and as clearly as possible "where the enemy is, who he is, and how fast he is coming." The other characteristic that the ESD Commander emphasizes is "near-term combat capability. I think we have to learn how to do things quickly and feel a greater sense of urgency in getting our systems into the hands of the troops." As he put it, "a bunch of critical design reviews of systems that we could have fielded" are not the stuff that military victory is made of.

Another concern of General Stansberry—and one that affects broadly all military research and development as well as acquisition programs—is "our relationship with industry. Keeping industry at arm's length just doesn't work, and it is foolish to try. Industry is a key player on the team, and it's simply not possible to run a team without talking to the players."

ESD, like other military acquisition organizations, is concerned over deficiencies in the defense industrial base. Sluggish growth in the productivity of US industry—dead last among the world's industrialized powers—leads both to higher cost and lower quality for the military consumer and lower profitability for industry. In the ESD Commander's view, "there probably is a greater potential for increased profit realization in quality improvements than in any other step that could be taken quickly."

A cardinal step toward correcting the quality problem, he suggested, is for both the Air Force and industry to focus top-level attention on product quality, including especially maintainability and reliability: "Management can do a

lot here even though I believe that the need is for leadership more than for management." The Defense Department's shift to multiyear contracting also should prove beneficial in regard to better products and greater profitability. A number of ESD programs, he said, are earmarked for multiyear contracting arrangements.

ESD, like the other elements of AFSC, is facing a problem of pervasive importance—the declining retention rate of technically trained officers and young civilians. At this time, General Stansberry told AIR FORCE Magazine, in program offices and planning organizations about forty-three percent of ESD's technical officers—science and engineering graduates as well as other technically trained specialists—are lieutenants. This high percentage—up from thirty-seven percent a year ago—means that "too many captains and majors are getting out. Retention of these middle-level managers is our key problem and priority," according to the ESD Commander.

Although recent improvements in military pay and benefits have eased the problem slightly, the continuing nationwide shortage in engineering and other "hard-science" graduates suggests that there probably is "no real solution in sight." A carefully structured bonus system and continued improvements in military pay could, however, prevent further deterioration. General Stansberry opposes creation of an engineering officer corps with its own higher pay schedule as "potentially divisive and a form of elitism" inimical to military morale.

Strategic C^3

The basic elements of strategic defense consist of the surveillance and warning systems to detect and characterize hostile actions by strategic aircraft, missiles, or spacecraft, and the defensive weapons to counter these forces. Since the burden for deterrence is placed on this country's strategic offensive forces, only limited resources are being applied to developing defensive weapon systems.

USAF's warning programs are designed to improve the ability to detect and determine the character of a Soviet attack so that the national command authorities could make use of available options for strategic response, such as launching the alert bomber/tanker force.

In the field of bomber warning, the Distant Early Warning (DEW) Line was designed in the 1950s to provide long-range early warning of medium- and high-altitude bomber attacks. It has gaps in coverage at low altitudes and is becoming expensive to maintain because of its age. The Air Force is continuing to evaluate alternatives to modernize and improve the DEW Line; however, the Defense Department temporarily suspended efforts to develop any new sensors.

To improve the capability of bomber warning systems and substantially reduce operating costs, USAF developed minimally manned, technically improved long-range radars to be located in Alaska. This system, called SEEK IGLOO, replaces obsolescent radars at thirteen Alaskan Air Command sites with highly reliable equipment. These new radar systems are expected to require only about 100 maintenance hours a year at each site and no more than three maintenance people. General Electric, under a thirty-two-month development contract, is developing, fabricating, and testing two preproduction prototype solid-state Minimally Attended Radars (MARs). Fabrication of the MARs (designated AN/FPS-117) has been completed, and the first prototype will be installed at King Salmon AFS, Alaska, late this year where testing in the operational environment will occur. A production contract to provide the full complement of thirteen AN/FPS-117 radars is expected to be awarded to the General Electric Co. next year.

(Although far afield from North American strategic surveillance and control functions, a special AN/FDS-117 radar system will be used to modernize the antiquated Berlin Air Route Traffic Control Center.)

SEEK IGLOO is linked closely to the Joint Surveillance System (JSS); it performs peacetime surveillance as the latter's Alaskan component. The system will replace the aging and uneconomical SAGE network. JSS is to consist of forty-six radar sites in the CONUS, in addition to the Alaskan SEEK IGLOO and Canadian radar sites. Information from the system's civilian and military radars feeds into seven ROCCs (Region Operations Control Centers), where data processing, display, and command control functions are carried out.

Last summer, the Air Force changed the function of the ROCCs somewhat by assigning them the role of primary command and control centers during crisis and attack for as long as they are capable of doing so. If in the case of an attack by strategic air-breathing weapons the centers are put out of commission, the command and control function would then be handed over to

". . . too many captains and majors are getting out. Retention of these middle-level managers is our key problem and priority."

E-3A AWACS aircraft. AWACS regularly performs special airspace surveillance/air sovereignty functions in peacetime, thus augmenting JSS. Installation and checkout of JSS's data processing and display equipment are under way at the Southeast ROCC at Tyndall AFB, Fla., by Hughes Aircraft, the prime contractor. The system is to achieve full operational capability in 1983. One of the JSS radars is balloon-borne. This so-called aerostat radar surveillance system is located at Cudjoe Key, near Key West, Fla., and provides twenty-four-hour coverage of the Florida Straits and parts of Cuba over a radius of about 150 nautical miles.

The CONUS OTH-B Radar program is ESD's biggest (physically and financially) ground radar program. This $800 million program began with a DSARC IB in 1974. After extensive studies, OSD authorized development of a prototype system. That contract was placed competitively in 1975 with General Electric. The program was later restructured to a technical feasibility demonstration. Testing began in June 1980. A DSARC II is scheduled in October 1981.

There is strong support for a wide area surveillance system to detect aircraft attacking in North America. The CONUS OTH-B is the prime alternative. The system uses over-the-horizon backscatter radar technique for aircraft detection and tracking. The radar signals are transmitted around the earth's curvature by refraction and reflection of the signal off the ionosphere. Target refraction and reflection of the signal (backscatter) are returned to the receiver by the same processes. The propagation path permits detection of targets well-beyond the horizon and, therefore, beyond the detection capabilities of ground-based, line-of-sight radars.

The Experimental Radar System is located at two sites in Maine. The transmit site and receive site are separated by approximately 100 miles and cur-

rently provide thirty-degree azimuthal coverage and a barrier coverage adjustable in range from 500 to 1,800 nautical miles.

An operational system will consist of a transmit, receive, and operational site on each coast providing 180-degree coverage to the east and west of North America.

One of the critical challenges associated with OTH-B is the system's ability to operate in the presence of auroral activity, the so-called Northern Lights. While there is no easy solution to this problem, program officials are convinced that random periods of reduced performance of this type along the northern edge of the coastal fans can't be exploited strategically by the Soviets. Reason is that there is no way for the Soviets to predict if, when, and for how long an occurrence of Northern Lights will degrade the far north performance. The Air Force is considering three advanced technologies to solve the auroral problem: space-based radar, advanced microwave systems, or a north-looking OTH-B whose backscatter occurs south of the auroral zone.

OTH-B is expected to be adequately effective against raids involving air- or sea-launched cruise missiles. There is, however, reasonable expectation that the system will prove moderately effective against potential Soviet "Stealth" or low-observable aircraft. This sanguine outlook is based on the fact that OTH-B looks down on penetrating aircraft, meaning it sees the biggest and flattest part of the vehicle rather than the frontal area where radar cross sections are easier to minimize. Further, OTH-B functions in the HF (high frequency) band where it is far more difficult to mask radar signatures than in the microwave area.

Tactical Warning and Attack Assessment

Because of the increasing national concern with tactical warning and attack assessment, a single Air Force Systems Command manager was established at ESD to oversee all its aspects, from sensors to communications links and command centers. One of the key elements of the tactical warning and attack assessment function is PAVE PAWS, two dual-faced, phased-array radars, one on each coast, that provide early warning of SLBM launches against the US over a 3,000-nautical-mile range and monitors satellites in low earth orbits. Both East Coast and West Coast sites—Otis AFB, Mass., and Beale AFB, Calif.—are under the operational direction of SAC and ADCOM, and provide improved coverage along the two coasts. Augmenting PAVE PAWS, for the time being, are an older FPS-85 phased-array radar and a yet older FSS-7 SLBM warning radar in Florida to cover possible SLBM launch areas southeast of the United States.

Two additional PAVE PAWS sites—one in the Southeast and the other in the Southwest—are under tentative consideration, but as yet have been neither authorized nor funded.

The system detects Soviet SLBMs flying minimum-energy trajectories at distances of about 2,200 nautical miles from the US coastline—or about 3,000 miles in the case of "lofted," or high-altitude trajectories that overfly other US sensor systems. PAVE PAWS is a "soft" system that is Electromagnetic Pulse and Electronic Counter-Countermeasures resistant but not physically resistant to blast attack. Such an attack, however, would provide warning of a probable follow-on attack against the CONUS and thus is seen as unlikely. In order to reduce the vulnerability of the communications link between the PAVE PAWS sites and the National Command Authorities (NCA), the Air Force is weighing plans to provide each site with a ground satellite center and thus the ability to transmit via space rather than by vulnerable land lines.

PAVE PAWS's prime contractor is Raytheon's Equipment Div., with IBM acting as the software developer. The system is linked to ADCOM's Cheyenne Mountain Complex, the NCA, and SAC to provide SLBM launch, warning, and characterization information. Space surveillance information is furnished to ADCOM.

On completion of the system's Southeast site, it is possible that both the FPS-85 radar at Eglin AFB and the FSS-7 facility at MacDill AFB, Fla., could be decommissioned. These older installations are expensive to maintain.

USAF's Ballistic Missile Early Warning System (BMEWS) is another key component of the tactical warning and attack assessment. BMEWS's job is to reinforce this country's satellite early warning system by providing detailed warning information concerning ICBM attacks.

Current plans call for replacement of the system's obsolete computers at the system's three sites—in Greenland, Alaska, and the United Kingdom—and to upgrade the Thule, Greenland (site I) radar to provide better attack characterization, especially for attacks against the US ICBM force.

Computer replacement for the BMEWS modernization program is on contract with Federal Electric Corp. The requirement is for a family of computers that can "grow" sufficiently to accommodate potential upgrades in the BMEWS radars. The existing radars lack both accuracy and capacity since they were designed for the small-size raids postulated in the 1950s, way below the number of warheads available to the Soviets in the 1980s. The need now is for radars with improved resolution so that the system can "see" individual targets within dense clusters, not become saturated, and at the same time make accurate predictions of where the warhead will impact.

BMEWS and the Perimeter Acquisition Radar Characterization System (PARCS) are uniquely capable of "seeing" individual reentry vehicles after they have been released from a MIRVed Soviet ICBM's post-boost vehicle, or "bus." The system can thus make general judgments of what types of targets—such as a Minuteman missile field or bomber base—the individual warheads are being deployed against.

PARCS is an ICBM warning and attack assessment system involving modification of the US Army's Safeguard long-range radar developed originally for ballistic missile defense. PARCS, located at Grand Forks, N. D., some 1,000 miles south of the BMEWS sites, was turned over to the Air Force to provide attack assessment information and for satellite-tracking support functions. The system, as developed for ballistic missile defense, intrinsically has high capacity and great accuracy but is handicapped because of its location, so far as early warning is concerned.

ESD's shipborne phased-array radar system (COBRA JUDY), while not a warning system as such, will support missile and space R&D activities, serving as a national technical means for collecting information on foreign strategic ballistic missile tests. The USNS *Observation Island*, the platform of the radar system, was turned over this April to the Navy's Military Sealift Command, the operator of the ship. Air Force and Air Force contractor personnel will manage, operate, and maintain the technical systems associated with COBRA JUDY, including the 140-ton radar turret.

Raytheon is the manufacturer of the system's phased array. Upon completion of systems integration and checkout late this year, COBRA JUDY will put to sea for full shakedown testing.

ESD's Ground-based Electro-Optical Deep Space Surveillance System (GEODSS), when fully operational, will permit observation of satellites up to geosynchronous (22,300 statute miles) altitudes when lighting and weather conditions are favorable.

GEODSS is a complex system of wide-field telescopes, extremely sensitive television cameras, and radiometers coupled with modern signal processors and digital computers, and some very sophisticated software. It will take over where current systems leave off, gathering orbital and optical signature data on all manmade objects in deep space. Five sites are planned to provide worldwide coverage. The first site will be installed in White Sands, N. M., early in 1981. The second will be located in Korea, the third in Maui, Hawaii. Two additional sites, one in Diego Garcia, in the Indian Ocean, and the other in the Atlantic, will round out the system. The last two facilities will be "relocatable" so they can be moved if necessary.

GEODSS detects reflected sunlight from satellites by using specially designed telescopes, very sensitive, high-resolution television cameras, signal processing electronics, computers, and some sophisticated computer software. Each telescope focuses light on a television camera tube face, and the camera in turn converts the light signals to electrical signals.

The importance of deploying GEODSS at five sites results from the fact that at any given moment only one or two sites will be operational because of the system's confinement to nighttime viewing and the configuration of the earth's shadow. In order to get full coverage, GEODSS has to move in synchrony with the earth's shadow, which dictates the need for five global sites.

GEODSS can operate in one of two principal modes: it can move at a sidereal, or stellar, speed, and thus detect satellites since they move at a different rate; or it can filter out the stellar background by moving at the rate of a particular satellite whose orbital speed is known from previous sightings.

Because of its relatively wide field of view—six degrees at geosynchronous altitude compared to about 0.1 degree for a ground-based deep space surveillance radar—data produced by GEODSS also is useful for astronomic research.

The Pacific Radar Barrier, involving a radar system developed by MIT's Lincoln Laboratory for the US Army at the Kwajalein atoll, is another system providing space surveillance. The radar is being modified by Sylvania to improve the system's low- and high-altitude capabilities.

ESD, in concert with AFSC's Space Division, is developing the NORAD/ADCOM Space Defense Operations Center (SPADOC), which will serve as the central information center for all commands and agencies concerned with space. SPADOC will combine in one spot the surveillance, satellite attack warning, and command and control functions necessary to support either a response by US satellites to a Soviet ASAT attack or an attack by a US ASAT. Operational specifications for SPADOC are being completed, and hardware and software are being developed for the Mission Operations Center in phase with development of a US ASAT.

Survivable Command and Control Systems

The E-4B Advanced Airborne Command Post (AABNCP) is the best near-term prospect for achieving survivability of strategic command and control. Fixed command posts, even if hardened, are vulnerable to a concentrated nuclear attack. The E-4B AABNCP is a survivable emergency extension of the fixed command centers and provides higher confidence in the Pentagon's ability to manage strategic forces during a nuclear war.

Communications for the E-4B include SHF (super high frequency) and UHF (ultra high frequency) satellite communications terminals, a high-powered low and very low frequency terminal, and improved communications processing. These systems have antijam features and will support operations in a nuclear environment over extended ranges. An austere, minimum essential automatic data-processing capability—paralleling that of the EC-135 airborne command post—will become operational on the E-4B next year. The improvements, when installed in the full complement of six or seven E-4B aircraft, will also permit a substantial reduction in currently operational EC-135 airborne radio relay and auxiliary command post aircraft.

The E-4 test-bed aircraft has been refurbished for operational use and has joined the National Emergency Airborne Command Post (NEACP) fleet. Modification of the three current E-4A aircraft to the E-4B configuration will begin in FY '82 and be completed in FY '85.

Concurrent with the acquisition of the E-4B, ESD is modifying the EC-135 aircraft to increase the jam-resistance of their communications systems. Included here is the addition of a 100-kw VLF transmitter and new antennas. Ancillary programs are being formulated to improve strategic command and control capabilities during the transattack and postattack phases of a nuclear war.

The AFSATCOM/MILSATCOM Program

The Air Force Satellite Communications (AFSATCOM) system provides worldwide communications links to the strategic nuclear forces and theater nuclear weapons storage sites. The terrestrial segment consists of terminals on B-52 and FB-111 bombers, EC/RC-135s, KC-10s, E-4Bs, TACAMO aircraft, ground command posts, and ICBM launch control centers. Installation of these terminals is under way, with 283 terminals now in service.

AFSATCOM's space segment consists of several components. All of them are operational and include transponders on Fleet Satellite Communications (FLTSATCOM) and Satellite Data System (SDS) spacecraft. The next component called "Transition" will upgrade existing or programmed Department of Defense (DoD) spacecraft at both Super High Frequency (SHF) and Ultra High Frequency (UHF) modes for Emergency Action Message (EAM) dissemination and Force Element direction by ameliorating the effects of nuclear scintillation and intentional or unintentional interference.

It will also provide the Commander in Chief Europe (CINCEUR) a multiple access capability for the CINCEUR Airborne Command Post for control of the EAM, Force Direction, and Force Element report-back communication nets in the European theater. "Transition" will upgrade all AFSATCOM command post and force terminals so that they are compatible for simultaneous operation with the modes on FLTSATCOM and Defense Satellite Communications System (DSCS).

The program is managed jointly by AFSC's Space Division and ESD, with the latter responsible for the development, test, and acquisition of airborne and ground terminals.

AFSATCOM reached two major milestones recently. The first occurred in October 1980 with the transfer of AFSATCOM I Terminal Segment program management responsibilities—with the exception of the Consolidated Ground Terminals (CGTs)—from ESD to Sacramento Air Logistics Center (SM-

The AABNCP is the best near-term prospect for achieving survivability of strategic command and control.

ALC) at McClellan AFB, Sacramento, Calif.

The second major milestone occurred in March 1981 when the first AFSATCOM Consolidated Ground Terminal was installed at Hq., Strategic Air Command, Offutt AFB, Neb. The terminal will provide SAC with global satellite communications between the battle staff at Offutt's underground command post and the airborne AFSATCOM terminals in SAC's EC-135, RC-135, B-52, and FB-111 aircraft. This multisatellite, multichannel command post terminal is the first of eleven such terminals that will be installed during the next year at various locations within the continental United States and overseas.

The AFSATCOM program office recently contracted for production of Strategic Transportable Satellite Terminals (STSTs). The STSTs will meet Joint Chiefs of Staff (JCS) and SAC contingency support requirements. Specifically, the STSTs will be used to support the SAC Projection Force; the Hq. SAC Emergency Relocation team; Tanker Task Force Deployments; Reconnaissance Missions; and JCS-directed missions. The Alternate National Military Command Center will have one STST for assured communications if primary communications are severed.

The STST is capable of transmitting and receiving either unencrypted and encrypted seventy-five bits per second teletype traffic. Provisions for growth to a secure satellite voice capability are included in the terminal design. The STST incorporates the present AFSATCOM capabilities and will be compatible with future AFSATCOM terminal upgrades. The STST is a transportable AFSATCOM terminal suitable for worldwide deployment including bare-base environment. The STST is packaged in transit cases and can be used for both airborne and ground operations.

AFSATCOM will lose a substantial portion of its capability when the FLTSATCOM system reaches the end of its design life. To fill the gap the Air Force is considering the addition of FLTSATCOM satellites. However, this stop-gap system will only partially provide the increased jam resistance, improved availability, sufficient capacity, communications security, and increased physical survivability necessary in the mid-1980s and beyond.

To meet these longer-term requirements the Air Force was directed to develop a follow-on system called the Strategic Satellite System (SSS). However, Congress did not fund this program. In response, the Office of Secretary of Defense initiated a Military Satellite Communications (MILSATCOM) Architecture Study in October 1980. This study advocated a "multimission satellite system" to satisfy satellite communication requirements for strategic and tactical users of all services.

AFSATCOM and its follow-on systems are components of the Defense Department's World-Wide Military Command and Control System (WWMCCS).

Another component of strategic C^3 that ESD is developing is the SAC Digital Network (SACDIN). This communications network conveys two-way, hard-copy, secure command and control information between Hq. SAC and subordinate SIOP elements, such as SAC missile and bomber/tanker command posts. SACDIN also integrates C^3 functions in ICBM launch control centers (LCCs).

SACDIN is a secure system, capable of handling messages with various security levels and can be adapted manually to such changing conditions as circuit outages and equipment failure. The system has the ability to grow or change as requirements change.

SACDIN's hardware and software are tailored for various needs of various users even though the general design approach emphasizes the use of common hardware and software throughout the system. The computer used at all SACDIN locations is the IBM CS-1, a militarized and slightly modified version of the IBM Series 1. Microprocessor controllers are used to provide interfaces to peripheral devices and external system interfaces. There is a single computer program architecture used at all SACDIN locations and specific programs are added or deleted depending on the functions and interfaces at each location.

The SACDIN system is being acquired in a phased approach with ITT's Defense Communications Division as the prime contractor, and IBM and BDM as the principal subcontractors.

The research and development phase of the program is to run for fifty-six months, to be followed in mid-1983 by a production decision, assuming a positive Air Force System Acquisition Review Council decision at that time.

The E-3A AWACS (Sentry)

ESD's E-3A AWACS (Sentry) is now operational in the Air Force and performs tactical air surveillance and control and contingency missions as well as North American air defense missions.

The E-3A provides mobile, survivable, jam-resistant, wide-area radar surveillance, along with highly sophisticated data processing, data relay, and communications capabilities. The basic requirement for the system stems from line of sight/terrain masking limitations and vulnerabilities of ground-based radars in the face of continued growth in threats from air and missile attack. Key advantages include comprehensive "deep-look" radar view of enemy air environment, force enhancement through radar controlled intercepts, and comprehensive display of air and maritime activity for commanders.

Twenty-four E-3A Airborne Warning and Control System (AWACS) aircraft have been delivered to the Tactical Air Command. The system, which supports worldwide tactical contingencies as well as the strategic atmospheric defense of North America, can operate independently of or in conjunction with ground-based warning and control systems. The E-3A's tests and exercises proved the system's capability to conduct both strategic air defense and tactical missions. In the last year E-3As have been deployed to Korea, NATO, and Saudi Arabia to support US interests abroad during periods of increased tension.

The Air Force plans to acquire at least thirty-four E-3As for its own use. At this writing, there are indications that a thirty-fifth aircraft will be acquired by USAF with the potential for eighteen more and that the US Navy eventually might be in the market for E-3As of its own for the fleet defense mission.

ESD recently initiated a program to improve the aircraft's radome that led to dramatic performance boosts, in the main by "seeing farther," providing greater accuracy, and reducing the radar's stray energy known as the "sidelobes," thereby increasing jam resistance.

NATO nations have agreed to purchase the E-3A aircraft. In December 1978, the US Secretary of Defense, along with eleven other NATO Defense

Ministers, agreed to participate in the NATO Airborne Early Warning and Control (AEW&C) program as part of an overall effort to improve NATO air defenses and to counter the growing Warsaw Pact low-altitude threat. The NATO AEW&C provides for eighteen E-3A aircraft, modification of the ground environment to assure interoperability with the airborne components, and construction of basing facilities. The program also includes a contribution by the United Kingdom of eleven Nimrod aircraft.

The NATO version of the system, now in full-scale acquisition, varies from the USAF "basic core" aircraft now in service. The so-called NATO enhancement roughly triples the number of target tracks—the specific number is classified—that the system can handle by installing a higher-speed computer with increased memory capacity. The E-3A Program Office plans to retrofit the more capable computer—the 4 Pi CC-2—to the twenty-four basic core aircraft of the Air Force.

A range of other E-3A improvements is being investigated by ESD, including "display remoting," meaning a secure link to theater command and control centers to give them a real-time situation display of enemy and friendly sea and air forces over a large geographic area as seen by E-3A. Increasing the number of UHF radios and situation display consoles to enhance the system's flying command post features also is under development.

In order to provide AWACS with protection against advanced ECM threats in the next decade, ESD is studying various ECCM that could be retrofitted after the last aircraft comes off the line. Adding a voice encoder that digitizes voice for transmission via the Joint Tactical Information Distribution System (JTIDS) is also under development. The E-3A design incorporates considerable nuclear hardening, a feature of special importance to the CONUS air defense mission or in case of theater nuclear war in Europe.

Occasionally questions are raised about AWACS self-defense capability, which includes maneuvering at jet speeds, calling in interceptors, or directing friendly SAMs against airborne threats. Probably the mere fact that in the pulse—as opposed to the pulse Doppler—mode, the E-3A's radar can detect aircraft operating at altitude over a distance of up to 350 miles precludes surprise attack by hostile interceptors. Therefore, AWACS's self-defense capabilities are confined to hardpoint provisions for a standard countermeasures pod—possibly ECM, chaff, or flares. This was deemed essential because of the uncertain character of future threats.

Tactical C^3

Although much combat information is suited to voice channels, aircraft controllers and voice links can become saturated when voice is relied on as the sole means of real-time communications in a tactical theater. Studies have shown that certain elements of data, such as friendly and hostile air tracks, are passed more efficiently over digital data links. ESD is developing the JTIDS to correct these deficiencies.

JTIDS provides jam-resistant, secure communications between force elements using a high-volume, high-speed digital data link, which allows command and control nets to share more information. Also, each JTIDS terminal can compute its position relative to other terminals, thus providing location and identification of all participating platforms as well as an on-board navigation capability.

Eventually, JTIDS will interconnect large numbers of dispersed aircraft, SAM sites, ships, and ground mobile platforms.

JTIDS exploits sophisticated time division multiple access (TDMA) and other even more advanced technologies to create jam-resistant networks that can handle vast amounts of digital data. As the term implies, TDMA divides time rather than frequency to communicate with individual participants on a noninterference basis. Since it "frequency hops" across a wide spectrum, JTIDS is highly jam-resistant. Each unit of time is divided into a large number of time slots, and a precise synchronization mechanism allocates the slots to individual users for the transmission of short bursts, or encoded pulses, of digital data.

The combination of frequency hopping and coding not only leads to jam resistance and security but also makes it possible to create multiple nets within the JTIDS band. When a subscriber is not transmitting, the terminal monitors all transmissions but selects for further processing only those categories of information that interest him. Two classes of terminals are being developed under the JTIDS program. Class I is for such large aircraft as AWACS and for facilities that link JTIDS ground-based networks. Class I terminals for use on both US and NATO versions of the E-3A airborne warning control system aircraft are in production by Hughes Aircraft's Ground Systems Group of Fullerton, Calif.

The first JTIDS E-3A terminal will be delivered to the Boeing Co. in August 1982. It will be installed on the fifth NATO production aircraft scheduled for delivery in March 1983.

The first US E-3A equipped with the new JTIDS terminal will be the twenty-seventh production aircraft scheduled for an April 1983 delivery to Tactical Air Command. These units weigh about 330 pounds and are the size of a small refrigerator.

In January of this year, ESD awarded a full-scale engineering development contract for twenty Class II terminals to Singer-Kearfott and Collins Radio (Rockwell International) in a leader-follower arrangement. Fifteen of these units will be used by the Air Force and the remaining five by the Army.

Class II terminals are designed for small aircraft and the vans of the US Army's Position Location Reporting System. While similar in function to the Class I design, these units are smaller—about two cubic feet—and weigh only about 120 pounds. The Class II terminals are being developed for use on F-15 and F-16 aircraft, as well as on British aircraft.

Last summer, the Defense Department decided that the US Navy should develop an "enhanced JTIDS architecture," one that is compatible with the Air Force/Army JTIDS version.

From the point of view of fighter aircraft, the revolutionary feature of JTIDS is the system's ability to put the pilot in the middle of things by letting him know precisely and graphically where he is going, where the enemy is, and where his friends are. With all JTIDS sensors within the combat area tied together via JTIDS, the amount of information available to combat crews will provide timely threat information as well as decrease the chance of surprise attack from enemy aircraft. JTIDS also makes it possible for escort aircraft to call up detailed information on SAM threats in the target area.

Key contractors on the JTIDS program are General Dynamics, Hughes, IBM, ITT, McDonnell Douglas, Rockwell Collins, and Singer-Kearfott.

Antijam Systems

The key flaw of existing tactical communications systems is their susceptibility to enemy jamming. ESD's HAVE QUICK and SEEK TALK programs provide antijam (AJ) capability in the critically important tactical voice communications network. Both programs—the former a quick fix and the other a long-term solution—will pro-

vide an ECCM capability for the Air Force's primary ultra-high frequency (UHF) command and control communications, in the main ARC-164 radios used for air-to-air and air-to-ground operations.

ESD has finished the major part of the HAVE QUICK program's R&D phase and awarded both an initial production and follow-on production contracts in May 1980 and March of this year, respectively. Initial hardware delivery got under way in December 1980 and will continue through 1981. Modification of the UHF radios is being carried out by Air Force personnel.

At this writing more than 100 HAVE QUICK units have been installed on A-10 aircraft. Present contracts provide for a buy of more than 2,000 units from Magnavox Government and Industrial Electronic Co. for Air Force use, but there may be follow-on buys by the Air Force as well as the US Navy. The latter plans to equip the aircraft of three of its battle groups with HAVE QUICK units by the end of next year.

By about 1985, ESD's advanced jam-resistant and secure voice communications system, SEEK TALK, will take over from HAVE QUICK. This spread-spectrum, random-noise system will use adaptive antenna array techniques to "null" a number of jammers at once. SEEK TALK will enable fighter and attack aircraft to operate even in the most intense jamming environments imaginable. SEEK TALK will provide an improved jam-resistant conferencing capability, meaning that a wingman can break into the traffic without delay to report such emergency information as SAM sightings.

Full-scale development contracts, incorporating time phased development and production options, were awarded in January of this year to Hazeltine Corp. and General Electric Co. A production decision concerning SEEK TALK is scheduled for the second quarter of FY '84. ESD plans to select one of the two competing contractors in about twelve months for completion of full-scale engineering and production of SEEK TALK. Ultimately the program will involve more than 8,000 systems for the tactical forces.

ESD is working with the Army on the latter's Single Channel Ground and Airborne Radio Subsystem (SINCGARS-V), with an eye on replacing or augmenting the Air Force's VHF-FM radios with secure and jam-resistant designs. Total SINCGARS procurement will be almost 200,000 radios and 30,000 ECCM modules. USAF eventually might require between 1,500 and 5,000 SINCGARS radios for its airborne and ground-based forward air controllers who interface with the Army.

ESD's SEEK SCREEN program provides improved ECCM for USAF's tactical air-control radars in three specific areas. The ULSA (for Ultra-Low Sidelobe Antenna) program reduces drastically the vulnerability of ground-based radars to antiradiation missiles (ARMs). Using technologies developed for the AWACS radar, ULSA eliminates radar sidelobes (stray energy emissions), thus confining ARM attacks to the main radar beam, which is extremely difficult. Westinghouse, the developer of the AWACS radar, is also developing ULSA.

ULSA, which includes advanced signal analysis and processing, can detect aircraft over ranges of approximately 260 miles. A production decision is expected in the first quarter of FY '83.

SEEK SCREEN's second element is the ARM alarm sensor, which is in fact a small radar that operates on different frequencies from the ground-control radar to which it is connected by cable. A low-cost, unattended, compact, and remotely located device, the ARM alarm detects enemy radar-seeking missiles and either warns the ground-radar operators of impending attack or shuts down the ground radar automatically. The ARM, without a radar beam to home on, is unable to find its target. Advanced development has been completed on this program.

The third element of this ECCM program involves developing decoy radars, saturating the battlefield with devices that radiate energy like real radars. The classified techniques underlying these decoys are being developed by RADC.

ESD's Tactical Air Battle Management Systems (TABMSs) Program Office manages six programs that focus on tactical command control and communications. Their goal is improved management of Tactical Air Force Aircraft and Support Systems through automation.

The Computer Assisted Force Management System (CAFMS) program will greatly improve the performance of Tactical Air Command Control Centers. By using computers, it will increase the speed and accuracy of information exchange, storage, and processing. Tactical air operations will be better planned, controlled, and able to respond to rapidly changing battlefield conditions.

In the EIFEL I program, the US is purchasing a Tactical Command and Control System from the Federal Republic of Germany. When installed in late 1982, the US EIFEL I system will be connected to the German EIFEL I network to provide a limited, interoperable US/German network that may be extended to cover the entire NATO Central Region. The EIFEL II program is planned to be a bilateral US/German effort over several years to add new functions to the EIFEL I system, improve security, and greatly enhance the survivability of the system.

The Constant Watch program is supporting PACAF's development of an automated C^3 system to aid in force management. The Constant Watch system will consolidate communications, intelligence gathering and dissemination, and data-processing capabilities and facilities, as well as provide operations support, airlift control, and weather information. This system will improve the management of both US and Republic of Korea forces in the Korean theater.

The Joint Interoperability of Tactical Command and Control Systems (JINTACCSs) program is developing standard messages to make all the services' Tactical Command and Control (C^2) systems used in joint operations interoperable. JINTACCS will provide a common language for information exchange among automated and manual tactical C^2 systems, thus reducing errors and misunderstandings in communications during peacetime or war.

The Radar Prediction System (RAPS) is an automated system to generate radar predictions for flight crews in support of airborne bombing, reconnaissance, and airdrop operations. A radar prediction is a representation of the image expected to be seen on the radarscope over the target area. RAPS provides timely, accurate radar predictions for a wide variety of target areas and flight paths.

A related program, BETA, for Battlefield Exploitation and Target Acquisition, went through development and demonstration of joint tactical fusion test-beds and delivered them to the Air Force and Army. BETA, carried out jointly by the Air Force, Army, Navy, and Marines, demonstrated the ability to take information from many different sensors and display correlated battlefield information almost in real time. The test-beds have been delivered to Hurlburt Field, Fla., and Fort Hood, Tex., for test and evaluation by operational users. The results are expected to influence the newly established Joint

(Continued on p. 81)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F-5G TIGERSHARK

The F-5G Tigershark. Northrop's new Mach 2 air defense fighter. First six aircraft now being built. Flight test 1982. First deliveries July, 1983.

Technology advancements in aerodynamics, avionics and systems. A new General Electric F404 engine gives Tigershark a combat thrust-to-weight ratio of 1.06 to 1.

Combat performance: Rate of climb 50,300 feet per minute, 32 percent higher than the F-5E. With a 38 percent greater turn rate. 48 percent faster acceleration. And unrestricted maneuverability.

Pilot-designed cockpit under a new panoramic canopy. Varying combinations of advanced radar and avionics equipment, selected for both capability and reliability, to meet specific mission requirements.

The Northrop F-5G Tigershark. New levels of air combat performance. Same proven reliability, maintainability and economy of F-5 system. For total force effectiveness.

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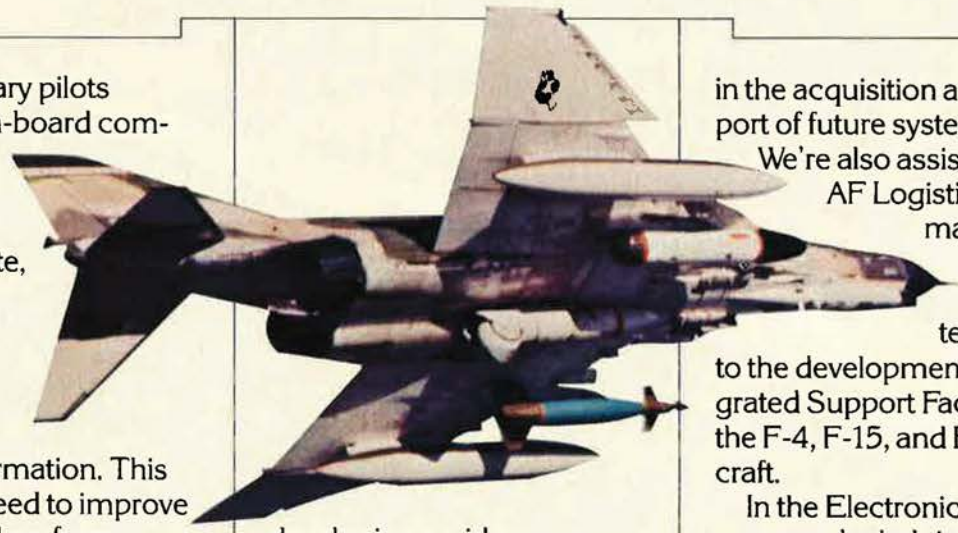

Today's military pilots need their on-board computers more than ever to help them navigate, automate weapons delivery, and access real-time mission information. This means the need to improve reliability and performance margins in avionics systems has increased. So has the need to reduce spiralling life-cycle costs.

That's why TRW has been working with the Department of Defense and NASA to apply digital technology to avionics—developing a wide range of advanced systems for air and space applications. Take DAIS, for example, the Air Force's Digital Avionics Information System. Since 1975, TRW has supported DAIS with advanced simulation technology, analytical and test software, and avionics integration and analysis. Programs like DAIS, investigating standard architectures and interfaces promise to reduce life-cycle costs in the acquisition and support of future systems.

We're also assisting the AF Logistics Command in applying digital technology to the development of Integrated Support Facilities for the F-4, F-15, and E-3A aircraft.

In the Electronic Warfare arena, we're helping to develop an in-theater reprogramming capability to ensure that critical mission data is always accurate and up-to-date.

We're also at work in space, developing advanced flight software for IUS, HEAO, and the TDRS system.

If you'd like to learn more about digital avionics technology at TRW, contact: Richard Maher, 1 Space Park, Redondo Beach, Ca., 90278. Phone (213) 536-3238.

DIGITAL AVIONICS TECHNOLOGY from

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DEFENSE AND SPACE SYSTEMS GROUP

What's Happening in Electronics at ESD

A CHECKLIST OF MAJOR ELECTRONICS PROJECTS

NAME AND MISSION	STATUS	CONTRACTOR
COMMUNICATIONS AND INFORMATION SYSTEMS		
Air Force Satellite Communications System (AFSATCOM) A program for acquisition of UHF airborne/ground terminals, airborne/ground command post terminals, ancillary equipment for operational control and communications transponders on selected Air Force satellites. The associated family of modular UHF transceivers will provide a command communications capability in the line-of-sight mode. The full-grown family of modular UHF radios will result in a common base to provide the transceiver for the satellite SIOP and force communications terminals.	Development/Acquisition/Deployment	Rockwell, Linkabit Corp.
Air Force Single Channel Ground and Airborne Radio System (AFSINCGARS) Air Force portion of the Army Single Channel Ground and Airborne Radio System for VHF/FM communications. Purpose of the Air Force program is to provide jam-resistant, secure VHF/FM communications between Air Force elements and US Army ground forces.	Development	Not yet named
Combat Theater Communications A program for acquisition of new hybrid analog/digital communications equipment for both Air Force-unique tactical requirements and for the DoD Joint Tactical Communications (TRI-TAC) program. Within the TRI-TAC program, the Combat Theater Communications Office carries out the development, test, and production of equipment procured through this joint-service program. Also responsible for the interoperability of TRI-TAC equipment with other communications equipment within the tactical Air Force environment.	Definition, Research and Development, and Acquisition	Martin Marietta, ECI, Raytheon
Digital European Backbone (DEB) Incremental upgrade of portions of the European Defense Communications System (DCS) from a frequency division multiplex (FDM) analog system to a time division multiplex (TDM) digital system with higher reliability components. This will provide a modern wide-band, digital, bulk-encrypted capability with increased capacity between Defense Satellite Communications System Earth Terminals and major commands.	Acquisition and Deployment	Many
Joint Tactical Information Distribution System (JTIDS) A program to develop a high-capacity, reliable, jam-protected, secure digital information distribution system which will provide a high degree of interoperability between data collection elements, combat elements, and command and control centers within a military theater of operations.	Engineering Development	Hughes, ITT, IBM, Singer-Kearfott, McDonnell Douglas
Operational Application of Special Intelligence Systems (OASIS) Improvement of tactical command control and communications capabilities through the application and interfacing of appropriate surveillance and special intelligence systems. Initially, improvements to the USAFE Tactical Fusion Center (TFC) in its role in support of Allied Air Forces Central Europe are being addressed. Although the OASIS program will concentrate initially on needs of the TFC, the program will, as required, develop operational acquisition of special intelligence systems for other commands.	Development and Acquisition	Martin Marietta
Strategic Air Command Digital Network (SACDIN) A program for a secure record data communications system to support the command and control requirements of the Strategic Air Command. It will replace parts of the SAC Automated Command and Control System (SACCS).	Development	ITT, IBM, ECI
HAVE QUICK A program to reduce the vulnerability of UHF radios to enemy jamming. HAVE QUICK provides the Air Force an improved near-term air-to-air and air-ground-air jam-resistant UHF voice communications capability that will allow mission accomplishment in an enemy jamming environment through 1985.	Development and Production	Magnavox
SEEK TALK A long-term solution to reducing the vulnerability of UHF radios to enemy jamming. SEEK TALK will develop and acquire equipment for a Class V Modifications program which will provide the Air Force the capability to conduct air-to-air and ground-air-ground UHF voice communications in a jamming environment. This will be achieved by modifying existing UHF voice radios and adding a spread-spectrum modem and null steering antenna array.	Development	General Electric, Hazeltine
Tactical Air Control System Improvements (TACSI) This program will increase Tactical Air Control System capabilities for combat command and control of tactical aerospace operations. Improvements consist of mobile communications and electronic systems, capable of nuclear worldwide deployment, that are interoperable with Army, Navy, and Marine Corps tactical data systems. Projects include ECCM improvements to the AN/TPS-43E Tactical Radar, the AN/TPN-28 Dual Band Radar Bombing Beacon, a weapons controller training system, and the improved Forward Air Control Post.	Definition, Engineering Development, Production	Goodyear, Applied Devices Corp., GTE Sylvania, Westinghouse
Tactical Information Processing and Interpretation System (TIPI) The USAF TIPI/USMC MAGIS (Marine Air General Intelligence System)/USA MAGIIC (Mobile Army Ground Imagery Interpretation Center) will provide more timely and accurate intelligence to tactical commanders at various echelons. Air transportable and housed in mobile shelters, separately deployable segments of the system use automated aids for rapid processing, interpretation, and reporting of intelligence from airborne electronic reconnaissance infrared, photographic, and radar sensors.	Development, Acquisition and Deployment	Many
SURVEILLANCE AND CONTROL SYSTEMS		
Air Force SAFE Program Acquisition and deployment of commercially available and DoD BISS Program-developed physical security equipment to approximately sixty USAF bases and 130 sites worldwide. These systems will protect mission-critical/high-value resources such as weapons storage sites, strategic/tactical alert aircraft areas, special mission aircraft parking ramps, and specified command posts.	Acquisition/Deployment	Many
ARIA Phased-Array Telemetry System (APATS) A phased-array telemetry system for installation on the ARIA aircraft in support of the MX and Trident test programs.	Development	Not yet named

NAME AND MISSION	STATUS	CONTRACTOR
Automated Weather Distribution System (AWDS) AWDS will enhance Air Weather Service's meteorological support for the Army and Air Force. The system will reduce labor-intensive tasks using advanced computer technology, color graphic displays, and sophisticated meteorological and graphic presentation software. Automation of 163 base weather stations worldwide, and twenty tactical versions will interface with two communication networks for distribution of global alphanumeric and graphic meteorological data.	Development	Not yet named
BMEWS Modernization Program The purpose of the BMEWS Modernization Program is to upgrade the three operational sites (Greenland, Alaska, England) operated by SAC and the Royal Air Force. The eight Tactical Operations Room consoles at each site are being replaced by four modern consoles to improve operating efficiency and reduce personnel requirements. The Missile Impact Predictor is being upgraded by replacing the aging computers now in use with off-the-shelf computers and translating software assembly language into a higher-order language. Radar improvements are planned that will meet the threat expected in the 1980s, and give the system an attack assessment capability to meet the need of the National Command Authorities.	Acquisition	RCA
DoD Base and Installation Security Systems (BISS) An evolutionary RDT&E program to provide a DoD standard electronic security system for exterior physical security of DoD resources worldwide. This system's components include sensor, imaging, entry control, and command and control equipments. The system concept emphasizes maximum commonality of major items and a variety of supporting subsystems. It offers a flexible choice of equipment to assemble a system tailored to the physical characteristics of the location and to the threat.	Advanced Development/Engineering Development	Many
CONUS Over-the-Horizon Backscatter Radar (OTH-B) This program provides long-range detection of aircraft approaching North America as part of the NORAD air surveillance and warning capability. Distinguishing technical feature of the OTH-B is its ability to detect targets at all altitudes at extended ranges. The present program is to build and test an experimental radar system.	Development/Validation	General Electric
COBRA JUDY COBRA JUDY is a USAF shipborne phased-array radar system. It will serve as a national technical means for collecting data on foreign strategic ballistic missile tests. Air Force and Air Force contractor personnel will manage, operate, and maintain the technical systems on board the ship. The Navy's Military Sealift Command will own and operate the ship.	Acquisition	Raytheon
Enhanced Perimeter Acquisition Radar Characterization System (EPARCS) The EPARCS program consists of hardware and software modification to the present PARCS system. It will include range extension of the radars, and increasing the accuracy and improvement of the traffic-handling capability in support of the launch-under-attack mission.	Acquisition	Bell Telephone Labs
Ground Electro-Optical Deep Space Surveillance System (GEODSS) The GEODSS system will extend the Strategic Air Command's and North American Air Defense Command's spacetrack capabilities for detecting and cataloging space objects out to the 3,000–20,000 nautical mile range. This will be a global network of five sites to detect optically, track, and identify satellites in earth orbit.	Acquisition	TRW
Joint Surveillance System (JSS) The JSS program is to acquire and deploy a peacetime air surveillance and control system to replace the Semi-Automatic Ground Environment (SAGE) system for the US and Canada. For Canada, the mission is expanded to include support of wartime air defense functions, and in Alaska the mission includes the performance of tactical air control functions.	Implementation	Hughes Aircraft
NORAD Cheyenne Mountain Complex Improvements Acquisition of data-processing equipment, software, displays, and communications for the NORAD Cheyenne Mountain Complex. The Core Processing Segment, Modular Display Segment, and Communications System Segment will provide NORAD with an integrated, responsive capability and a growth potential over a projected ten-year life span without major changes to equipment or software.	Operational	Ford Aerospace & Communications Corp.
Pacific Radar Barrier (PACBAR) The PACBAR system will provide space surveillance coverage and early detection of new space launches in the Central and Western Pacific areas by placing improved radars at three sites.	Development/Acquisition	GTE Sylvania (Army contract)
PAVE PAWS Two dual-faced phased-array radars, one on the East Coast and one on the West Coast. This system will be operated by the Strategic Air Command and will provide warning to the National Command Authorities of a sea-launched ballistic missile attack against CONUS.	Operational	Raytheon
SEEK IGLOO Upgrading or replacement of all thirteen Air Force long-range radar sites in Alaska on a Minimally Attended Radar concept with maintenance by not more than three medium-skill radar technicians and no on-site radar operators. A major objective is a large-scale reduction in the life-cycle cost of Alaskan radar surveillance systems.	Development	General Electric
SEEK SCORE This program is to develop and produce a radar bomb scoring system for SAC for training and evaluation of aircrews in a realistic operational environment.	Development	Not yet named
Space Defense Operations Center (SPADOC) SPADOC, to be located in the NORAD Cheyenne Mountain Complex, is the central command control communications and intelligence (C^3I) element of the Space Defense Command and Control System (SPADCCS). It will consist of new ADPE, displays, interface equipment, and communications upgrades. It will act as the focal point for higher echelon command and control and disseminate space-related information to other US commands. SPADOC will collect and disseminate real-time information on system status, warning, and operational direction.	Acquisition	RFP issued
Spanish Systems This program provides assistance to the Spanish Air Force for maintenance and operation of air defense system. Provides modifications and improvements to the network including weapon and command and control improvements, increased radar coverage, and augmentation and upgrade of communication links.	Acquisition	COMCO (Hughes Aircraft and CECSA), General Dynamics
Tactical LORAN Digital Avionics Systems Development and acquisition of the AN/ARN-101 (V) Navigation, Weapons Delivery, and Reconnaissance Systems for the RF-4C and F-4E aircraft. This digital modular avionics system combines LORAN/inertial information and integrates radar, optical, infrared, and laser sensors to satisfy requirements for precision weapons delivery during the 1980s.	Installation, Operation	Sperry Gyroscope, Lear Siegler

NAME AND MISSION	STATUS	CONTRACTOR
Traffic Control and Landing System (TRACALS) TRACALS encompasses fixed and mobile ground facilities, with associated avionics, to support the USAF Air Traffic Control function. Major systems being acquired include navigation aids, radar approach control equipment, landing systems, and simulators.	Continuing Development and Acquisition	Many
TECHNICAL OPERATIONS		
Command Management Information System/Graphics (CMIS/Graphics) Design, implementation, and test of an automated graphics and telebriefing for each of the product division elements of AFSC. Includes local graphic stations within system program offices and selected functional elements, centralized photocomposition, typesetting and graphics processing and large-screen display with interbase voice and graphics connections.	Prototype Acquisition	Booz, Allen, and Hamilton
Competitive Acquisition for the Scientific Environment (CASE) Acquisition of computer replacements for all AFSC data-processing installations. The program includes systems engineering to address inter- and intra-AFSC data-processing installations requirements and a fifteen-year program of replacement and upgrade of existing equipments.	Acquisition	Booz, Allen, and Hamilton
Improved Administrative Capability Test (IMPACT) Design, implementation, test, and evaluation of a prototype automated office system for AFSC. Objective is to ensure the introduction of modern office technology to management and support functions for the purpose of increasing office efficiency while reducing manpower requirements and operating costs.	Prototype Demonstration	Booz, Allen, and Hamilton
AIRBORNE COMMAND POST SYSTEMS		
E-4 Airborne Command Post This program is to provide the National Command Authorities and the Commander in Chief of Strategic Air Command with a survivable airborne command and control system that will operate during the pre-, trans-, and postattack phases of a nuclear war. As a survivable emergency extension of NMCS and SAC ground command and control centers, the E-4 Airborne Command Post provides high confidence in US ability to execute and control SIOP forces in a nuclear environment.	Development, Production/Deployment	Boeing, E-Systems
Air Force Support to MEECN This program upgrades the Air Force and Army Survivable Low Frequency Communications Systems (SLFCS) as part of the Minimum Essential Emergency Communications Network (MEECN). Major developments include airborne LF/VLF transmitters, new receive antennas for transverse electric mode reception, incorporation of the Navy MEECN Message Processing Mode (MMPM), and mini-LF/VLF receive terminals for bomber aircraft. This program is designed to meet the requirements of the Joint Chiefs of Staff, CINCSAC, and theater CINCs.	Definition, Development, Production/Deployment	Westinghouse, Sonicraft Inc
AIRBORNE WARNING AND CONTROL SYSTEMS		
E-3A Airborne Warning and Control System (AWACS) This system provides airborne air surveillance capability and command control and communication functions. Its distinguishing technical feature is the capability to detect and track aircraft operating at high and low altitudes over both land and water. Used by Tactical Air Command with Tinker AFB, Okla., as the main operating base, aircraft may deploy throughout the US and overseas to provide surveillance, warning, and control in a variety of peacetime and wartime situations.	Acquisition and Operational	Boeing, Westinghouse for radar
NATO E-3A Acquisition of E-3A Sentry aircraft for the North Atlantic Treaty Organization (NATO), with special modifications to meet NATO requirements.	Acquisition	Boeing, Dornier, and others
DEVELOPMENT PLANS		
Air Force World-Wide Military Command and Control System (AFWWMCCS) Involves systems planning and engineering for Air Force elements of the World-Wide Military Command and Control System. Activities will focus on intersystem engineering of selected AFWWMCCS existing and planned assets.	Conceptual/Validation/Development	Not yet named
Command and Control Countermeasures A program designed to degrade an adversary's capability to engage effectively in combat. This would be accomplished by electromagnetic means (jamming, deception, or exploitation) or force, i.e., physical destruction, to inhibit use of his command control and communications for managing his combat.	Development	Not yet named
C^3I Interoperability This effort involves a process that emphasizes user/developer interaction in defining interoperability requirements for systems being developed by ESD. Includes a study of trade-offs between technical, operational, and procedural requirements and options so that C^3I systems will interoperate where required.	Continuing	Not yet named
Ground Target Attack Control System (GTACS)/Assault Breaker GTACS is a program to design and develop a near-real-time capability to detect and destroy hostile second-echelon ground forces. Assault Breaker is a series of technology demonstrations designed to illustrate the technical feasibility of accomplishing real time detection and attack of forces. ESD's responsibility includes coordinating and conducting the Air Force portion of Assault Breaker demonstrations and preparing for full-scale engineering development.	Concept Development/Demonstration or Validation	Not yet named
Space Communications Architecture To develop and update annually a time-phased program for satisfying a critical subset of Air Force command and control information flow requirements via satellite relays. Provides basis for formulating portions of the Air Force Budget Submission and Five-Year Development Plan. Analyzes current capabilities and deficiencies, projected requirements, and enemy threat; structures needed development and acquisition programs.	Continuing	Not yet named
Vanguard A comprehensive planning process that measures capabilities against mission responsibilities, identifies deficiencies, and proposes solution with each Air Force mission area. ESD is responsible for the strategic, tactical, and support C^3 plans, the ballistic missile and atmosphere surveillance and warning plans, electronic counter-countermeasures, C^3, and correlation/fusion plans.	Continuing	Not yet named

The 507th Tactical Air Control Wing—Its Mission Is 'To Command the Sky'

Involved in providing ground forces with much more than close air support and dependent as it is on electronic equipment ranging from radars to computers to radio nets, this unique Ninth Air Force wing is a fitting subject for inclusion in this month's Electronic Air Force issue.

BY WILLIAM P. SCHLITZ, SENIOR EDITOR

"THE Air Force takes someone right out of college and sends him through pilot training. Then it puts him in a sophisticated multimillion dollar fighter. After a couple of years he begins to believe that he and the aircraft *are* the Air Force.

"Then that pilot is sent to the 507th Tactical Air Control Wing as a forward air controller and receives the shock of his life. He discovers that the fighter is not an entity unto itself, but rather a small cog in an immense wheel."

Speaking is Capt. Dave Webb, from the 507th Tactical Air Control Wing Weapons Shop at Shaw AFB, S. C.

"Once attached to an Army unit on the ground or in the cockpit of an O-2 guiding in air strikes," continued Dave Webb, "the pilot begins to understand what Tactical Air Command is all about. He learns that on the Air Force side there is a huge apparatus dedicated to supporting the ground forces, and if it weren't for that mission, TAC probably wouldn't exist."

Dave Webb points out that the 507th Tactical Air Control Wing is essential in providing interface between Air Force resources and ground-force elements. The 507th, one of only three such wings in the Air Force, is distinctive because of its size, geographic dispersion, and the scope of its varied and complex mission.

The wing's parent unit is TAC's Ninth Air Force, also headquartered at Shaw AFB. To provide liaison with the respective air and ground units, the wing has eleven squadrons, four flights, and seven detachments located in eight states throughout the southeastern United States.

The 507th's responsibilities go far beyond directing close air support for the ground forces, as important as that may be. The wing is also involved in all tactical air missions including counter-air, tactical airlift, tactical reconnaissance, special operations, and interdiction. In short, it is the Ninth Air Force's instrument in operating the Tactical Air Control System. It tells TAC fighters and other aircraft where to go, what to do, and when to do it in support of ground operations.

The Green-Suit Look

With its close ties to the ground forces, the wing is noted for its "green-suit" look; many of the 507th's more than 2,600 men and women wear Army-style camouflage combat fatigues as their working uniform.

"Where the Army goes, our people have to be prepared to go," said Col. Keith B. Connolly, 507th Commander. "To that end, the wing is truly mobile, equipped with 1,050 vehicles and trailers—more rolling tactical assets than any other wing in the TAC—to assure that when deployed in the field wing units can keep up with their Army counterparts."

Units of the 507th are dispersed widely in support of ground forces: its Detachment 1 is located at Fort Bragg, N. C., in support of the 18th Airborne Corps and 82d Airborne Division; Detachment 2 is at Fort Steward, Ga., with the 24th Mechanized Infantry Division and 1-75th Ranger Battalion; Detachment 3 is at Fort Knox, Ky., with the 194th Armored Brigade; Detachment 4 is at Fort Benning, Ga., with the 197th Infantry Brigade; Detachment 5 is at Fort Campbell, Ky., with the 101st Air Assault Division; Detachment 6 is at Fort Polk, La., with the 5th Infantry Division; and Detachment 7 is at Fort Riley, Kan., with the 1st Infantry Division.

Since several of these Army units have been earmarked for the Rapid Deployment Joint Task Force, 507th planners must think in terms of airlift mobility. (Ninth Air Force Commander Lt. Gen. [selectee] Larry D. Welch is the RDJTF's top Air Force representative.) "If those Army units deploy overseas in support of a contingency, our people and equipment will go with them," said Colonel Connolly.

"We've 'skinnied down' our needs to 'initial packages' of essential equipment in terms of the number of C-141s required to haul it," Colonel Connolly said. "The idea would be to get some basic capability into the area of con-

Clockwise from far left: Airborne forward air controllers perform many other missions in addition to directing air strikes in support of ground forces; radar equipment housed in a portable van; an inflatable shelter being erected; fully camouflaged tactical air control party that would maneuver with the ground unit to which it is attached sets up shop under netting; loading a wing-mounted rocket pod on an O-2 FAC aircraft at Shaw AFB, S. C.

flict—enough to conduct our mission tasking and conduct around-the-clock operations."

Each quarter of the year the wing elements at Shaw conduct mobility exercises during which equipment is moved down to the flight line for loading inspections. In a full-scale deployment abroad, the plan is for the entire complement of equipment to arrive in subsequent waves of airlift.

"Characteristic of the Tactical Air Control System," said Colonel Connolly, "is its flexibility. It can be tailored to meet the contingency. For example, when Saudi Arabia asked for AWACS aircraft, the 507th and 602d Tactical Air Control Wings deployed a ground station to act as a communications and data interface link with the aircraft, and also a ground radar to supplement the Saudi radar net. We work closely with our sister 602d Tactical Air Control Wing in meeting our taskings. Saudi Arabia was a good example of our mutual cooperation." *(See box.)*

In a major deployment involving the RDJTF, the wing would be the Ninth Air Force's tool to coordinate and manage tactical air support, area air defense, and airspace control in league with Army, Navy, and Marine Corps units in a theater of operations. All wing elements must be mobile, transportable, and deployable worldwide.

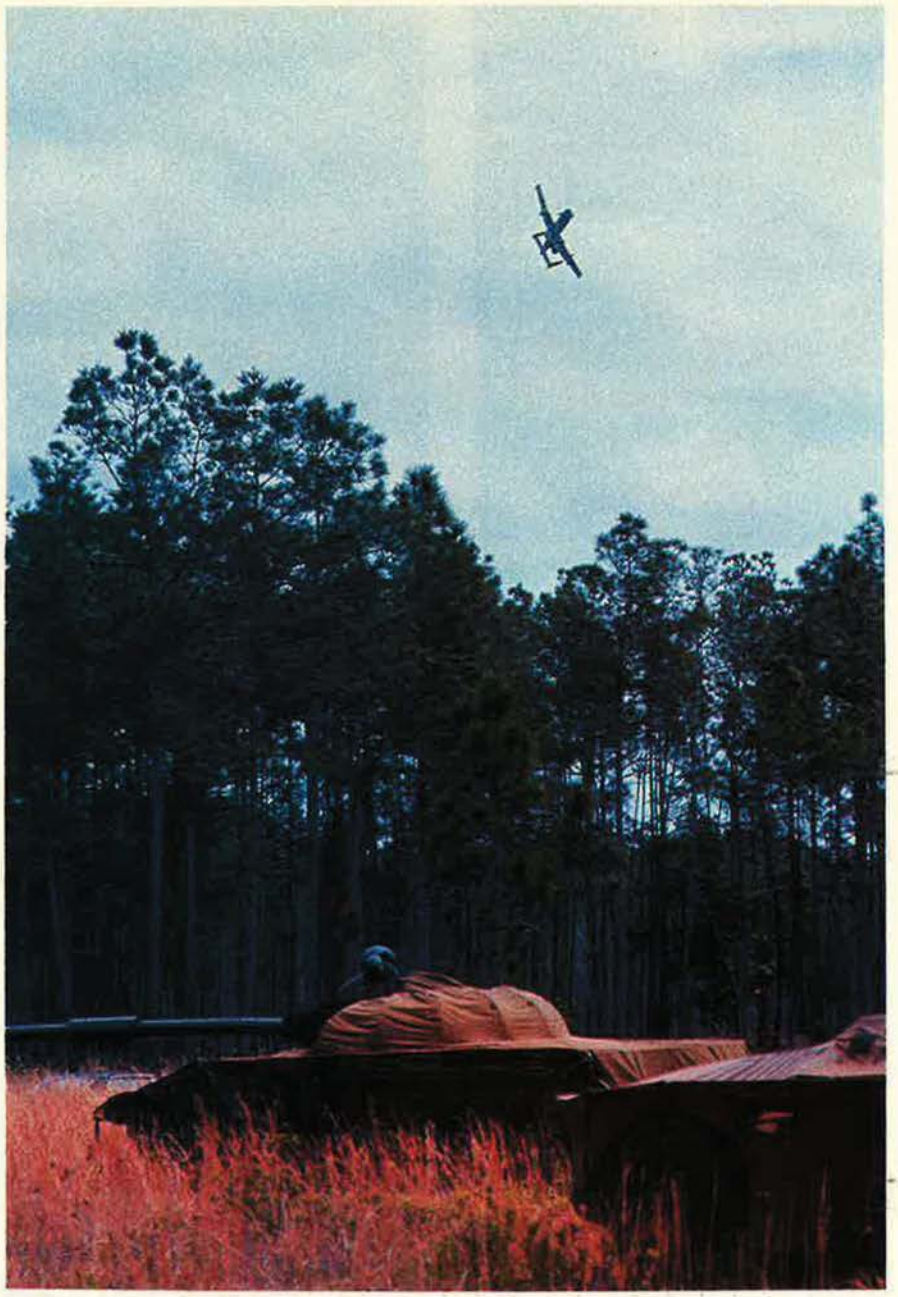
Subordinate to the JTF Hq. would be an Air Force component headquarters to plan, direct, and control tactical operations. "Force management is of prime importance," said Colonel Connolly. "You might have lots of aircraft and ordnance to work with, but if they are not directed to the right place at the right time the result would be uncoordinated chaos."

The Heart of the System

In terms of the 507th's mission, the heart of the Tactical Air Control System is the Tactical Air Control Center (TACC) formed by two of the wing's elite squadrons: the 507th Tactical Air Control Center Squadron (TACCS) and the 9th Tactical Intelligence Squadron (TIS).

Deployable with their own vehicles, inflatable shelters, mobile vans, communications, and other equipment for field operations, the TACCS and TIS would provide an immediate battle staff. Depending on the size of the operations being supported, the squadrons, combining to provide operations and intelligence expertise, would become the command post for the Air Force component commander and interface with Army at corps or division level. At full strength, the TACC would be manned by about 450 people who could control more than 1,000 flights per day.

In peacetime, the operations arm of



Clockwise from top: The 507th Tactical Air Control Wing has heavy-lift helicopter capability; an A-10 being directed against simulated enemy armor; out the door during a training jump. Parachute-qualified forward air control parties are honed to support airborne operations.

the TACC, the 507th TACCS, functions at Shaw with a skeleton operations staff and a full complement of maintenance, computer, and communications technicians. The squadron flexes its muscles daily by planning and controlling such training missions as those flown by AFRES and ANG aircraft that would be gained by TAC in the event of war.

The intelligence component of the TACCS, the 9th TIS, also at Shaw, operates in peacetime as a key intelligence planning element for the Ninth Air Force commander. The squadron produces threat analyses and target studies on each of the possible areas to which the command might deploy. The squadron maintains and exercises its highly mobile computer system, which also has the most sophisticated communications capability within the TACS.

The Tactical Air Control Center—located with the Air Force headquarters well back from the battle area—would have two primary tasks: Fighting today's war and planning tomorrow's. In decision-making, the Center would determine enemy threats, support US ground forces, issue mission tasking to the operations centers of the various Air Force combat wings, monitor mission execution, adjust and readjust mission priorities, and apprise the Air Force component commander of the current enemy situation. It is a sophisticated mix of operations and intelligence supported by highly skilled maintenance, computer, and communications technicians.

In wartime, the combined capabilities of the 507th and 9th Squadrons in a TACC would be impressive. Their vehicle, communications, computer power, and refrigeration maintenance personnel and equipment assets would allow them to operate alone in the most austere environment. Their power and responsibility become awesome as they swell in numbers to marshall Ninth Air Force tactical air resources in support of ground operations.

A TACS element which supports the TACC is a Message Processing Center. This equipment enables the TACC staff to interface and exchange data with Navy, USMC, Army Tactical Air Control Systems, and AWACS aircraft. Information from these systems is fed into the

MPC to enable the Air Force commander to meet his responsibilities as area air defense manager. The Navy and Marine centers would also receive Air Force and Army data.

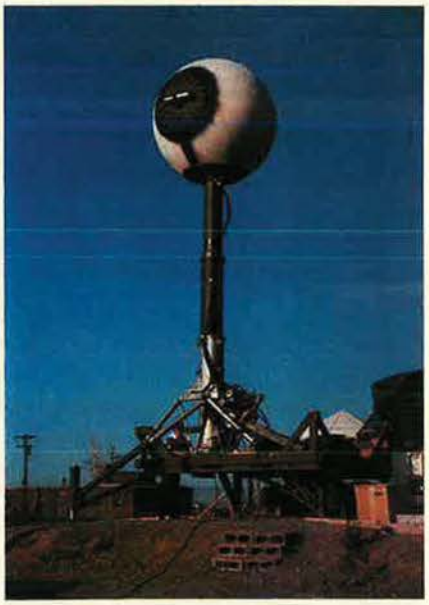
The Supporting Rungs

Agencies responsible for air surveillance and control are at a lower rung in the Tactical Air Control System ladder: Working directly for the Tactical Air Control Center are the wing's 726th and 728th Tactical Control Squadrons, ground radar units referred to under the Tactical Air Control System as Control and Reporting Centers. Assisted by Army Hawk ground-to-air missile managers attached to them, the CRCs would fulfill many of the 507th's functions by directing and controlling air operations and providing area defense. The aim is to use Hawks and vectored tactical air-superiority fighters to "attrit" attacking enemy aircraft. The 726th TCS is located at Homestead AFB, Fla., while the 728th is at Duke Field, Fla. Strength when fully deployed is about 275 people. In combat, these radar units would be positioned about 150 miles from the battle area. Their radar range, depending on terrain, is 200-plus miles.

Next down the ladder are the 507th's 71st, 72d, and 73d Tactical Control Flights. These flights are small, quickly deployable ground radar units known under the TACS as Forward Air Control Posts that would be located closest to the forward edge of the battle area (FEBA). They are the most mobile of the wing's radar assets and can be torn down for movement in approximately four hours. Setting up requires about the same time. These units are completely autonomous, having their own electricity generation equipment, and even field kitchens and shower units. These units are located at MacDill AFB, Fla., Fort Monroe, Va., and Myrtle Beach AFB, S. C. Each is manned by some sixty-four people.

Another specialized unit within the framework of the Tactical Air Control System is an Air Support Radar Team (ASRT), made up of the 507th's ground-radar-equipped 75th Tactical Control Flight, that can provide night and all-weather precision guidance to attacking aircraft. So precise is the guidance this unit can provide that in marginal weather pilots wouldn't even have to see their targets. The ASRT could also guide in MAC transports for high-precision paradrops. The 75th Tactical Control Flight is located at Duke Field, Fla.

Another important 507th Wing element interfacing with ground forces at the corps or division headquarters level is the 682d Air Support Operations Center (ASOC) Squadron. Its mission is to collocate with the highest-level Army Tactical Operations Center to provide immediate response to Army needs for tactical air support. This support is usually close air support of friendly troops by fighter aircraft or tactical air reconnaissance, but it can also include immediate tactical airlift. The ASOC receives requests for tactical air support from all echelons of the Army forces by means of the Immediate Air Request Net, a radio linking it to all the Tactical Air Control Parties (TACPs). It processes these requests by scrambling aircraft on ground alert or by diverting aircraft already airborne to fill the immediate need. The ASOC can also talk directly to FAC aircraft and other tactical aircraft when necessary. The 682d has a personnel strength of about 106 when fully deployed.



Above, all 507th Wing radar equipment is transportable aboard its own vehicles. Left, the futuristic-looking Air Support Radar Team AN/TPB-1C is capable of directing aircraft to extremely precise coordinates.

All Pilots

While Ninth Air Force forward air controllers may be located with the ground units they are to support, they are all members of the 507th's 21st Tactical Air Support Squadron at Shaw. The FACs—whether ground-based or airborne—are interchangeable, since all are pilots.

All airborne FACs destined for whatever command Air Force-wide are trained to fly either the OV-10A Bronco a twin-turboprop aircraft, or the two-engine O-2A by the 507th's 549th Tactical Air Support Training Group based at Patrick AFB, Fla. Ground FACs go through the Air Ground Operations School at Hurlburt Field, Fla., under the aegis of Tactical Air Warfare Center, which is answerable directly to Hq. TAC at Langley AFB, Va.

Ground FACs, while involved in the close-support mission, also act as liaison with the ground commanders, whether in combat or preparing for it.

Airborne FACs, aside from the close-support role, may have the hazardous chore of marking targets with Willie Pete (white phosphorous rockets). Other missions: keeping track of downed pilots in the early stages of search and rescue operations, escort-

ing ground convoys to guard against ambush, helping with artillery registration, providing visual reconnaissance of the battle area, and reporting on the effectiveness of artillery and air strikes. While ground FACs are "liaison"-oriented, the optimum word for airborne FACs is "control." Although vulnerable in a hostile environment, one big asset is the airborne FACs' view of the battle area. Also important is their ability to skirt or withdraw from the battle area to provide jam-resistant radio communications.

Airborne FACs are also flexible. For example, they can be shifted quickly from a quiet sector of the battle area to where the action is. Airborne FACs with the 21st Squadron fly the O-2 exclusively, with thirty-six aircraft assigned. OV-10s are flown by airborne FACs in Europe and Korea. (Approved at Hq. USAF has been a Mission Elements Need Statement outlining the requirements for an improved FAC aircraft to replace the O-2 and OV-10. This would presumably have improved survivability in a hostile environment and be able to make better use of the capabilities of the advanced tactical aircraft coming into the inventory, among other things.)

A primary task of both ground and airborne FACs is to assure that ordnance is not delivered on friendly troops.

Keeping Mission Ready

Pilots of the 21st fly about 12,500 training hours a year in controlling fighter aircraft dropping either real or simulated ordnance, marking targets, or practicing low-level navigation or night tactics. Also stressed: flying in both low-threat and high-threat environments.

The squadron also has an extensive training program for its "275s"—enlisted radio specialists who are part of the ground FACs' team in the field. Besides field deployments, they practice radio set-up and operations, vehicle operation, and equipment maintenance.

As part of its support for the 82d Airborne Division, the 21st has eighteen pilots and a like number of 275s on jump status. Normally, training jumps take place once or twice a month from C-7 or CH-3 aircraft at Shaw, nearby McEntire ANG Base, or North Field, S. C. The squadron is responsible for packing its own chutes and is the only squadron within TAC where pilots have an additional duty of parachute jumping. The aircrews draw flight pay but are denied hazardous-duty jump pay.

"The squadron's greatest current challenge from a mission readiness point of view," said 21st Commander Lt. Col. Larry Shane, "is coping with our decreasing experience level. From a manning posture where all pilots had previous fighter experience, we are transitioning to one where two-thirds of pilots assigned are coming directly from undergraduate pilot training. While for the most part the pilots are first-rate material, this lack of experience greatly increases the amount of training the squadron must undertake and adds greatly to the responsibilities of our instructor pilots."

Wing staffers also note that the 507th is suffering the same impact regarding pilot retention as USAF's conventionally constituted flying wings. Furthermore, a "corporate memory breakdown" is occurring through the loss of some highly specialized maintenance people and qualified air control warning specialists who it takes years to train. They are opting for lucrative jobs in the civil sector.

An important part of the squadron's training occurs through participation in numerous USAF, Army, or US Readiness Command exercises. In the past year, squadron people were involved with or participated in ninety-four exercises and deployments.

As examples of geographic versatility, recent major exercises the squadron supported included Red Flag in Nevada, Brim Frost in Alaska, Quick Thrust in Georgia, and Reforger in Europe.

A typical exercise involving 507th Wing elements was the recent deployment to Howard AFB, Panama, to participate in Black Hawk IV. The move consisted of eight people from the Tactical Air Control Center Squadron, four from the intelligence squadron, three wing staffers, and two from the 728th TCS. The exercise tested the joint US/Panama ground, air, and naval defense concepts for the canal.

In the Trenches

The lowest rung on the Tactical Air

USAF's Other Tactical Air Control Units

Constituted similarly to the 507th Tactical Air Control Wing is the TAC Twelfth Air Force's 602d TAIRCW with headquarters at Bergstrom AFB, Tex. Like the 507th, it has widely dispersed units, mostly in the western US.

Detachments of the 602d are at Fort Hood, Tex.; Fort Carson, Colo.; Fort Ord, Calif.; Fort Lewis, Wash.; and Fort Bliss, Tex. Assigned to the 602d and its fourteen subordinate units are approximately 1,500 people. The 602d doesn't have heavy lift helicopter capability nor does it train ground FACs, who go through the 507th's course at Patrick AFB, Fla.

Among its activities, the 602d has been in a "partnership" in providing staffing for the Tactical Air Control System elements supporting AWACS aircraft in Saudi Arabia. The 602d's Detachment 6, Fort Lewis, Wash., was instrumental in supplying communications and air-operations planning in association with the Civil Air Patrol following the Mount St. Helens eruptions in May of last year.

In January 1981, the 602d's 23d Tactical Air Support Squadron was picked by USAF as the first FAC unit to replace its O-2A aircraft with the jet-engine OA-37 Dragonfly—a modified Cessna T-37. The first was delivered in May. The aircraft will give the Davis-Monthan-based FACs more power and speed and better flight capabilities in the extreme heat of the Arizona desert and the mountain terrain in which the unit trains.

The 602d advises and supports five ANG wings and groups and their twenty-six subordinate units in twelve states.

The 601st Tactical Control Wing is based in Europe with USAFE and headquartered at Sembach AB, Germany.

There are some fundamental differences in OV-10 operations in Europe from those in CONUS and PACAF. European operations are tempered by the realization that an OV-10 may not survive near the forward line of troops (FLOT) in a high-threat environment. Historically, OV-10s have been used close to the FLOT in a low-threat environment for reconnaissance, target-marking for fighters, and search and rescue. While limited search and rescue is still possible, for the most part the OV-10 probably can't perform its traditional role.

As a result, and also because of its identification as a NATO asset, a new role as a radio-relay platform has evolved. In its new role the OV-10 is an integral part of the Tactical Air Control System (TACS), the network through which tactical air operations are controlled and directed, especially in coordination with Army units for close air support missions. The paramount problem anticipated in proper information flow through the TACS is the Warsaw Pact communications jamming (comjam) threat.

The TACS has many required steps for information flow both to and from the battle area. These range from the ground forward air controller located with the Army battalion up to the allied tactical operations centers. An OV-10, with its excellent loiter capability and communications package can provide a vital link in the NATO TACS. The OV-10

Control System ladder—but in no way the least important—is each Tactical Air Control Party located with the Army's maneuver battalion. (There are also Air Force liaison officers at brigade and division.)

"The role of ground forward air controller was invented in World War II, reinvented during the Korean War, reinvented again in Southeast Asia, and now apparently is here to stay," commented one Pentagon observer. "When the close air support role was formulated, the Air Force and Army agreed that all FACs would be pilots," he added.

The Tactical Air Control Parties at the battalion level consist of two teams each of a pilot officer FAC assisted by "275" enlisted members. They are equipped with standard jeeps with MRC-107/108 communications pallets attached. The FAC or airman can use either UHF, VHF, FM, or HF radios, all tied into the Tactical Air Request Net.

The TACPs, in camouflage combat fatigues and outfitted just like Army ground troops with helmets and the like, provide their own security with M-16 automatic rifles and side arms for the officers. They carry their own rations but vehicles are refueled by the Army unit to which they are attached.

There is some potential for a morale problem, with the TACPs located in the midst of the Army and far from their parent 507th Wing. However, morale has been found to be consistently good by 507th staffers who make frequent trips to the field to ensure that it is.

"The young FACs have more authority and responsibility in the field than they would ever have in a fighter squadron, which usually is rank heavy," commented Dave Webb. "For the enlisted 275s, the duty is exacting but interesting."

Supplementing the TACP communications pallets are portable PRC-66 UHF, PRC-77 FM, and PRC-104 HF radios that are operable while the TACP is on the move. These communications are a very important part of overall effectiveness. Without communications, the ground FACs are pretty much out of the battle.

Operationally, one problem the TACPs would encounter in combat is enemy jamming. Expected to be in the inventory in a year or two are radio transmitters capable of sending "bursts" of information that would be difficult to jam. Also on the horizon is equipment to be built into radios that would allow operators to quickly cycle through frequencies that can be jammed, but can't all be jammed at once.

"The jeep has been a tremendous asset to our operation. However, it does have drawbacks. We can't keep up with Army units when they are in rough terrain and using armored vehicles," said one FAC. (Beginning in 1985, the 507th Wing is hoping to phase out its jeeps in favor of a highly mobile, lightly armored multiwheeled vehicle similar to the Army's Gamma Goat transport-type vehicle.)

The 507th currently provides advisory and training assistance to twenty-nine ANG units throughout the eastern US that are constituted similarly to the 507th elements. In an emergency, they are likely to be drawn on.

A force multiplier thought up by one 275 has also proved a morale booster for the enlisted team members. The 21st TASS recently initiated a strike control program for the 275s that includes classwork followed up by the enlisted team members' actually controlling aircraft conducting simulated air strikes, under the supervision of a FAC. "What happens if the FAC is disabled in combat?" asks Dave Webb, "Is the close support sortie he may be directing at the time aborted? Not now, because a 275 can take over." A regulation formally recognizing the 275's expanded role is currently being drafted and coordinated with higher headquarters. FACs, however, will retain solely the role of liaison with ground force commanders.

"For young pilots assigned as FACs, at first it's a hard pill to swallow," said Lt. Col. Larry Shane, 21st TASS Commander. "Especially for the pilots right out of flying school who have had visions of flying high-performance jet fighters. In the beginning, a new FAC may be 'beaked' about his lot, but he adjusts and 'rises to expectations' when he realizes how important the mission really is.

"The ground FACs face the prospect of being 'in the Army' for three years—the length of their tour.

"And for all FACs there is some

can be positioned near communications agencies to "burn through" comjam. The pilot relays information between directing agencies and the incoming fighter. In this capacity, the pilot becomes a forward attack coordinator—airborne. Additionally, the pilot can still act as forward air controller, directly controlling a fighter attack by giving headings and target information. In heavy comjam, the challenge is to pass essential information quickly.

The 601st TCW has forty-five OV-10s assigned.

The 601st Wing provides Tactical Air Control Party (TACP) support for each European US Army combat maneuver headquarters from battalion through corps. Specifically, TACP support is provided for two corps headquarters (V and VII), four division headquarters, thirteen organic brigades, four independent brigades, sixty-four battalions, and one airborne battalion combat team. The 601st TCW may also provide TACPs for the ground forces of allied nations if directed by higher authority. The assignment of such TACPs is tailored to the particular situation. TACPs are composed of combinations of air liaison officers, forward air controllers, and tactical air command and control specialists, plus assorted communications equipment and vehicles, depending on the level and type of army unit supported.

To accomplish this support for the US Army in Europe the 601st maintains twenty-four different operating locations and detachments, collocated with the Army combat maneuver units on the Army installations. At these air liaison offices, the ALOs and TACPs live and work with their Army counterparts on a daily basis. The third element of the TACP, the airborne forward air controllers, are stationed at Sembach AB, where they serve as pilots in the OV-10 aircraft.

TACPs in USAFE are equipped with a variety of communications equipment and vehicles including back-pack portable radios; the MRC-107 and MRC-108 communication centrals used at corps, division, and brigade; and the Army M-113 armored personnel carrier (APC), which is the primary TACP vehicle at the battalion level. The introduction of the M-113 APC last year added a new dimension to the mobility and survivability of the USAFE TACPs.

In support of this mission, the 601st provides the following personnel and equipment: thirty-seven air liaison officers; 100 tactical air command and control specialists; and 110 forward air controllers, sixty-five of which are aligned on a by-name basis with Army battalions.

Of course, the elements described above are just a portion of the 601st mission, as the wing owns, operates, and maintains an extensive system of ground-based mobile radars located throughout Germany.

Rounding out the tactical air control picture: at Eielson AFB, Alaska, is the 25th Tactical Air Support Squadron; and with PACAF in the Pacific is the 81st Tactical Control Flight at Kadena AB, Okinawa, Japan, the 5th TACG and subordinate units in Korea, a TASS at Wheeler AFB, Hawaii. There are TACS elements with the 24th Composite Wing, Howard AFB, Panama.

apprehension about what effect the tour will have on their career progression. This is allayed by the promise by TAC that they will transition into fighters once their tour here is up."

In addition to daily training, the 21st TASS is constantly looking for better ways to do business with the Army. While in the field, the FACs have to be able to maneuver by themselves or with the Army. "Army tracked vehicles can cross streams and roll over obstacles which our jeeps can't. So, in many instances, we can't keep up with the forward elements we are supporting," said the 21st TASS's Capt. John D. Sweeney. "If we are really going to be serious about close air support, the right equipment in the form of scout helicopters would be just the ticket," he said. "Several years of exercise experience has proven to me that a scout helicopter is the most flexible and effective communications vehicle for forward air control," he added. During the last year, members of the 21st TASS have developed a concept of Forward Area Liaison and Control (FALAC) that promotes the use of helicopters and addresses costs, maintenance, and operational considerations. The FALAC study also includes such other aspects of the FAC business as manning, training, and basing. This concept has been briefed and studied through Ninth Air Force level and is now at Hq. TAC for consideration.

Wing Support and Maintenance

Also located at Shaw is the 507th's 703d Tactical Air Support Squadron, which is equipped with four CH-3 helicopters. The big helicopters support all wing elements and can transport troops as well as ground FAC teams and their vehicles.

The 703d's big choppers are capable of airlifting up to 8,000 pounds and stay in the air in flights up to four hours. The CH-3s can "kneel" to unload vehicles and, while not equipped with a penetrator and hoist, count search and rescue among their missions as well as paradrops and special operations. There are thirty-five people—including five forward aircrews—assigned to the 703d TASS.

Both O-2 and CH-3 maintenance for the 507th is performed by the 4507th Consolidated Aircraft Maintenance Squadron, whose some 250 people and their equipment are up to the TAC standard of being ready to deploy with the aircraft.

There are two types of specialized aircraft that work closely with the 507th TAIRCW. The radar-equipped E-3A Sentry Airborne Warning and Control System aircraft is an airborne extension of the TACS's ground radars.

The second aircraft is the C-130 Airborne Battlefield Command and Control Center (ABCCC), an offensive TACS arm that directs fighter and other aircraft to their targets. The ABCCC, with a full battle staff aboard, can fly into forward areas as an on-scene extension of the Tactical Air Control Center and the Air Support Operations Centers equipped to task aircraft on missions. ■

Mission to Saudi Arabia

In the news has been the Reagan Administration's controversial decision to sell E-3A Airborne Warning and Control System aircraft to Saudi Arabia.

With the outbreak of the war between Iran and Iraq last year, the Saudis requested—and got—the deployment of USAF AWACS aircraft to perform air defense surveillance over Saudi airspace.

To support the operation, the Air Force deployed a ground unit known as a Message Processing Center (MPC) to provide an information exchange and communications link with the aircraft. Additionally, a TPS-43E radar-equipped forward air control party was deployed to supplement the Saudi radar net. These were—and continue to be—alternately manned by specialists from the Ninth Air Force's 507th Tactical Air Control Wing, Twelfth Air Force's 602d TAIRCW, and USAFE's 601st Tactical Control Wing *(see other box)*, as well as personnel from the Tactical Air Warfare Center's 727th Tactical Control Squadron, Eglin AFB, Fla. (Equipment airlift from CONUS to the Mideast required some fifteen MAC C-141s.)

Maintenance and aircrews staffing any subsequent AWACS operations in Saudi Arabia may well benefit from those earlier arrivals in weathering the climatic and cultural shocks to which they'll be exposed.

Besides the area's extreme heat, the 507th and other people soon learned, for example, they would have to contend with another culprit—the windblown superfine sand that was a constant menace to equipment and caused some equipment filters to be replaced daily instead of in the normal two-week span.

And, as guests of the Saudis, the US Air Force people were cautioned to abide by the customs and courtesies unique to that country. For one thing, alcohol is banned there. For another, the Saudis have careful guidelines as to the activities of their womenfolk, who are generally forbidden to drive automobiles, for instance.

In any event, the upshot has been the development by the 507th Deputy Commander for Intelligence staff of a "Crescent of Crisis" Southwest Asia cross-cultural interaction training program consisting of unclassified area study briefings to acquaint all wing personnel with the cultures, customs, and laws of Mideast countries. The focus is on countries where the 507th may be deployed and/or the US has basing privileges.

The program is currently useful because wing people are rotated TDY to Saudi Arabia to staff the MPC and radar site, and USAF has conducted joint training exercises in Egypt. Similar deployments can be assumed for the future.

The initial wing briefing is entitled "Orientation to the Middle East" and discusses the Arab world as an entity. Follow-on briefings also make use of color slides and other materials to discuss Saudi Arabia, Egypt, Oman, Turkey, Greece, Pakistan, Israel, Kenya, and Somalia.

Airmen sent to the Mideast are admonished in the briefings: "In most cases your contact with Arab women will be only formal. It is a serious mistake to try to engage an Arab woman in conversation unless you have been properly introduced. The privacy of Arab women wearing the veil *must* be respected. Furthermore, *do not* attempt to photograph women in the Arab world. When visiting with Arab friends, *do not* inquire about the health or whereabouts of women members of the family."

Additionally, "You will find Moslems at prayer in streets, shops, everywhere. *Never show curiosity* or lack of respect when Moslems are in the act of praying. . . . *Do not stare* while they are praying and *do not take their picture*."

Other helpful hints: Never extend your left hand to an Arab in greeting; it is a supreme insult. In home or office it is offensive to cross your legs while sitting and point the sole of your shoe toward others. And, finally, never display impatience.

Wing female personnel are advised that "American women should dress conservatively and be escorted when in public places . . . the less a woman appears to be Western, the less of a 'target' she will appear."

While the majority of the information is derived from scholarly sources, including the James F. Byrnes International Center at the University of South Carolina, substantial information is obtained from Air Force people returning from Arabian states: the 507th intelligence staff debriefs people returning from the TDYs to Saudi Arabia, for example, and makes updates as required.

The briefings are distributed to Hq. TAC, Ninth Air Force, all 507th units, and ANG units advised by the wing.

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Exploiting Electronic Warfare

In the last decades of the twentieth century, electronic warfare promises to achieve prominent influence in the application of national power. For that reason and others, USAF electronic warfare specialists are laying on a "full-court press" in the field, so this nation can fight and win the esoteric conflicts.

BY MAJ. GEN. DOYLE E. LARSON, USAF
COMMANDER, ELECTRONIC SECURITY COMMAND

OVER the past two or three years, we have discussed at great length a new philosophy of electromagnetic combat with great potential: command control and communications countermeasures (C^3CM). We have called it signals warfare, radio electronic combat, command and control warfare, and so on. Whatever we name it, we are on the threshold of a major change in the way we conduct modern warfare.

The electromagnetic environment is emerging as a medium of warfare on a par with ground, sea, and air. Through the eighteenth century, military forces were basically organized around ground armies. In the nineteenth century, naval forces became prominent. In the twentieth century, air forces became prominent. And, in the twenty-first century, electronic forces will be prominent. Effective control of the electromagnetic environment requires that we learn how to apply the principle of *concentration of force* to the frequency domain, time domain, and the geographic domain. This alone triples the complexity of battle management in the electromagnetic environment.

The term C^3CM is a hybrid, derived by crossing strains of electronic warfare, destructive weapons, deception, and intelligence. C^3CM means the integrated use of jamming, deception, and physical destruction to degrade and destroy the enemy's command and control while protecting our own. To date, the Air Force has really only worked C^3CM concepts with the intent to degrade enemy command and control systems associated with air defense. The objective has been to increase the survivability of strike aircraft during ingress and egress. This is certainly a very useful and worthwhile objective, but we have yet to fully embrace the more powerful role of C^3CM to attack the total enemy command and control structure. The entire command and control structure of the enemy can, in fact, be dismembered, individual systems reduced to isolated islands, uncoordinated, and ineffective. With his command and control in disarray, the enemy will become as helpless and uncoordinated as a blind, deaf, mute giant. Modern military forces have a serious vulnerability, directly traceable to their dependence on electronic technology.

Central Nervous System

Warfare today is a complex undertaking consisting of a centrally planned sequence of time-critical actions that smashes together firepower with such force and speed that it dwarfs the concept of a blitzkrieg. The command and control structure is the network used to orchestrate this coordinated combined offensive. It is the central nervous system of a military force. In developing a strategy or plan for attacking the central nervous system, several points become apparent. First, the command and control structure is a massive network of nodes and links and cannot be easily blanketed with C^3CM resources. Analysis will show, however, that the relative importance of certain nodes and links is much greater than others. This kind of in-depth analysis requires a comprehensive data base on the enemy command and control structure. A fully developed C^3CM data base is our most urgent requirement.

There are differing schools of thought on how to target this massive network of nodes and links. One group favors the creation of a priority list of targets against which a systematic attack can be preplanned. Others feel that C^3 targets cannot be placed in priority order in advance. Neither school of thought is 100 percent correct. There are nodes in the C^3 structure where information from several sources merges and critical commands are disseminated. These command centers, usually in the higher echelons of the C^3 structure, are of such strategic importance that they can be set in priorities and preplanned for attack. But lower down in the C^3 network, the criticality of the tactical links and nodes is more fluid and cannot be prioritized in advance. They can be preselected as candidate C^3 targets, but their actual criticality depends on how the battle unfolds.

A Full-Court Press

Critics and skeptics of C^3CM often say there is no doctrine to provide an authoritative base on which we can develop C^3CM systems and concepts. I don't think that's a valid criticism. Doctrine normally lags behind technological advancement and innovative thought. Doctrine does not precede technology or experience; it formally documents it. Military doctrine is predominantly the outgrowth of combat experience and tends, unfortunately, to stagnate during periods of peace. In fact, it tends to lead us into the pitfall of always fighting yesterday's war. Distillates of actual experience evolve into fundamental principles which become universally accepted and eventually labeled "doctrine." The doctrinal process is a long one—we need to get it started for C^3CM. We need to take advantage of new technologies, and we need to remove self-imposed barriers to new thought and ideas. We need some iconoclasts to break down the icons of traditionalism.

Because of the variety, density, and complexity of today's threat environ-

Maj. Gen. Doyle E. Larson took over as head of the Electronic Security Command in January 1979.

Maj. Gen. Doyle E. Larson commands USAF's Electronic Security Command at Kelly AFB, Tex., and the collocated Joint Electronic Warfare Center. His USAF service since joining in 1951 includes Russian language training, pilot and radar observer qualifications, and a series of increasingly responsible tours in communications intelligence, communications security, and similar matters. He has served as director for intelligence, US Pacific Command, and DCS/Intelligence, Strategic Air Command. He is a graduate of Hardin-Simmons University, Abilene, Tex. (bachelor's degree), and Auburn University (master's).

ment, we can no longer rely solely on electronic self-protection techniques to protect our aircraft from all threats at all times. It is time to recognize the limits of self-protection, concentrate on a broader-based solution, and thoroughly investigate integrated lethal and disruptive methods to attack systematically the overall enemy command and control system. From an Air Force point of view, disrupting the enemy air defense system is a high-priority objective. We must gain access to the flight regimes needed to conduct the Air Force missions. This has prompted us to center our investigation on the application of C^3CM as a tool for suppressing the enemy air defense (SEAD). But over and above disrupting the enemy air defense system, a comprehensive C^3CM attack on the enemy command and control structure will accomplish even greater military objectives. It is possible to eliminate the enemy's ability to maneuver his forces, provide resupply, orchestrate the sequence of combat tasks and, in general, conduct warfare.

An integrated, coherent strategy to dismember the enemy's command and control structure is needed. Simply stated:

- Jam those targets that are jammable.
- Insert deception where it will confuse.
- Destroy critical targets susceptible to destruction.

Inherent in this strategy is an in-depth knowledge of the enemy's command and control structure—where we must examine fundamental target systems to include electrical power generators, transmission lines, transformers, radar and radio transmitters, antenna systems, nodes and links of the entire C^3 structure, and where we must document the utility and criticality of individual targets to the enemy's ability to control his forces. And, finally, we must determine the susceptibility of each target to C^3CM attack—whether it be jam, deceive, or destroy. We need a well balanced mix of countermeasures: self-protection, area effect ECM, and lethal weapons.

To deal the enemy command and control structures a truly devastating blow, we need to expand the variety and capability of our C^3CM arsenal—let me brainstorm a few examples:

- Expendable and loitering jammers;
- Ground-based jammers;
- Electromagnetic pulse capable of destroying solid-state components;
- Lasers capable of cutting transmission lines and destroying antennas;
- Deception techniques and capabilities—both intrusive and manipulative.

We have barely scratched the surface of this latter approach to C^3CM. There are many links that are particularly susceptible to deception. The impact is insidious on the operator. Once deception has been experienced by the operator, uncertainty and loss of confidence sets in and remains long after the incident.

More emphasis needs to be placed on such dedicated lethal systems as:

- Antiradiation missiles with improved seeker heads to home on power generators, transformers, radios, and radars;
- Mini-drones.

We should not exclude long-range systems such as ballistic missiles and cruise missiles as candidate vehicles for deep delivery of C^3CM weapons. Space platforms may not be too far in the future to consider. Weaponry for C^3CM will not be cheap, but the military benefits to be gained by denying the enemy a reliable command and control system are worth the investment. The stakes in the C^3CM game are high, and we will need a full deck to play and win.

Ten Commandments for C^3CM

Let me suggest ten fundamental principles for C^3CM. These are principles derived from limited experience and minimal assets used in Red Flag, Bold Eagle, Northern Wedding, Team Spirit, and Global Shield exercises, but I believe they are valid and a useful beginning:

One—Modern military forces depend on electronic devices for command control and communication.

Two—Electronic devices are susceptible to jamming, deception, destruction, and exploitation.

Three—The principles of surprise, mass, and concentration of force apply to C^3CM.

Four—A balance of lethal and disruptive options is required to conduct C^3CM effectively.

Five—Execution of C^3CM is time sensitive—seconds count. Sensor data for planning must be available in hours; sensor data for execution must be available in seconds.

Six—Overall battle objectives dictate specific C^3CM targets and operations.

Seven—Communications between C^3CM elements must be jam resistant and secure.

Eight—Good defensive C^3CM measures are essential for successful offensive C^3CM.

Nine—Intelligence analysts can provide essential quality control for deception activities.

Ten—Once channels of command and control are cut, military forces of modern warfare go into a state of disarray and confusion.

C^3CM must be integrated into the same command and control system as all other tactical operations. A key element to effective C^3CM is identifying critical targets in time to allow effective application of lethal and disruptive assets. This requires that we speed up the interface between intelligence collection and the tactical command and control system. We need to streamline the flow of special data which meets the very-near-real-time (VNRT) information requirements of C^3CM execution.

Most of this data exists today. It is a matter of screening it and passing it on in time for the operational commander to apply effective countermeasures. By very-near-real-time I mean that the time lapse between acquisition and display is fifteen seconds or less. The data processing required is not an elaborate battle management system, but a small, fast processing unit with its input and output scoped specifically to satisfy the C^3CM task (an acupuncture approach to relieve a specific need). It is not technically feasible nor particularly brilliant strategy to attack the target-rich electromagnetic spectrum with blanket barrage, brute force, or dumb jamming. The results would be comparable to a duck hunter who shoots at the flock rather than sighting at a single duck.

Double-Edged Sword

The offensive side of C^3CM is impor-

tant. But perhaps more important and just as difficult to implement is the defensive side. C^3CM is a double-edged sword—what we can do to the enemy's command and control, he can also do to ours. As far as our ability to defend against an opposing C^3CM attack—we have been our own worst enemy. We have made it too easy. But we are changing that. Change we must if we are going to survive and fight in the electromagnetic environment of the future. We must provide the training, the tools, and the techniques to operate a command and control system in a hostile C^3CM environment. Technological improvements are on the way that will make our command and control significantly more survivable. To name just a few:

- Spread spectrum;
- Fast frequency hopping;
- Adaptive HF;
- Error coding;
- Hardened or mobile command control facilities;
- Redundant comm links;
- Dispersed command and control nodes.

These are state-of-the-art capabilities that can be fielded today. There are other powerful concepts that eventually can also increase the security of our command and control systems—fiber optics, laser communications, and millimeter wave communications. But before that happens, before we see the large investment required for programs such as JTIDS, SEEK TALK, NEW LOOK, redundant command control links, and hardened mobile and dispersed command and control facilities—there will have to be a broad awakening to the sobering reality of the devastating impact that a coordinated C^3CM attack would have on our own war-making ability. Funding lags behind our vulnerabilities.

The electromagnetic environment is emerging as a medium of warfare on a par with ground, sea, and air. Above, an F-4 C^3CM platform. Left, a microwave tower.

Joint Nature of C^3CM

C^3CM operations must be joint in nature. The preceding paragraphs were written from an Air Force point of view, but it must be clear that in no way is C^3CM a single service undertaking. What goes on in the electromagnetic environment is each service's concern and each service's responsibility. C^3CM must be a joint venture, fully coordinated and executed by all three services. However, a joint concept calls for integrated battle management of C^3CM operations.

The need is twofold. First, it is required to eliminate fratricide of our own command and control. Electrons don't recognize or respect service roles and missions or geographical boundaries. Secondly, we must optimize the use of our C^3CM assets. Critical C^3CM targets identified by sensors operated by one service may be countered optimally by another service's weapon system. We need lateral coordination and nomination of C^3 targets within our tactical command and control facilities *(see illustration)*.

There are real challenges ahead. A new era is beginning, a new medium of warfare emerging. We need creative, innovative thinking to get us out of the "penetration aid" and "defense suppression" era and into "the counter command and control" era. Right now we are where Billy Mitchell was with airpower sixty years ago. But, if we are to proceed, we must overcome the inertia of the past. We must not only be prepared to accept change, we must make it happen. ■

Coordinating Electronic Warfare

Now in its second year of operation, the Joint Electronic Warfare Center has established an impressive record of achievement.

A STAFF REPORT

THE Joint Electronic Warfare Center (JEWC) evolved from the Air Force Special Communications Center of the Vietnam era, when enemy electronic antiaircraft defenses had to be offset with equally sophisticated countermeasures. As the influence of electronic technology on modern warfare continued to increase, the Defense Department in 1977 initiated plans for a joint service organization to meet its electronic warfare (EW) needs. In October 1980, the Joint Electronic Warfare Center was constituted at Kelly AFB, Tex.

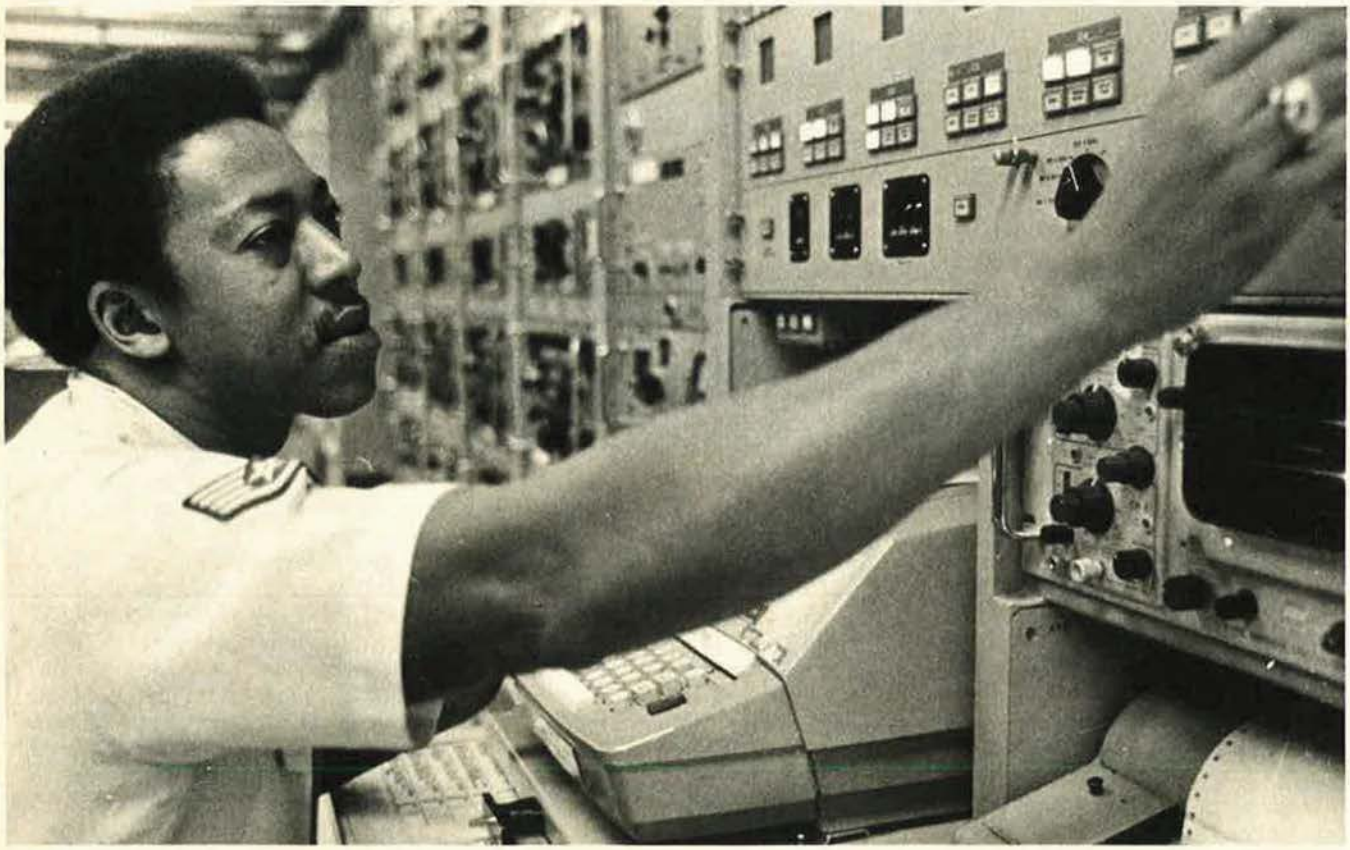
The Joint Center's work brings it in contact with military commands of all services, advising and assisting them with electronic warfare plans and projects. Responsible directly to the Office of the Joint Chiefs of Staff, the JEWC has become involved in survivability studies of the USAF F-16 and Navy fighters. It supports electronic warfare play in exercises; has advised about C^3CM (*i.e.*, Command Control and Communications Countermeasures) interoperability in NATO; supplied EW capabilities information during the AWACS deployment to Saudi Arabia; and has undertaken long-term projects to improve US electronic warfare measures and countermeasures.

JEWC's present Commander, Maj. Gen. Doyle E. Larson, who also heads USAF's Electronic Security Command, sees an "inherent vulnerability" in today's modern weapon systems because of their reliance on electronic equipment. (*See May '81* AIR FORCE *Magazine, p. 90.*) The Joint Center's mission is to reduce this vulnerability by protecting friendly command control and communications systems and destroying or disrupting the enemy's. A major goal of the Center is to provide analyses of the electronic warfare environment when requested by combat unit commanders. These evaluations, known by the code name Proud Flame, will analyze an enemy's C^3 activities, with the findings reported back to the requesting commanders in twenty-four hours.

Exercises, Incidents, and Tests

The Joint Center participates in JCS-sponsored joint exercises and such large single service ones as the Navy's Seabat series of air defense exercises in the Atlantic. A manual to help Unified, Specified, and Component Commands with joint exercise planning in EW is due out later this year. The JEWC has also developed lesson-plan material for the NATO Intermediate Level Electronic Warfare Officer's course in Oberammergau, Germany, and it is helping prepare an EW course for the Armed Forces Staff College.

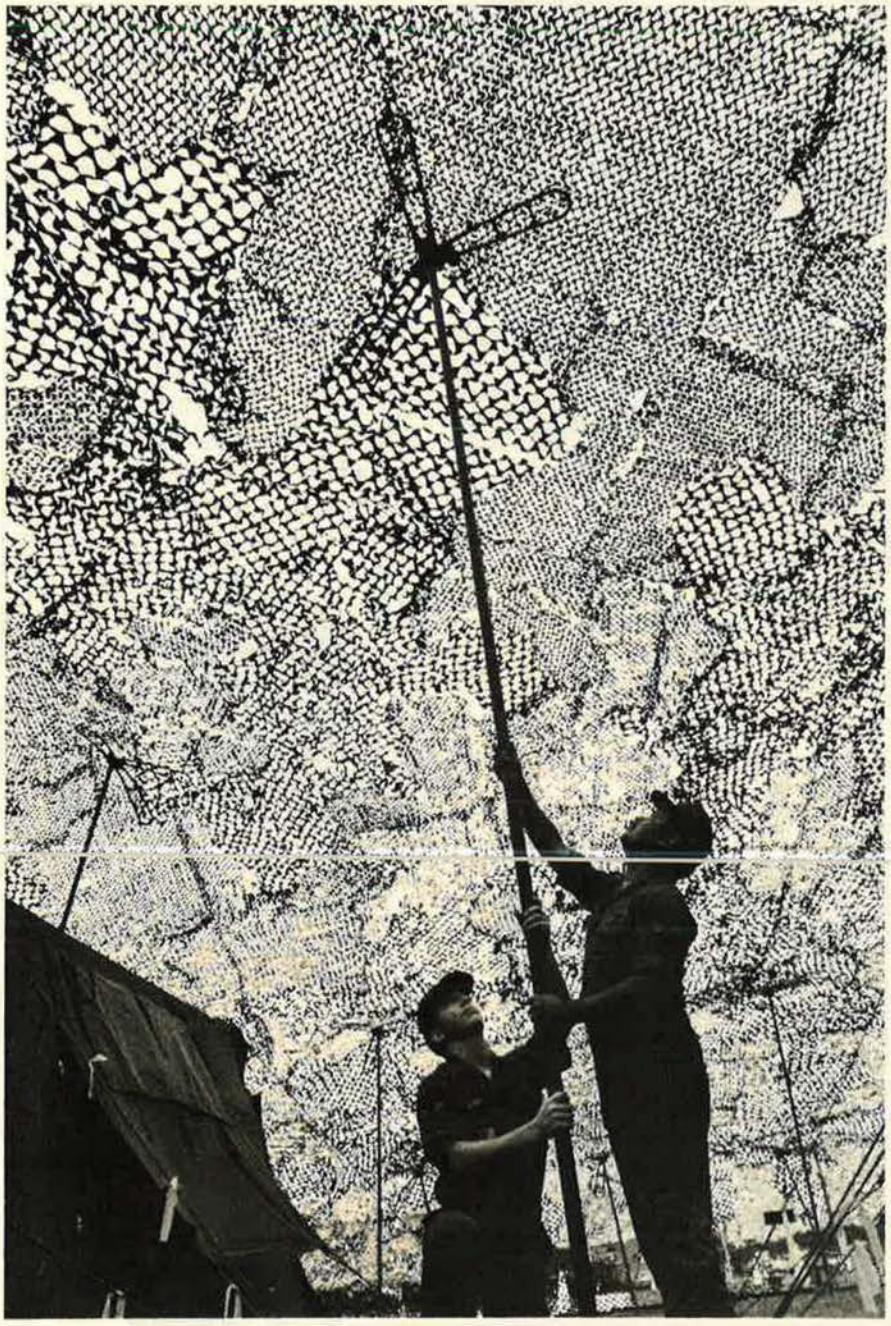
Annually, almost 1,000 incidents of



Teleprinter systems are among those areas of communications of vital interest to electronic security experts of all services. The old mechanical printers and keyboards have been succeeded by high-speed electronic hardware.

meaconing (intentional transmission of false navigational signals), intrusion, jamming, and interference are reported to the JEWC with approximately five percent of them categorized as hostile. Hazard warnings and notices of potential hazards, monthly and quarterly reviews of hazards, and trend analyses based on information collected since 1969 keep commanders advised of the EW threats to their forces.

Advising those organizations that design and test electronic warfare equipment is the responsibility of JEWC's Test and Measurements Division. Emphasis here is on meeting user needs. The F-16 and Navy aircraft studies mentioned above help to determine the vulnerability to detection of friendly weapon systems equipped with airborne self-protection jammers from optical and infrared sensors and their vulnerability to attack from antiradiation missiles. Electronic warfare effects on close air support and helicopter operations in a dense air defense environment are being studied, as is the vulnerability of joint tactical communications equipment to such threats.



Despite the sophistication of their hardware, men and women deployed in the field on electronics security exercises and operations still have to perform the muscle work of erecting camouflage nets to conceal their gear from prying eyes.

Developing Concepts

Assisting the different armed services with EW and C^3CM policies, operational concepts, doctrine, and procedures is the responsibility of the Concepts and Doctrine Directorate. Such efforts resulted in a joint C^3CM concept between Tactical Air Command and the Army's Training and Doctrine Command. An Army C^3CM concept is being studied with the Army's Combined Arms Center at Fort Leavenworth, Kan. Other concepts being developed include communications countermeasures for the US Navy against Soviet forces in the Mediterranean. This one grew out of a study about countering attacks on carrier task forces by Soviet Backfire bombers. A communications connectivity study is under way for the Rapid Deployment Joint Task Force, and another is defining C^3CM doctrine for the Joint Special Operations Command at Fort Bragg, N. C.

Contingency planning for the Joint Chiefs of Staff and other service organizations is supported by the JEWC's Studies and Analysis Directorate. When the AWACS aircraft went to Saudi Arabia, the JEWC took only two days to provide estimates of the vulnerability of the AWACS radar and communications systems. Such estimates can be provided on request to support joint or service military contingency planning.

In the long term, the JEWC will see developed a computerized program that will enhance its ability to support the C^3CM efforts of the Unified and Specified Commands. It will include the Advanced Electronic Warfare Evaluation Display System (EWEDS) already under development by the Air Force Electronic Warfare Center. Operational, technical, and intelligence information will be stored for immediate display, replay, and analysis. Advanced EWEDS will also be linked to additional bibliographic sources of EW information. The JEWC is also considering development of a large-scale engagement model called the Tactical Disruptor. This will be a computer program to simulate the Electronic Warfare Environment in any theater of operation. These two initiatives will be used to develop a data base for commanders in planning their C^3CM efforts.

The JEWC is certain to play an important role in future US war planning and execution. ■

C^3I Key to Battlefield Effectiveness

From small-unit commanders to generals and admirals, military decision makers are swamped with communications. Blizzards of intelligence, operations, and logistics data pour into their command centers, afloat and ashore.

That's why TRW has committed first-line talent and other major resources to the development of tactical C^3I systems. Like I^2S^2, for example, the Intelligence Information Sub-System now in operation at USAREUR headquarters, or BETA, the Battlefield Exploitation and Target Acquisition system developed under joint service sponsorship. Or PCOTES,

a prototype C^3I test-bed for the Navy's Carrier operations, and MIFASS for the Marines. These processing centers exploit data collected by mobile intercept and direction-finding systems like Guardrail and EH-1X, developed by our ESL subsidiary.

These systems and future systems now under development reflect the skill and experience of our C^3I specialists... specialists who have designed new software and hardware to process floods of data from all kinds of sensors, rapidly, flexibly, and efficiently... men and women who are developing advanced maxi, mini, and micro computer networks to process information economically and in

near-real time.

If you're interested in applying TRW's tactical C^3I expertise, contact Stan Cochran, TRW Systems, 75/1900, One Space Park, Redondo Beach, California 90278. Phone: (213) 535-3625

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(Continued from p. 59)

Tactical Fusion Program, which is charged with developing and acquiring operational fusion systems for the services, the enemy situation correlation element for the Air Force, and the All Source Analysis System for the Army.

Advanced Technology Programs

Some time in the 1990s or beyond, it is likely that an improved AWACS will be required to perform a surveillance mission against the evolving atmospheric threat.

ESD's affiliated Rome Air Development Center, therefore, is examining the potential for a new generation sensor which could complement earlier sensors, with an eye on deciding within the next few years whether and in what form such a new program should be launched. Current notion is that such a follow-on system might be either a derivative of a wide-body jetliner or of the high-altitude TR-1 aircraft (modified U-2). Whatever the choice, it seems almost certain that the new sensor will have a "conformal" antenna, meaning one embedded in the skin of the aircraft rather than in the E-3A's radome.

PAVE MOVER is an ESD/RADC program that is scheduled for DSARC II (full program go-ahead decision by the Defense Systems Acquisition Review Council) in about a year. The objective of the program is to design, develop, test, and evaluate an advanced development model of an airborne radar system with ECCM and Low Probability of Intercept (LPI) features for real-time standoff surveillance, location, and cooperative strike against a large number of fixed and moving armored ground targets.

The system consists of an airborne radar sensor and a ground data processing and control station with a data link to the aircraft. Radar signals will be relayed to the ground station for data processing for multiple display presentations and computation of track and weapon guidance data. The system will be evaluated by launches of GBU-8 (HOBO) glidebombs against moving and stationary targets. Ultimately, the radar will provide target position update and inertial navigation update data to attacking aircraft which launch wide-area antiarmor munitions and to surface-launched US Army missiles, which will disperse terminally guided submunitions against arrays of moving targets. Evaluation and demonstration will be completed in FY '82.

The PAVE MOVER effort utilizes advanced technology in the areas of side-looking moving target indicator radar, digital signal and data processing, and weapon guidance capabilities, and integrates these technologies for real-time target acquisition/strike capability.

PAVE MOVER will make it possible to survey wide areas of potentially hostile territory to acquire, track, and guide weapons against selective targets well beyond the FEBA (Forward Edge of the Battle Area).

A number of aircraft types are being considered for the PAVE MOVER role by the Air Staff. No firm decision has been made as yet, but the principal candidates include 707, B-52, and C-130 type aircraft.

RADC, working in concert with AFSC's Space Division and DARPA, also is exploring the possibility of developing a space-based radar system that can detect bombers. This system, which could achieve operational status by the end of this decade, probably will use a phased-array radar.

Cruise missile surveillance technology also is being pursued jointly by RADC and DARPA. The program's purpose is to assure that enemy cruise missiles can be detected and intercepted.

A basic challenge is to develop the means to detect, track, and identify advanced cruise missiles using low observable technology. The program involves three major milestones—selection of sensors capable of detecting low-observable cruise missiles, analysis and limited testing of evolutionary and revolutionary sensor concepts, and integration in various sensors with engagement procedures and interceptors to build a reliable cruise missile intercept capability.

RADC's Advanced Airborne Surveillance Radar program examines technologies for an improved airborne surveillance radar for the 1990s and beyond. The radar will have increased detection capability against low cross-section targets and enhanced survivability against both electronic and physical countermeasures.

The evolving threat in the 1990s is centered around reduced cross-section targets resulting from Stealth improvements to bombers, high-performance fighters, cruise missiles, and helicopters. These targets, used in an ECM-aided attack with numerous sidelobe and mainlobe jammers, pose a serious threat to current airborne surveillance systems. The ability of most platforms to survive such attacks, while continuing to provide early warning and air defense, is seriously reduced.

To counter these threats in both strategic and tactical missions, a large-aperture, multimode phased array is being developed for airborne platforms using arrays embedded in the vehicle's skin. The array radar will feature multimode, wideband/adaptive surveillance with full on-board signal and data processing as well as adaptive radar scheduling and software control. Lightweight designs of the space-based radar program including solid-state modules, arrays, and signal processing serve as models for this system. The phased array makes possible search, target tracking, and identification over wide areas.

Wide-body jets as well as high-flying TR-1 type aircraft are being considered as platforms. While the wide-body aircraft can carry much more equipment and provide greater flexibility in its operation, the high flyer is more survivable.

RADC's Advanced Tactical Radar (ATR) program is directed at the eventual replacement of the Tactical Air Command's AN/TPS-43E air surveillance radar with a new-generation radar having performance characteristics that will include automated tracking of high-performance aircraft, variable target update rates, automated ECCM (Electronic Counter-Countermeasures) management, and transfer of coverage data between individual radars.

RADC's Multi-Imagery Exploitation System (MIES) is to tie together a variety of sensors operating rapidly (near real time) for automated detection, identification, and pinpoint location determination of ground targets. Infrared, radar, and electro-optical sensors are being linked under MIES to improve tactical intelligence and permit rapid translation of intelligence information into target data.

Exploratory development efforts in pattern recognition, precise target location, mass digital image storage and retrieval, Very Large Scale Integrated (VLSI) circuits, advanced reporting concepts, data base and data base interfaces, and man-machine interfaces are being investigated at RADC for possible use in MIES to improve the Air Force's ability to exploit sensor information rapidly and automatically. ■

THE NATIONAL AIR AND SPACE MUSEUM...

FIVE YEARS AND 46,000,000 VISITORS LATER

PHOTO FEATURE BY WILLIAM A. FORD, ART DIRECTOR
Text by William P. Schlitz, SENIOR EDITOR

The Smithsonian Institution's National Air and Space Museum opened July 1, 1976, to international acclaim in the midst of the nation's Bicentennial Celebration. Since then, the Museum has played host to more than 46,000,000 visitors from across the nation and around the world, making it *the* top attraction in the nation's capital. This July, it observes its fifth anniversary.

The Museum has not rested on its laurels, but continues to expand its educational resources with the acquisition of noteworthy aircraft and historical hardware. New specimens range from a restored Navy F4U-1D Corsair of World War II fame to the human-powered *Gossamer Condor.*

Among major new exhibits is the Jet Aviation Gallery featuring a twenty-by-seventy-five-foot mural by artist Keith Ferris depicting the evolution of jet flight. Among aircraft on display is an Me 262, history's first operational jet fighter.

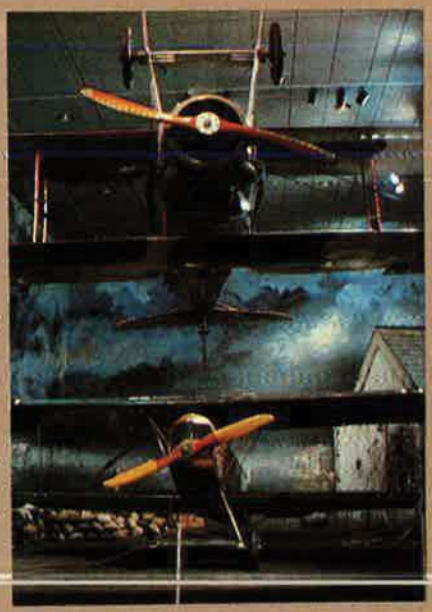
The Museum isn't all hardware, though. It has added another fine film—"Living Planet"—to rotate with the screening of its popular "To Fly." In the art category, NASM recently put on display a collection of aviation paintings by the nation's school of photo-realist artists. (AIR FORCE Magazine plans to present a number of these in September's Air Force Anniversary issue.)

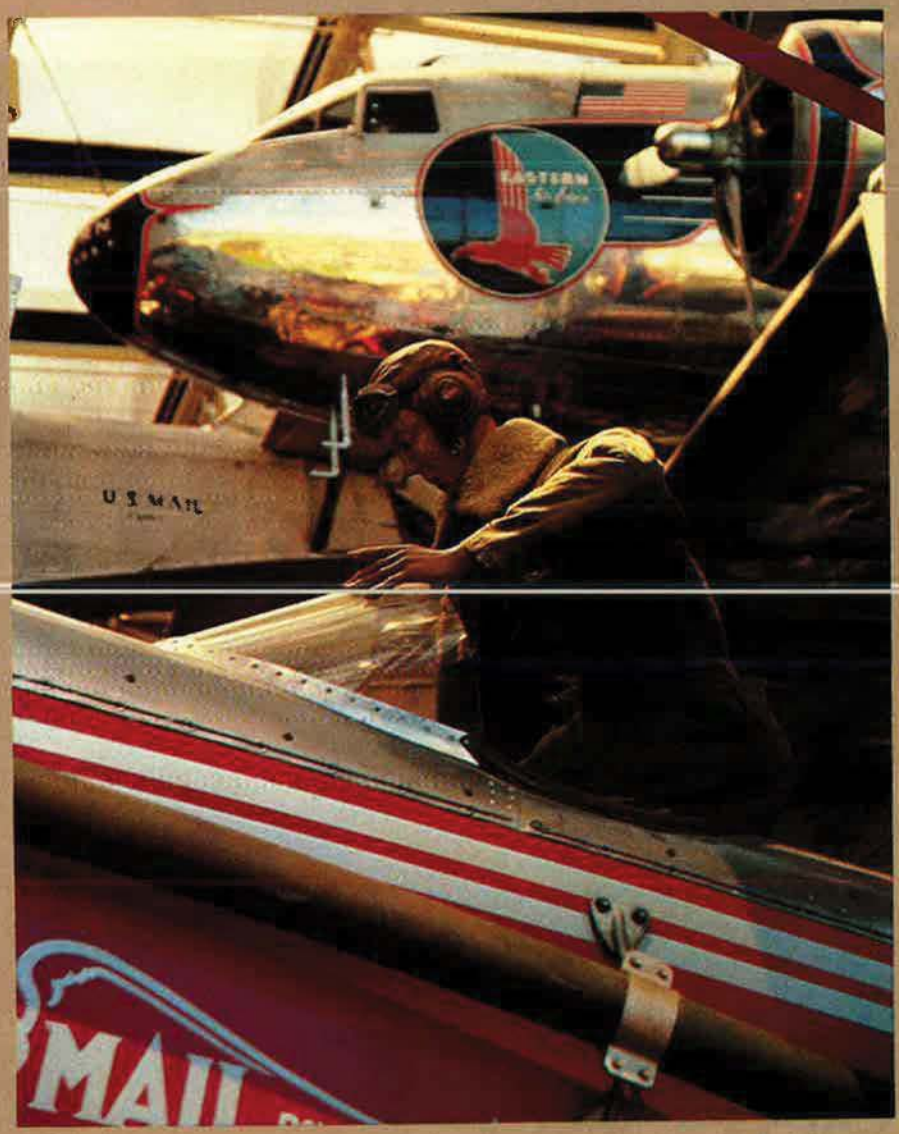
The list of the Museum's activities could go on, from its lecture series to its presentation of historic aviation films.

NASM, then, is not a drab and musty edifice, but a living testimony to mankind's continuing challenges in the realm of air and space. ■

The striking black, white, and red tail of an Army Air Corps Boeing P-26A, and the orange canopy of a Grumman Gulfhawk II. In the early 1930s, the P-26A, affectionately known as the "Peashooter," marked the transition from fabric-covered biplanes to all-metal, low-winged, monoplane fighters.

TOP: In the World War II Gallery, an Italian Macchi C.202 Folgore appears to attack Thunder Bird, a B-17G in Keith Ferris's painting, "Fortresses Under Fire" (© Keith Ferris 1976). Also visible in this photo are the tail of a Supermarine Spitfire, and the wing and nose of a P-51D Mustang. LEFT: The National Air and Space building is more than three city blocks long and houses twenty-three galleries and two "presentation centers" in its 200,000 square feet of exhibit space. ABOVE: The original Wright Flyer greets visitors as they enter the "Milestones of Flight" Gallery.





TOP: Ready for NASM's fifth anniversary, the newly completed mural by Keith Ferris in the Jet Aviation Gallery depicts twenty-seven significant jet-powered aircraft from the Heinkel 178 (large in foreground) to the Lockheed SR-71 (far right) (© Keith Ferris, 1981. Photo by Jack McConnell). LEFT: A Curtiss P-40E Warhawk, Boeing P-26A, and a Grumman Gulfhawk II vie for position. ABOVE: A SPAD VII with the insignia of the Escadrille Lafayette N. 124 in mid-victory roll over a German Fokker D.VII in the World War I Gallery. RIGHT: A mannequin climbs into the cockpit of a 1920s Douglas M-2 mailplane as the civilian version of the Douglas C-47, the DC-3, looms overhead.

Coming in September . . .

In commemoration of the thirty-fourth anniversary of the US Air Force as a separate service, and the thirty-fifth anniversary of the Air Force Association, AIR FORCE Magazine will present a special anniversary issue in September.

This special anniversary issue will be distributed at AFA's National Convention and Aerospace Development Briefings and Displays.

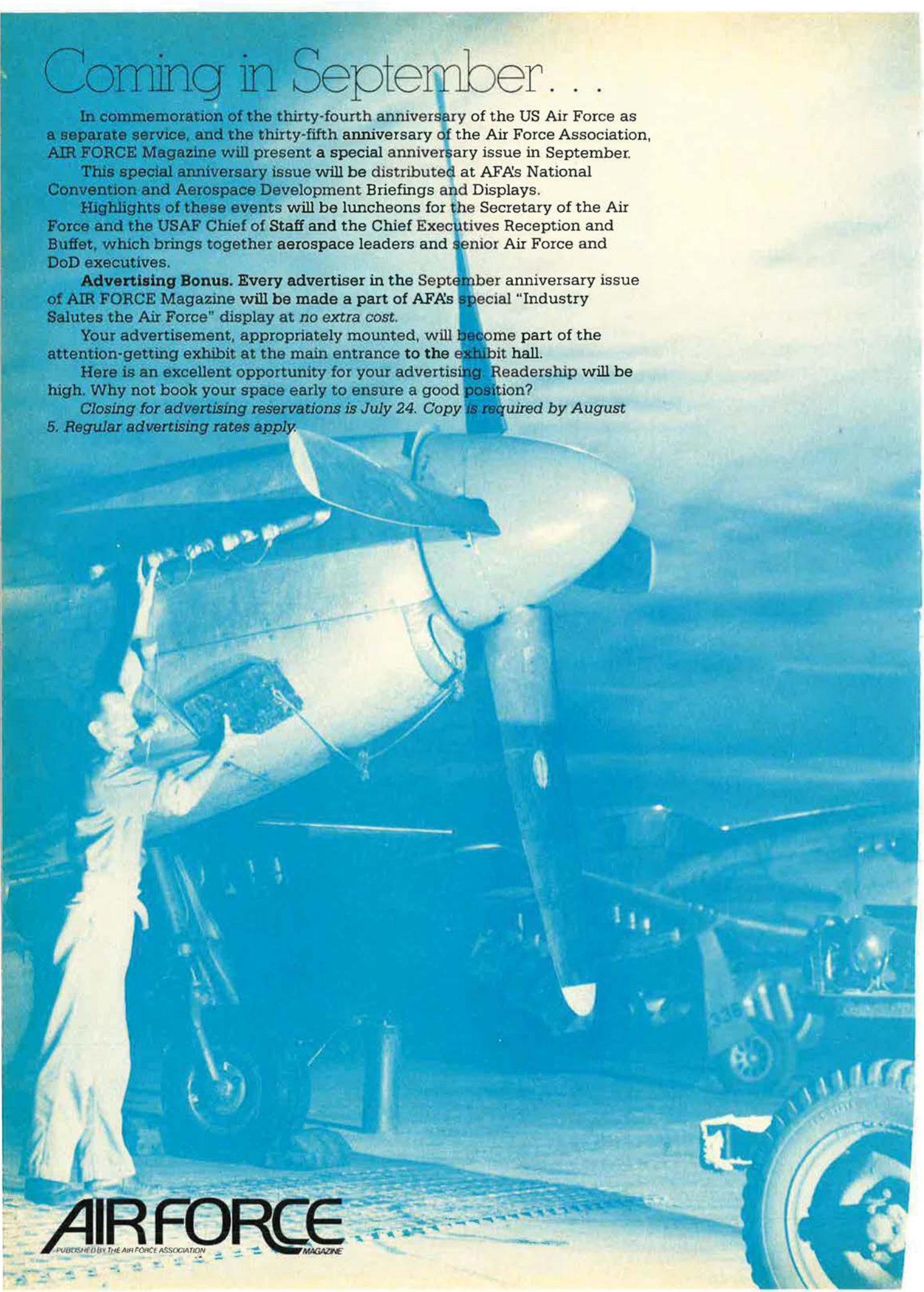
Highlights of these events will be luncheons for the Secretary of the Air Force and the USAF Chief of Staff and the Chief Executives Reception and Buffet, which brings together aerospace leaders and senior Air Force and DoD executives.

Advertising Bonus. Every advertiser in the September anniversary issue of AIR FORCE Magazine will be made a part of AFA's special "Industry Salutes the Air Force" display at *no extra cost.*

Your advertisement, appropriately mounted, will become part of the attention-getting exhibit at the main entrance to the exhibit hall.

Here is an excellent opportunity for your advertising. Readership will be high. Why not book your space early to ensure a good position?

Closing for advertising reservations is July 24. Copy is required by August 5. Regular advertising rates apply.



AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

While the aircraft carrier is undeniably an essential arm of the US's force projection into international waters, another, long-reach capability has gone largely unappreciated . . .

The Aerial Tanker and Maritime Strategy

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

THERE has been a lot of talk lately about our new concentration on a maritime strategy, and not only talk. The defense budget is bulging with items associated with that strategy, even one providing for the exhumation of a battleship from the ghost fleet. Whether the *New Jersey* is a logical contributor to that strategy or simply an expensive exercise in maritime nostalgia I will leave to others to debate. For me, maritime strategy in this era is mainly built around airpower, whether sea- or land-based, and it is the land-based contributor to that strategy that needs an airing.

A persuasive argument for aircraft carriers has always been the carrier's relative independence of bases. Carriers can perform the job of power projection, or simply showing the flag, without the complicated business of arranging for on-the-spot base agreements. And then, when there is no further business to be done, the carrier and its escorts can sail away. It is a convincing reason for keeping some of our airpower afloat, and no sensible person could want it any other way.

The fact that land-based air can now offer power projection capabilities with a similar independence of local basing arrangements is neither generally understood nor appreciated. The Air Force capability for in-flight refueling has developed over the years into something unique and truly revolutionary in the tactical sense. The concept was born in 1929 with the legendary flight of Ira Eaker, Tooey Spaatz, Harry Halverson, Roy Hooe, and Pete Quesada who stayed aloft in the Los Angeles area for nearly 151 hours in the *Question Mark,* refueled by Ross Hoyt and others. Refueling was then almost forgotten until the late forties. The distances SAC faced as it began to address targeting of the USSR brought tankers into the inventory, not so much as a tactical innovation but simply as the alternative to one-way missions.

Again, as in World War II, air refueling played no part in the Korean War. Later on, when fighters began to train routinely in air refueling, their tankers were shaky old KB-50s with drogues streaming out and auxiliary jet engines blasting at full throttle. Those distractions, along with a considerable speed differential, made for interesting night sorties in F-100s. Refueling was becoming accepted, but it had a way to go before anyone truly realized what it could mean to the tactics of airpower.

In Thailand, which saw the daily rendezvous of North Vietnam-bound fighters with an aerial fleet of KC-135s, we began to understand what we had. The tankers served as forward bases, and a concept had come of age. Squadrons of bombers, fighters, or even transports could now move at high Mach numbers around the globe, taking their fuel on the run.

A recent SALT negotiator remarked that the Soviets seemed envious of only one American military capability—the routine and seemingly effortless way we refueled, at night and in all weather, our tactical and strategic forces.

For some reason, that capability has not received the same appreciation in the Pentagon's E-Ring these past several years. There has been a tentative, almost reluctant, buy of twelve KC-10 tankers, but no enthusiasm whatever for a program to rejuvenate the aging KC-135 fleet.

There are 615 of these old tankers, bought in the days when SAC got what it wanted. It is not likely, just to understate things, that the Air Force will ever again see any administration lay out the kind of money 600 new tankers would require. The 615 KC-135s are, then, a priceless asset, an asset with its time running out unless something is done.

As is the case in most defense areas this year, things are looking up for the tanker force. There will be eight more KC-10s for a total of twenty, and the program to reengine and thoroughly overhaul at least 300 KC-135s appears to be on fairly solid ground. Taking into account all the demands a war would make on the tanker force, 300 is not enough, but it is a nice start.

A maritime strategy today must visualize a good deal more than simply concerning itself with an opposing navy. Among other objectives, we presumably intend to keep the sea and air lanes connecting ourselves, our allies, and our suppliers of vital resources free from interruption from whatever source. Air surveillance is an essential part of this task, as is the ability to apply airpower quickly where needed. The air surveillance capabilities of such sophisticated birds as the RC-135 and the SR-71 are multiplied by aerial refueling. With it, there is almost no limit to what can be seen, documented, and reported.

Fighter squadrons based anywhere along the Mediterranean basin, for instance, and supported by tankers, have the whole Med in their sights. A task force of bombers, fighters, recce, even transports, can be formed in the United States and arrive, say, in the Mideast in a matter of hours, with only the tankers in need of en-route basing. It is a maritime strategy Admiral Nelson (who always sought an edge) would have applauded.

But first, the tankers must have a little fixing. The KC-135s in their present state need too much runway, don't carry enough fuel, and use too much fuel themselves. Furthermore, they are old, and they need new skins and avionics. It is an expensive bill the tanker people are presenting, but like many big investments, the long-term payoff is what makes it attractive. Besides, look at the alternative: a United States Air Force slowly working its way back to ever-increasing dependence on the uncertain goodwill of countries around the world for base agreements. In that case, we can forget about an Air Force role in a maritime strategy. ■

Although they might have been considered "winged rubber stamps," the check pilots at World War II primary flying schools learned a lot about student pilots, flying, and themselves.

The Cloud With the Mild Blue

BY JOHN L. FRISBEE
Cartoons by Bob Stevens

THE last assignment any newly commissioned birdman wanted during those early days of World War II was check pilot at a primary flying school. After mastering the AT-6 or the AT-9, and maybe getting a little time in operational aircraft, going back to a sparsely instrumented primary trainer that might do 120 mph nose-down and with the throttle firewalled was like repeating fifth grade at the age of sixteen. To borrow a term from our gravel-scratching Army brethren, it was a retrograde movement—a dark cloud on the horizon of a dawning career.

"We were, in a sense, winged rubber stamps."

Eight months after I pinned on pilot's wings, that cloud descended on me. I was shipped off to Carlstrom Field near Arcadia in central Florida. The scene was familiar. A year earlier I had been a cadet at Carlstrom.

World War II primary schools were run by civilian contractors. Carlstrom was owned and operated by the Embry-Riddle Co. of Miami. There was only one word to describe the physical plant—magnificent. A quadrangle of white stucco buildings surrounded a swimming pool and tennis courts. Bright flowers bloomed everywhere. Palm trees swayed in the tropical breeze. Behind all that splendor lay the flying field, its ramp lined with row after row of (ugh!) Stearman PT-17s.

A military presence was maintained by a detachment of about twenty officers and a like number of enlisted men. I use the word "military" loosely. With the exception of two ROTC products who seemingly had been inattentive in class, the rest of us came off the streets with only a brief introduction to military life in Preflight. None of us had been overseas. That was changed later as pilots began to rotate back to the States from combat zones.

Six of the seven pilots were assigned to Operations as check pilots. The seventh was the detachment commander who had to divide his time between administration, liaison with the contractor, and flying. Our principal duty was to fly twenty-, forty-, and sixty-hour checks with the cadets and proficiency checks when one was put up for elimination.

The civilian flight instructors had been recruited from all over the country. Their flying time ranged from a few hundred to several thousand hours, and ninety-nine times out of a hundred their judgment of a cadet's competence was right on the money. We were, in a sense, winged rubber stamps.

One of the flight supervisors I remember with some awe was a man named Clem Whittenbeck, who had been barnstorming with flying circuses before any of the cadets was born. At one time, he reportedly held a world record for the most consecutive outside loops. Clem's legs had been crippled by accident or polio—I never knew which—but once he dragged himself up on the wing and climbed into the cockpit, what he could do with a Stearman was sheer magic.

The four sergeants assigned to Operations made life easy for us pilots. They did all the brain work while we did all the flying. From time to time, one of them would shove a mysterious form in front of me, the Operations Officer, with the terse instruction, "Sign here." Apparently they, at least, knew what they were doing. We were never gigged on an inspection.

"... even at Mach 0.20."

Lining

"I may be the only pilot to have been downed by a wasp."

Dawn Patrol

The flying field at Carlstrom was a square mile of prairie devoid of runways. It was surrounded by a drainage ditch inhabited by water moccasins and an occasional coral snake. The ditch also served to keep cattle off the field. The sod auxiliary fields, on the other hand, weren't as well ditched, so every morning one or two of us had to fly over and run the cattle off before the day's business could begin. It was a great way to start the day—the closest you could come to a strafing run in a primary trainer.

We tossed coins in the morning, and the winners got the cow-shooing detail. Losers who didn't have checks to ride had to slow-time engines that had been overhauled in Embry-Riddle's shops on the flight line. That task involved grinding around the area at reduced power for an hour to break the engine in.

More fun than slow-time but less than cow-chasing was test-hopping PT-17s that had had major airframe repairs or overhaul. A screaming power dive in an open-cockpit biplane, bristling struts and guy wires, can be quite a thrill, even at Mach 0.20.

The Boeing-built PT-17 was, as I soon learned, a great airplane for its time and purpose. It had a 220-hp Continental engine, a wingspan of thirty-two feet, and an empty weight of just under 2,000 pounds. The book said its ceiling was 13,800 feet, but I never had the patience to climb one above 10,000. It was stable, easy to fly, and had no bad habits in the air. It gave you plenty of stall warning and would come out of a spin by itself if everything was turned loose and you had enough altitude.

The Stearman was a little heavy on the controls, but it would do any of the standard aerobatic maneuvers that didn't require inverted flight or pulling negative Gs. Fuel was fed to the engine by gravity from a tank in the center section of the upper wing, so the engine quit whenever gravity wasn't pulling in the right direction. When the airplane was inverted, all you got out of the tank was a fine spray of fuel in your face from a small tank vent in the trailing edge of the upper wing. More about that later.

That PT-17 was really rugged. We had a cadet spin in from 3,000 feet and walk away from the wreckage. According to an instructor who saw it happen, the cadet had broken the spin and begun to get the nose up when the plane smacked down in a marshy area surrounding one of the many little round ponds that dot the prairie in central Florida. Another time a solo cadet landed on top of a Stearman that was waiting to take off. There were no injuries in either plane.

Twice I learned personally how rugged the PT-17 was. While flying an overhauled Stearman from the Carlstrom shops to a primary school in South Carolina, my engine quit near Lake Wales. I couldn't see

The reappearance in AIR FORCE *of John L. Frisbee's byline is a singularly welcome event. A flight instructor and combat pilot in World War II, he is a Command Pilot whose active-duty assignments ranged from operations to assistant professor of social sciences at West Point, head of the history department at the Air Force Academy, and on the Air Staff as special assistant to top Air Force leaders. He graced* AIR FORCE *Magazine's staff from December 1969 to June 1980, retiring as Editor. Living now in Leesburg, Va., he continues writing and editing.*

anything in gliding range but orange groves, so I decided to put down between two rows of trees, figuring the wings would shear off and I'd ride what was left down the lane of trees. Unfortunately, I failed to note that the first two trees in the row weren't exactly aligned. The right wing hit first and the old PT spun into the trees like a rotary mower. I stopped at the end of a fairly wide swath and climbed out, shaken in spirit but unscathed.

After the maintenance people from Carlstrom had gathered up the wreckage and trucked it back to base, they discovered that a wasp had crawled into that fuel tank vent mentioned earlier and had built a nest. With the vent blocked, a vacuum developed in the tank after a few gallons of fuel were burned off, and the tank stopped feeding gas to the engine. The wasp's nest was neatly mounted by the maintenance people and presented to me as a memento. I may be the only pilot to have been downed by a wasp.

The PT-17's one bad habit was its tendency to ground loop on takeoff, landing, or just taxiing in a cross wind. It had a long springy landing gear with narrow tread, a high center of gravity, and a lot of wing area to catch the wind. If you could land that little bird in a strong cross wind, you could probably land anything.

The Wing Walkers

The Stearman's engine was fired up with an inertial starter, and that brings to mind the wing walkers who wound up the starter and shepherded the plane out of its parking spot. They were locals, some just literate enough to read the numbers on an airplane.

To get the engine going, a wing walker inserted a crank into the inertial starter, which was located on the left side of the engine housing. He turned the crank with both hands until the starter's whine reached the right pitch, then signaled the pilot who called, "Contact!" and turned on the ignition switch. The wing walker pulled a handle that engaged the starter, and the engine came to life with a satisfying roar and a lot of smoke.

Necessarily, the wing walker stood uncomfortably close to the propeller—at least by my standards—many times a day. Familiarity may not have bred contempt, but it did engender a cavalier attitude. I once saw a wing walker who was wearing a baseball cap walk so close to a turning propeller that it knocked his cap off. He turned his back on that prop and walked away with all the disdain of a toreador who had just passed a bull within a half inch of his navel.

In the summer, most of the wing walkers went barefoot on the asphalt ramp, which by midday was hot enough to fry eggs. (That was in the days before OSHA.) I wondered how they could stand that heat on their bare feet until one day I passed a wing walker who was sitting on the ground, his legs stretched out in front of him, eating lunch. Embedded in his heel was a bright yellow thumb tack.

"Maybe I'm Right and Maybe I'm Wrong . . ."

Meanwhile, back at Operations. Every cadet rode at least one check with an Army pilot. (Yes, that's what we were called, but "Air Force" sounds better, so let's stay with it.) No cadet was washed out on the basis of a single ride—a sound policy since any fledgling pilot can have a bad day and no checker's judgment is infallible. I remember years later flying to Europe as a passenger on one of MAC's first jets. I was invited to come up and look over the business end of the C-135.

"I'm glad to see you again after all these years," the AC said.

"Sorry, Major, but I forget where our paths crossed," I replied.

"Colonel," he said, "I'll never forget you. You failed me on my sixty-hour check."

Under the circumstances, I'm sure he *was* glad to see me, and I prefer to think that he was just having a bad day on that long-ago check ride.

After flying a few hundred checks with cadets, it became pretty much routine. Only once did I have a cadet freeze on the controls, as they used to do in the prewar grade-B movies. With a little persuasion over the Gosport speaking tube—the only communication between instructor and student, except for hand signals—he let loose. The closest thing to emergency action was likely to be a bit of fast rudder, aileron, and throttle work to keep a slow-reacting cadet from ground-looping.

Nevertheless, my second most embarrassing experience occurred while giving a cadet an elimination ride. It was customary, once you determined that the cadet ought to be washed out, to do some aerobatics before returning to the flight line to give him the bad news. The aerobatics out of the way, I decided to put some icing on the cake.

"Mister," I said, "do you believe we can come over the edge of the field at 1,000 feet and land before we get to the wind tee?"

"No, Sir."

"Well, I'll show you."

It wasn't a very difficult trick in a Stearman. You came back on the power, pulled the nose up in a partial stall, and kept the wings level with rudder while the plane mushed down. Just before the wheels touched, you gave it a blast of throttle to break the descent.

Back came the throttle, up went the nose, and down we came like a slow elevator. A few feet off the ground, I slammed the throttle forward. The engine coughed and quit. So did the landing gear as we slammed into the ground.

I expect that cadet went back to barracks wondering who should have eliminated whom.

I don't want to give the impression that we Air Force types didn't take our duties seriously—especially rides with cadets who had been put up for elimination. Most of them wanted desperately to fly. It wasn't exactly heartwarming to see a six-

foot, hundred-ninety-pounder who may have been all-conference the year before cry when you told him he was washed out.

Most of the cadets recommended for elimination hadn't yet soloed. I rode with one who went through the basic maneuvers fairly well, so I told him to fly over to an auxiliary field and shoot a landing. He didn't break anything.

"I think you can solo, Mister," I said. "Do *you* think you can?"

"Yes, Sir."

"Okay. Taxi over to the end of the field, run up your engine, check the mags, look for landing traffic, and shoot three."

He gulped, taxied out, and sat. And sat. And sat.

Just as I was about to pick up my chute and walk over to the plane, he revved her up and off he went for three creditable circuits and bumps. As he taxied back, I stomped out my third cigarette.

"You sat out there so long I thought you'd changed your mind. What happened?"

"Sir," he said, "I didn't change my mind. I was praying."

We gave him another instructor and he made it—at least as far as Basic.

The Sixty-Percent Ace

My most embarrassing experience, and the second time I inadvertently tested the PT-17's ruggedness, happened right after one of the torrential downpours for which Florida is famous. All the low spots on the auxiliary fields and the main field, too, suddenly became little lakes. Solo cadets who had landed at auxiliaries to get out of the weather weren't allowed to take off through such an obstacle course, so we check pilots and some of the civilian instructors had to fly over and bring back the cadets and their PT-17s.

On this particular day, I led the charge, with a civilian instructor in the back seat. Since it was beginning to get dark, I took the most direct course, starting our takeoff run on the ramp and planning to lift off before we got to the first gigantic puddle. Well, it didn't quite work out that way. We were still rolling when we hit the water. The tail went higher and higher until that Stearman flipped over on its back, in clear view of a large group of civilian instructors standing on the ramp.

My passenger and I released our safety belts and dropped head first into about two feet of very cold water.

I was met on the ramp by one of the Operations sergeants. "Here's a dry chute," he said. "You can take 459 on your next try. I even have a civilian instructor who's willing to ride with you."

Counting the forced landing and the splayed landing gear, that made three PT-17s I'd downed in about three months. I never did get two more to become an ace.

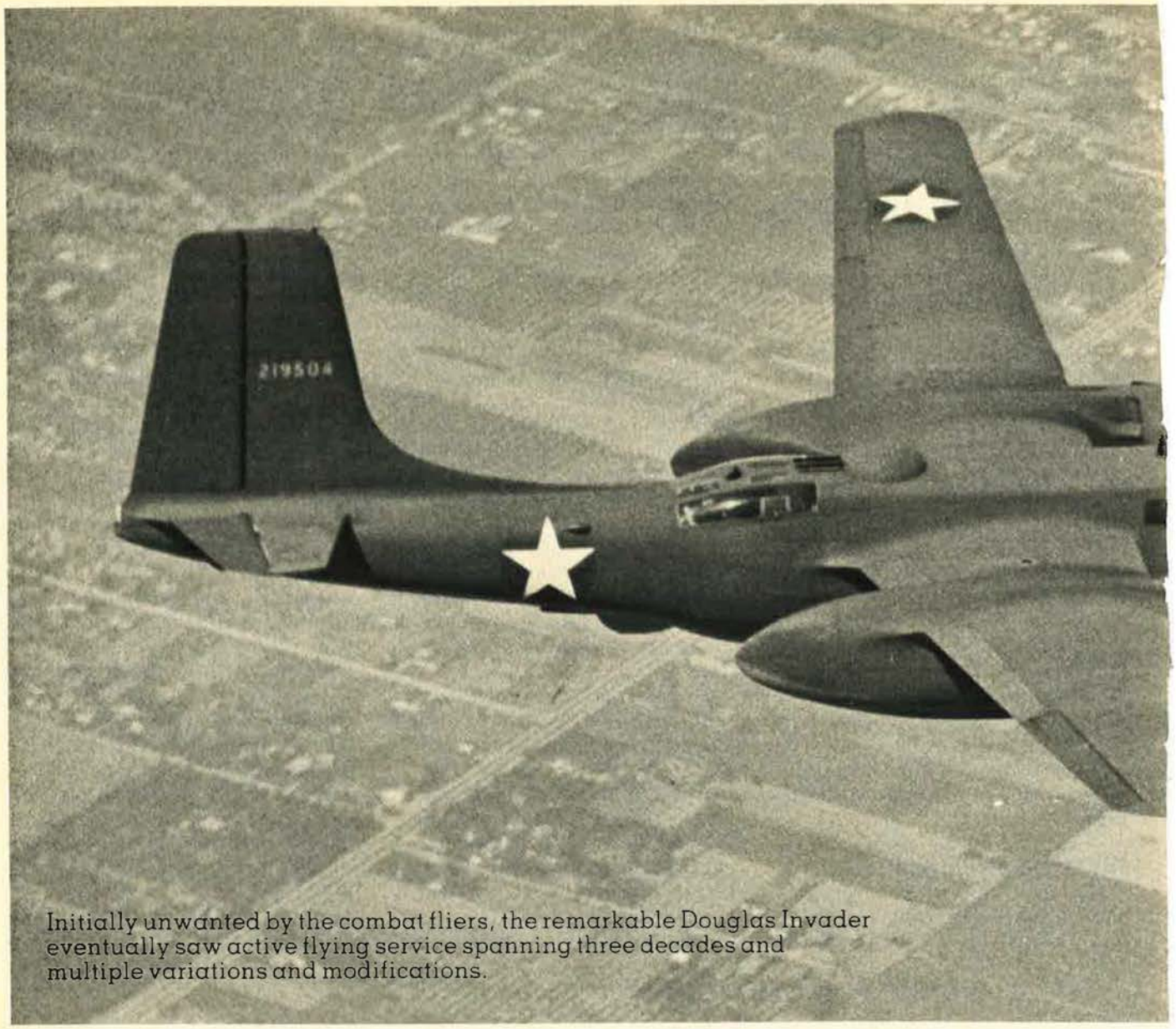
I still believe that no pilot has experienced all there is to flying until he has flown an open-cockpit plane. The wind in your face, the scream of guy wires, and the roar of an engine—even if it is only 220 hp—makes you one with your plane in a way that's almost forgotten. You can't savor the aroma of orange blossoms at 35,000 feet in an air-conditioned cockpit. You could in the low-flying Stearman. And if there's any poetry in a man's soul, the hushed murmur of wind in the wires at the top of a power-off loop on a moonlit summer night will bring it out.

Twelve months of roaring off into the Mild Blue Yonder in a PT-17 turned out to be great fun. I also learned a lot about what not to do in an airplane, and the experience as a whole proved not too damaging. I went directly from the Stearman to P-47s with only a quick look at the tech order and a crew chief's introduction to the cockpit. Things were pretty informal in those days.

Now, nearly forty years later, I sometimes think about that sturdy old PT-17 that I came to love and wonder if I could still snap it at the top of a loop.

Maybe it's best just to wonder about that. ■

"The engine coughed and quit. So did the landing gear as we slammed into the ground."



Initially unwanted by the combat fliers, the remarkable Douglas Invader eventually saw active flying service spanning three decades and multiple variations and modifications.

A-26: THREE-DECADE AERIAL WORKHORSE

BY JOSEPH A. VENTOLO, JR.

"*We do not want the A-26 under any circumstances as a replacement for anything!*" Gen. George C. Kenney, Commanding General of the Far East Air Forces (FEAF), pronounced that judgment on the A-26 in July 1944, soon after the first production models were introduced into the Southwest Pacific Area for combat evaluation.

It was an inauspicious beginning for the airplane that was supposed to replace such combat veterans as the Douglas A-20 Havoc, the Martin B-26 Marauder, and the North American B-25 Mitchell. Another year would pass before General Kenney would change his opinion of the Invader.

Development

The A-26 Invader had been developed to meet a 1940 Army Air Corps requirement for a successor to the Douglas A-20 light attack bomber. Concerned that the A-20 would not be able to meet the expected combat requirements of a European war, in 1940 the Air Corps asked for a new airplane—one that was faster, stronger, had more defensive armament, and required less takeoff and landing distance than the A-20. Eventually, the Air Corps also intended to replace the B-25 and the B-26 with this new airplane.

The Experimental Engineering Section at Wright Field, Ohio, gave the Douglas Aircraft Co. first priority for developing the airplane. Consequently, on June 2, 1941, the Air

The Douglas XA-26 basic attack bomber. This prototype made its first flight on July 10, 1942. Two .50-caliber fixed guns were later added in the nose.

Corps approved a contract for the purchase of one XA-26 basic bomber and one XA-26A night fighter. Shortly afterward, a third version of the airplane, designated the XA-26B, was added to the contract.

The XA-26 initial prototype made its first flight on July 10, 1942. As a basic attack bomber, it was equipped with a Plexiglas-enclosed bombardier's position and provisions for two .50-caliber fixed guns in the nose, plus two .50-caliber guns each in upper and lower turrets. Both turrets were remotely controlled from a gunner's position in the upper central section of the fuselage. The second version, the XA-26A night fighter, had four forward-firing 20-mm cannon housed in a lower gun bay, and four .50-caliber guns in an upper turret. The third airplane, the solid-nosed XA-26B, had a nose-mounted 75-mm cannon in addition to a pair of .50-caliber guns in each of the two remotely controlled turrets, as in the XA-26 basic bomber.

Tests with these three experimental A-26s resulted in the adoption of the A-26B version as the first production model. Powered by two Pratt & Whitney R-2800-27 or -79 engines of 2,000 hp each, the airplane could attain speeds up to 355 mph in level flight, making it one of the fastest bombers used by the Army Air Forces (AAF) in World War II. It carried a crew of three: pilot, navigator/radio operator, and gunner. There was no copilot. With a full crew and payload, it had a combat range of up to 1,000 miles. The XA-26A version of the airplane was never produced, but late in the war a Plexiglas-nosed version of the A-26B, similar to the XA-26 basic bomber, did reach production.

Armament and Production

With a solid nose fitted with six .50-caliber guns (instead of the 75-mm cannon of the XA-26B), plus the two .50s in each turret, the production A-26B was, to say the least, well-armed. After the 820th airplane had been produced, nose armament was increased to eight .50-caliber guns. The A-26 could accommodate a variety of armament configurations because multipurpose noses had been designed to be interchangeable according to need. If necessary, it could be equipped with either cannon or machine guns—or both—in the nose. Furthermore, eight more .50-caliber guns could be added in four packages under the wings. The upper turret could be locked in the forward firing position and controlled by the pilot, if desired.

In that configuration—with eighteen forward-firing .50-caliber machine guns brought to bear—the A-26B became a truly awesome strafing machine. Many A-26s, however, had six .50s mounted internally in the wings, thus eliminating the need for the drag-producing externally mounted wing gun packages.

The A-26B's normal bomb load was 4,000 pounds carried internally. An additional 2,000 pounds of bombs could be carried externally under the wings. Instead of bombs, sixteen five-inch rockets, or eight five-inch rockets and two fuel tanks could be carried externally.

The A-26B went into production in September 1943, even while further modifications were being proposed. More than a year earlier, the AAF had made plans to replace all its other medium bombers with the A-26, but serious production delays prevented those plans from being carried out. Shortages of machinery for making wing spars held A-26 acceptances down to a mere twenty-one airplanes by March 1, 1944, and prompted Gen. H. H. Arnold, Commanding General of the AAF, to demand ". . . A-26s for use in *this* war, not the next war." The high-level pressure he generated helped to overcome certain machine tool shortages, and after July 1944, A-26 production began to increase.

Combat Tests

In June 1944, four A-26Bs assigned to the Fifth Air Force in the Southwest Pacific were tested under combat conditions. A FEAF report on their performance, submitted to Wright Field, Ohio, in late July, declared the airplanes unsatisfactory.

Deficiencies in these early production models generated considerable disenchantment with the A-26 among those who flew them. Chief among the complaints was the lack of adequate visibility for the pilot. The "flat top" canopy on early A-26Bs restricted the view over the large engine nacelles. The report claimed that the inability to see well on either side of the aircraft made it nearly impossible to fly the formations necessary in low-level tactics. In fact, some pilots considered the Invader downright dangerous to fly in such a manner.

General Kenney agreed and grounded the airplanes after less than 175 hours of total flying time. Furthermore, Kenney believed that the A-20s and B-25s he had been using were good enough to do the job, and he could see no reason to begin experimenting with a new airplane so late in the game.

The A-26 was introduced into combat in the ETO on September 6, 1944, when thirteen aircraft attacked a coastal gun position at

Brest. The mission was successful despite poor weather conditions, and reports on it concluded that the A-26 had met the test. Then, on November 19, 1944, the Ninth Air Force used A-26s—along with A-20s and B-26s—in large-scale attacks on bomb storage depots, bridges, junctions, ordnance depots, and defended positions in or near ten German cities and towns. Again, the airplane performed well.

Even so, reports of the A-26's combat performance in Europe were a mixed bag of praise and complaint. On one hand, Maj. Gen. Samuel E. Anderson, of the Ninth Bombardment Division, reported that pilots had taken to the A-26 more quickly than they had to either the A-20 or the B-26. Once they became familiar with it, they considered the A-26 superior to anything they had flown before. In particular, they liked its performance with one engine out.

On the other hand, there were some reports of major deficiencies, including faulty brakes and an unreliable nose landing gear that had caused concern among the crews. Other, perhaps less critical problems—such as marginal visibility for the pilot, canopy frosting, failure of bomb release units, and hydraulic system problems—had also hampered operations. These difficulties could be corrected, however, and the general feeling was that, in Europe at least, the Invader was a superior attack bomber.

This photo shows not one, but two A-26Bs of the Ninth Air Force dropping bombs on a Siegfried Line strong point in the path of advancing American ground forces. You have to look closely to spot the second Invader.

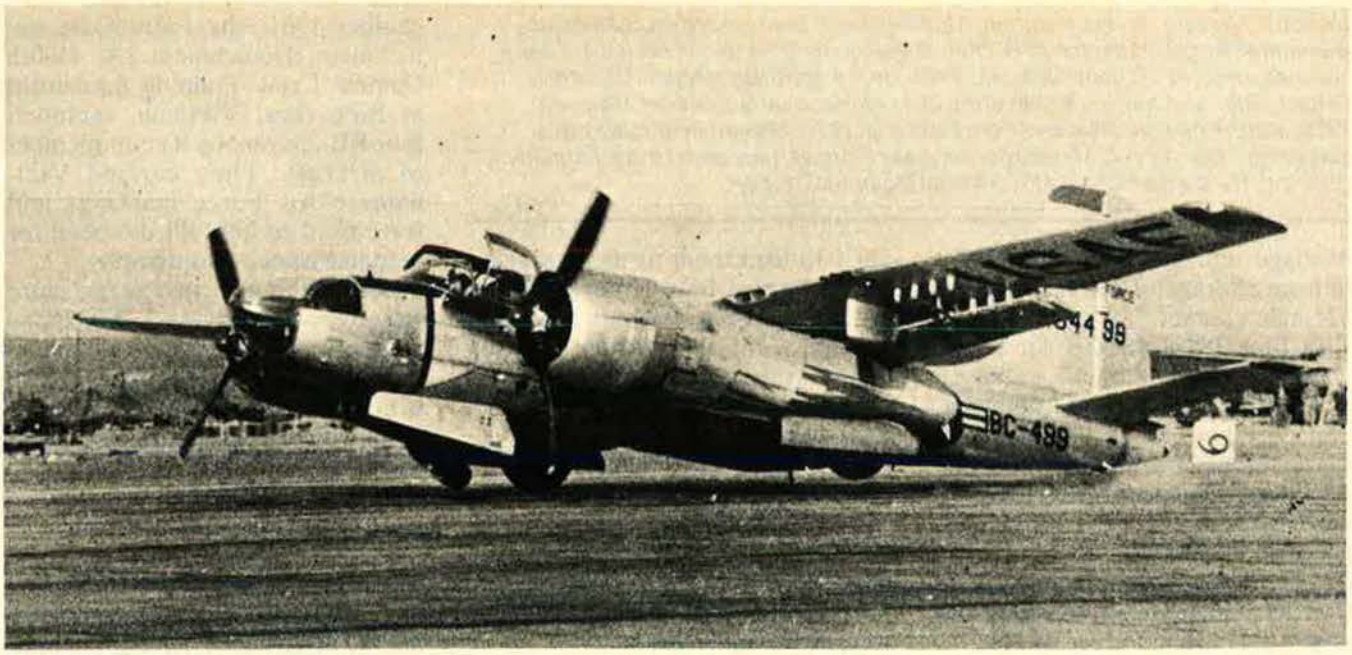
By the time of the Korean War, the Invader had been redesignated B-26 and saw extensive service on night patrols over railways and supply roads in North Korea. Part of the armament the B-26 could carry is shown here, including bombs, .50-caliber ammunition for sixteen guns, napalm tanks, and rockets (not shown).

A-26 Gains Acceptance

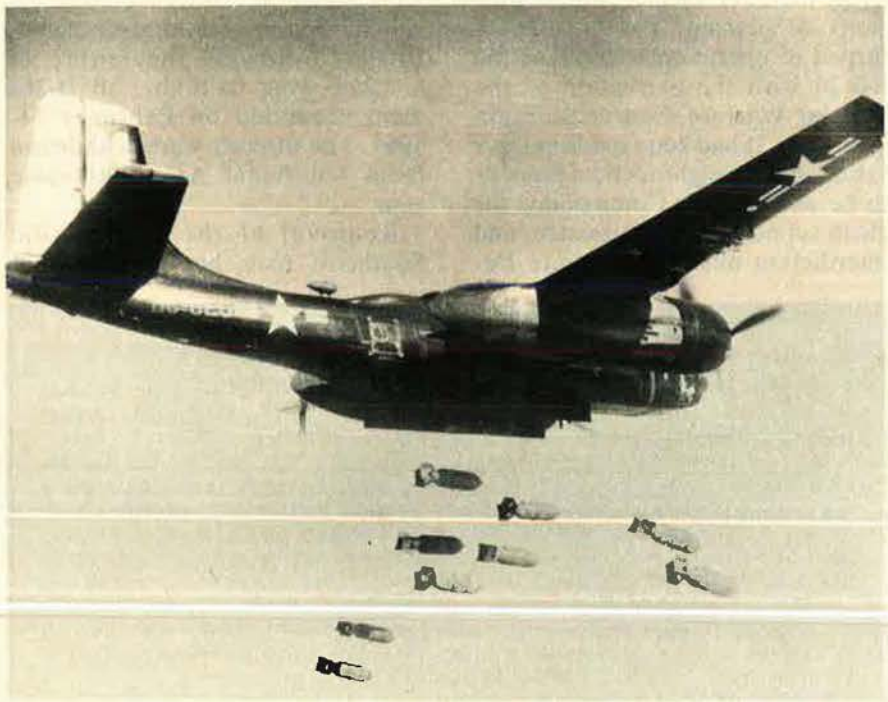
In November 1944, the AAF Assistant Chief of Air Staff for Operations, Commitments, and Requirements recommended to the Chief of Air Staff that all light and medium bombardment units be converted to A-26s as soon as enough aircraft became available. All European A-20 groups and all but three Martin B-26 groups were slated for conversion by July 1945. Despite reservations that had been expressed about the A-26's suitability, conversion in the other theaters of operations was to follow. General Kenney's Far East Air Forces, however, were next to the last on the conversion schedule.

By July 1945, an enlarged, raised canopy to provide increased visibility had been fitted to the A-26s coming off the production line. At the same time, several other modifications were made to enhance the airplane's effectiveness and safety. General Kenney revised his earlier, negative opinion of the A-26, and, on July 15, 1945, he told the War Department, "The A-26 with the eight-gun nose . . . has proven highly satisfactory as a replacement for the A-20 and later on for the B-25. Request the re-equipping of the 3d and 417th Groups with the A-26 be expedited."

In the last stages of the war in the Pacific, and during the campaign against the Japanese homeland, the A-26C joined the A-26B in combat service. The "C" series airplane was similar to the XA-26 basic



If there is such a thing as a near-perfect wheels-up landing, it's being demonstrated here by this Douglas B-26C ready for touchdown at a base in Korea. In combat, the B-26 proved to be a sturdy and dependable machine.



This unusual photo, taken from the "glass" nose of another B-26, shows a portion of the bomb load starting toward a target in Korea. The unusual pattern of ordnance results from the Invader's having two extra bombs tucked under its wings, between rockets, in addition to the regular bomb-bay load.

bomber prototype, and practically identical to the "B" except for its transparent Plexiglas bombardier nose (the navigator/radio operator crew position was replaced with the bombardier position). A-26C deliveries began in 1945 with five airplanes being produced by Douglas at Long Beach, Calif., and 1,086 ultimately being built at the Douglas factory, located in Tulsa, Okla.

A Versatile Aircraft

The A-26 Invader began the trend toward standardization and consolidation of combat roles within aircraft types. With it, the Air Force had three kinds of weapons combined in one: an attack airplane, a night fighter, and a medium bomber. The Air Force had increased the firepower of the medium bomber with the A-26 while at the same time cutting the crew requirements in half. The Invader was fast enough to compete with most enemy fighters of World War II. Despite the airplane's speed and relatively high wing-loading, its trailing-edge flaps gave better short-field ability and greater load-carrying capacity than its predecessors.

Although it was a latecomer to the war, the A-26 established itself as an excellent combat airplane. After the initial uncertainty following its introduction, it gained the acceptance and respect of the crews who flew it. After the war, the Invader became the Air Force's standard tactical bomber, and the primary offensive weapon of the new Tactical Air Command, which was created in 1946 from the wartime Ninth Air Force and Twelfth Air Force.

By August 1945, the AAF had accepted the delivery of 2,446 A-26s. Hundreds of them remained in operational service long after the war ended. The airplane also served in the US Navy as a target tug, and in the air forces of other nations, notably France, which used the A-26 during its war in Indochina and later on in Algeria. In June 1946, an experimental version of the Invader, equipped with a General Electric J31 turbojet mounted in the rear

Joseph A. Ventolo, Jr., is a historian in the Research Division of the US Air Force Museum at Wright-Patterson AFB, Ohio. Before joining the museum staff, he was a historian at Hq. AFLC from 1969 until 1979. He is a graduate of Miami University, Oxford, Ohio, and was a member of the Ohio Air National Guard from 1959 until 1965, and the Air Force Reserve from 1965 until 1970. His earlier article for this magazine, "Col. John A. Macready, Airpower Pioneer," appeared in the February '80 issue. He is a member of AFA's Wright Memorial Chapter.

fuselage and designated XA-26F, flew an average of 413 mph over a 621-mile course.

In June 1948, the US Air Force abandoned the "Attack" category as an aircraft mission designation. Since by that time the Martin B-26 Marauder had been retired from the Air Force inventory, the A-26 was redesignated a bomber, thus becoming the Douglas B-26 Invader and creating a designation problem that has plagued all but the seasoned aviation buff ever since.

The Invader in Korea

When the Korean War broke out, the Invader, under its new B-26 designation, was put to work by the Air Force for a second round of wartime service. Douglas B-26s served from the beginning to the end of that conflict, mainly in the bombing and attack roles for which they had been designed a decade earlier. They were very effective operating at night and at low altitudes, maneuvering in and out of the small Korean valleys, but enemy ground fire inflicted heavy damage on such missions.

In the early part of the war, the B-26 was used most often as a night intruder and the crews claimed the destruction of tremendous numbers of enemy vehicles. But the rugged terrain made it doubly dangerous for the Invader to operate so close to the ground at night. For that reason, B-26 crews soon learned not to venture below 1,000 feet when pulling out after a strafing run, unfortunately degrading the accuracy of fire on the target.

Overall, it was found that bombing was a more effective method of attacking enemy convoys and similar targets. Typically, Plexiglas-nosed B-26Cs would lead a flight of solid-nosed (gun-nosed) B-26Bs in medium-level attacks against railroads, highways, and bridges. Before long, B-26B pilots developed their own techniques for making modified dive-bombing attacks without having to rely upon the B-26Cs to lead them to their targets.

On the last day of hostilities in Korea, a B-26 dropped the last bombs of the war during a close-support mission.

Back Yet Again

The last of the B-26 Invaders were withdrawn from service in Air Force Reserve and Air National Guard units in 1958 and placed in storage. But it wasn't long before more uses were found for this durable and versatile airplane.

In 1961, the Air Force began taking B-26s out of storage and modifying them for special combat missions in Vietnam. The Invader returned to operational status as the RB-26 with the activation of the Special Warfare Center at Eglin AFB, Fla. It had been modified as a visual, day or night tactical bomber to be used by Air Commandos for close support, reconnaissance, and interdiction missions. By late December 1961, the Farm Gate detachment (Detachment 2A, 4400th Combat Crew Training Squadron) at Bien Hoa, Vietnam, included four RB-26s among its complement of aircraft. They carried Vietnamese Air Force markings and were used to help fill the need for reconnaissance photography.

During the next two years, more Invaders—B-26s and RB-26s—were brought to Vietnam for use in attack and reconnaissance operations. Unfortunately, the heavy ground fire common on most missions began to take its toll on the airplanes. By mid-1963, B-26 sorties started to decline due to aircraft losses from enemy fire, as well as a general reduction in serviceability. The old Invaders were simply wearing out after nearly twenty years of wartime and peacetime use. On August 16, 1963, a B-26 crashed after a wing broke off. Other incidents resulted in losses of more aircraft and, finally, following the failure of another wing in flight, all B-26s were grounded on February 11, 1964. The aircraft were withdrawn from Southeast Asia that same year.

Removal of the B-26s from Southeast Asia, however, did not

The Jump That Wasn't

Grounding the B-26 fleet in January 1964 probably saved the lives of a number of aviators. It also stimulated a collective sigh of relief from a group of Army paratroopers whose scheduled B-26 jumps were cancelled by the grounding.

The Tech Board of the Army's Airborne Department at Fort Benning, Ga., had received the task of developing and writing procedures for delivering parachutists out the bomb bay of the Invader. That was in December 1963. With the directive came a short movie of B-26 jumps just completed at the airborne test board at Fort Bragg. The movie, taken from a chase plane, showed life-size dummies plunging out of the open bomb bay. Their flailing was awesome, caused by the plane's necessarily high speed and turbulent airflow around the bomb-bay doors.

A final sequence showed the drop of a live paratrooper of the board. He suffered the same stresses as the dummies. We groaned with him as his arms and legs were jerked out of the impeccable body position he assumed for the jump.

A phone call to the test board confirmed our gut reaction to the film—the B-26 was a very tough airplane to jump from. But the tests had to be done, and procedures written for "the field," so that people could be dropped from the aircraft if necessary. A B-26 was to be provided from the Air Commandos at Hurlburt Field, Fla. Meanwhile, we worked out the field installations and procedures.

Simplicity was the key word. A rough plank bench would run the length of the bomb bay on one side, with an anchor line cable rigged on the opposite bulkhead. Red "caution" and green "jump" lights would be installed. The paratroopers would board through the open bomb bay, then ride to the drop zone sitting on the plank. Nearing the drop site, bomb doors would be opened, and on the green light the paratroopers would slide off the plank into the awful wash of air.

We ran that film a couple of more times to orient all those who would be jumping. The more we ran it, the less attractive the test became. This was abnormal. These men, all pathfinders and test jumpers, normally would be elbowing into line to jump from a plane they hadn't used before. Not this time.

The B-26 arrived, and we started to rig it, planning for the most senior and experienced jumpers to make the first drop. Then came the grounding order, cancellation of the jump tests, and the collective sigh of relief.

—F. C. B., Jr.

ABOVE: A YB-26K Counter Invader, modified by the On Mark Engineering Co., for use in Southeast Asia. LEFT: A B-26B in flight over South Vietnam, 1963.

spell the end of the Invader as a combat aircraft. A year earlier, a highly modified and improved version of the B-26, the YB-26K Counter Invader, had been successfully test-flown. Modified by the On Mark Engineering Co., the YB-26K had a completely remanufactured fuselage and tail assembly; redesigned, rebuilt, and strengthened wings; reversible pitch propellers; wingtip fuel tanks; dual flight controls; and other refinements. The YB-26K was equipped with eight wing pylons, which could accommodate rocket launchers, bombs (from 100 pounds to 1,000 pounds), napalm bombs, machine gun packages, or fuel tanks. Eight guns in the nose completed the armament.

The Air Force contracted with On Mark to produce forty of the highly modified aircraft. The first Counter Invaders were sent to Nakhon Phanom Royal Thai Air Force Base in July 1966. There they were used by the 606th Air Commando Squadron (later the 609th Special Operations Squadron) for interdiction missions along the Ho Chi Minh Trail. A long loitering capability enabled the B-26Ks to locate and attack an enemy often concealed by jungle or weather. In a short time the Counter Invader proved to be an effective hunter and destroyer of trucks and other vehicles.

In 1966, just as the Counter Invader returned to Southeast Asia, its designation was changed again. The Invaders and Counter Invaders resumed the original attack mission category designations: B-26Ks became A-26As, and other series Douglas B-26 aircraft became A-26Bs, A-26Cs, etc. After the 609th Special Operations Squadron flew its final Southeast Asian combat mission in early November 1969, the A-26s were returned to the US for disposal. More than twenty-five years had passed since the Invader's first introduction into combat.

The last A-26 used by the US military was finally retired by the National Guard Bureau in 1972 and turned over to the National Air and Space Museum of the Smithsonian Institution. In the mid-1970s, however, several South American countries were still using A-26s, although these were being phased out. Over the years many Invaders were sold as surplus and found their way into the general aviation fleet, modified as executive transports. Others were put to use in aerial photography, surveying, or in fighting forest fires. A few are still flying. A-26s can be found in various aviation museums in the US and around the world. One beautifully restored A-26C, for example, is on display in Korean War markings at the US Air Force Museum at Wright-Patterson AFB, Ohio. ■

AIRMAN'S BOOKSHELF

A Good Book Gone Wrong

Self-Destruction: The Disintegration and Decay of the United States Army During the Vietnam Era, by Cincinnatus. W. W. Norton & Co., New York, N. Y., 1981. 288 pages with index, notes, and bibliography. $15.95.

"Cincinnatus," pen name of an active-duty Army officer who wishes to remain anonymous, highlights serious tactical and ethical deficiencies that confronted the US Army during the Vietnam War. Almost all of the issues Cincinnatus details have been described before and, sadly, his message might well be disregarded by those for whom it is intended because the author laces his newly bottled old wine with gall.

Professional officers probably will be put on the defensive by the author's excesses, and likely will focus on the book's shortcomings rather than grapple with the valid issues he recapitulates.

Cincinnatus censures senior officers for not resigning when ordered to fight a war they believed to be unwinnable. He denounces the use of such tactics inappropriate to a counterinsurgency as the use of free-fire zones, defoliation, and search-and-destroy missions. He damns the Army's abuse of statistical indicators of progress—most notably the body-count.

He is sickened by the uncorrected racist views of the soldiers toward all Vietnamese. He criticizes the "up-or-out" promotion system and its reliance on mendacious effectiveness reports. He condemns "careerism," arguing that such phenomena as "ticket-punching," "zero-defects" programs, and the gross cheapening of combat decorations undermined the ethic of the officer corps. All of this is worth at least examination and debate, but it might be overlooked by officers eager to cite the author's defects.

According to Cincinnatus, all of the Army's vast problems during the Vietnam War—AWOLs, fraggings, drugs, combat refusals, etc.—came simply out of ignorance of revolutionary warfare by the top generals that was "little short of criminal negligence." Never does he cite the effects on morale of the inequitable conscription system and the antiwar protests back home.

When it became plain after the Tet offensive in 1968 that America was abandoning the war, fighting-will collapsed. Who wanted to die in a futile effort? The seemingly endless drift of the peace process destroyed combat-spirit certainly more than tactical shortcomings. The moral ills Cincinnatus cites were not commonplace until after the spring of 1968, when it was clear America would not stay the course.

Similarly, Cincinnatus gives the impression that the armed services were given "wide latitude" to defeat the enemy. The US "suffered a military defeat brought about by the ineptitude of its soldier leaders," not because of "political" restrictions. Professionals "planned the operations . . . developed the tactics and . . . ordered the assaults." Such statements are unfair, untrue, and disproved by the evidence collected in *The Pentagon Papers*, David Halberstram's *The Best and the Brightest*, and Leslie Gelb's *The Irony of Vietnam: The System Worked.*

Wide latitude?—Lyndon Johnson loved to chortle that "I won't let those Air Force generals bomb the tiniest . . . house without my permission." Cincinnatus claims that the Air Force "enthusiastically supported" Johnson's air war in North Vietnam, but that is false.

Self-Destruction is an example of a potentially good book gone wrong. There is an important message herein that probably will not be heard by those who can effect change—their ears will be shut because Cincinnatus is shouting at them. Cincinnatus!—lower your voice, and that's an order!

—Reviewed by Lt. Col. Alan L. Gropman, Hq. USAF. A frequent contributor to "Airman's Bookshelf," Colonel Gropman is a military historian and a Vietnam veteran.

ABOUT "CINCINNATUS"

Since this review was written, a feature article by Washington *Post* reporter Michael Getler has revealed the identity of "Cincinnatus." He is Dr. Cecil B. Currey, a history professor at the University of South Florida in Tampa. Although the publisher implies on the book's dust jacket that Cincinnatus is a senior ranking officer assigned to the Pentagon, it turns out that Currey is an Army Reserve lieutenant colonel chaplain who performs his annual duty in the Pentagon, where he also has a mobilization post. He acknowledged to Getler that he has never served in Korea or Vietnam. —The Editors

RAF Bomber Command in Action

A Thousand Shall Fall, by Murray Peden, Q.C., D.F.C. Canada's Wings, Stittsville, Canada, 1979. 473 pages. $18.95.

"They crippled a queen," decries the author, Murray Peden, as he deplores the obtuseness that limited the wingspan of the British Stirling bomber to ninety-nine feet. Existing hangar doors were 100 feet wide. The altitude performance of the RAF's first four-engine bomber was thus sacrificed down to 12,000 or 13,000 feet, when carrying a full bomb load, in deference to enlarging a few hangars.

Peden liked the Stirling at first sight and found that with its landing gear stowed it was "unbelievably maneuverable for her great size." In the book *A Thousand Shall Fall*, he takes us through an unusually thorough and detailed story of the British Commonwealth Air Training Plan as it provided aircrews for the RAF's strategic bombing offensive against Germany. Most of the training before combat operations was accomplished in Canada. It is, therefore, appropriate that Peden, himself a Canadian, has provided this fine story which traces his career from enlistment in the

RCAF to completion of a full combat tour as an aircrew captain.

Midway through their tour, Peden and his crew were transferred to B-17s when their 214 Squadron, formerly flying Stirlings, joined 100 Group, which was assigned a radar countermeasures mission. The Germans were using both long- and short-range radars to give the German fighter command a blow by blow description of the RAF bombers as they circled for altitude over their bases in England and then headed for their target.

Use of electronic countermeasures to blind these radars and negate the advantage enjoyed by the fighters was developed at the time that losses to the German defenses were becoming unacceptable. This game of cat and mouse played by the Germans and the Allies provided the first large-scale operational test of electronic countermeasures as an adjunct to tactics employed in attacking targets from the air. General Adolf Galland, famous German fighter ace and commander, attests to the "severe problems . . . in trying to defend Germany in the air."

In their inimitable fashion, American journalists in Britain created and nurtured a brouhaha concerning the effectiveness of the daylight bombing of the Americans compared with the night bombing of the RAF. Particularly galling to the British was the use of the term "precision" daylight bombing, with its obvious implication by these self-appointed experts in the art of warfare.

In this book, the author presents a logical, low-key analysis of all the elements involved. He leads one to the only sensible conclusion—that both the Americans and the British were conducting operations within the capabilities of their equipment as they considered how best to get the job done.

Peden is a master of understatement; therefore, it takes the reader some time before realizing that Peden and his crew would have at least an even chance of completing a thirty-mission tour.

He established and maintained standards of discipline that welded the crew into a highly competent team. They survived their share of narrow escapes with the help of some luck, but primarily by their professional performance.

His accounts of flying training, operational training, and combat operations reveal a keen sensitivity and insight into the underlying kinship of the aircrews. This is kept in perspective as recognition of the demands of the aerial mission is skillfully yet matter of factly kept in the forefront.

(Ed. note: The book is now in its second printing.)

—Reviewed by Lt. Gen. John B. McPherson, USAF (Ret).

New Books in Brief

Albatros D.Va: German Fighter of World War I, by Robert C. Mikesh. The various models of the Albatros were the most widely used and possibly most important German fighters of World War I. There is evidence that more than 2,500 of the D.V. and D.Va series were built, but only two are known to exist today. One is now on display at the National Air and Space Museum. Author Mikesh, curator of aircraft at NASM, has written a fascinating book blending the history of the aircraft with a behind-the-scenes look at how the skilled staff of the Air and Space Museum restored and displayed this important piece of aviation history. This book features many photographs and drawings of the Albatros, and is the fourth in the "Famous Aircraft of the National Air and Space Museum" series. Smithsonian Institution Press, Washington, D. C., 1980. 116 pages. $7.95.

The 8th Air Force Yearbook, by Lt. Col. John H. Woolnough, USAF (Ret.). This yearbook is a companion to *The 8th Air Force Album* published in 1978. It contains more than 1,000 photographs with no duplication from the *Album*. The *Yearbook* also lists the status, as of 1980, of each unit of the Eighth Air Force in World War II, including the identity and location of the active USAF unit now holding the unit history and honors; the name and address of the organizations representing unit veterans; published histories; and memorials and newsletters related to the Eighth. There are also special sections including photos of Eighth Air Force nose art, organizational charts, a unit location guide, and a station location map. This book is a must for anyone who served with the Eighth. Available from The 8th AF NEWS, P. O. Box 4738, Hollywood, Fla. 33083, 1981. 224 pages. $25.

Gavin, by Lt. Col. Bradley Biggs, USA (Ret.). James Gavin joined the Army in 1924 at the age of seventeen, attended West Point, and went on to distinguished service as commander of the 82d Airborne Division during World War II. After the war, General Gavin was named Director of Army Research and Development, but found himself swimming against the political and military tide of the 1950s. Gavin pushed for a buildup of conventional ground forces at a time they were being drawn down in favor of a policy of massive nuclear retaliation, and he resigned his post in 1958. He later served as Ambassador to France under President Kennedy. Biggs, a former staff officer under General Gavin, has written a flattering (and admittedly biased) biography of this uncommonly independent and outspoken man. With photos and index. Archon Books/Shoe String Press, P. O. Box 4327, 995 Sherman Ave., Hamden, Conn. 06514, 1981. 182 pages. $17.50.

The Third Option: An American View of Counterinsurgency Operations, by Theodore Shackley. Shackley, a retired CIA officer and authority on counterinsurgency operations, believes that the US is losing its ability to control or influence events around the world. This abdication of global responsibility creates power vacuums all too eagerly filled by the Soviet Union and its proxies. If the US is to face up to the Soviet challenge and remain a world power, Shackley believes that the US has three strategies it can pursue: at one end, negotiation and diplomacy; at the other, the horrifying prospect of war. The third option is one that Shackley believes the US has for foolish reasons misunderstood: Counterinsurgency and paramilitary operations. Shackley presents a thoughtful argument for his third option, and illustrates his case with four specific studies. With bibliography and index. Reader's Digest Press/McGraw-Hill Book Co., New York, N. Y., 1981. 185 pages. $12.

World War II Almanac: 1931–1945, by Robert Goralski. Many books have been written about World War II. This book is perhaps one of the more singular works concerning the subject—a detailed chronological record of the significant political, diplomatic, and military events related to WW II. In addition to the day-by-day listing, the book includes more than 300 photographs, maps and charts, short anecdotes, and statistics on everything from the equivalent ranks of various national military forces to munitions expended. This book will serve as an invaluable reference for students or as an interesting diversion for the general reader. G. P. Putnam's Sons, New York, N. Y., 1981. 486 pages. $17.95.

—Reviewed by Hugh Winkler, Associate Editor.

An important part of Air Force preparedness is involving the families by informing them on USAF missions, roles, and status. That was one purpose of the symposium for spouses held recently at Bolling AFB. They also learned of family-oriented programs aimed at improving the lot of USAF members.

Keeping Families Informed

BY ESTHER A. CURTIS, AFA LEGISLATIVE ASSISTANT

"FAMILY," spelled with capital letters, was the theme of the recently conducted Third Annual Symposium for Washington-area Air Force Spouses. The informative day-long event, sponsored by Mrs. Lew Allen, Jr., wife of the USAF Chief of Staff, emphasized the importance families have in the overall mission preparedness of the Air Force. The fast-paced and interesting briefings touched on all aspects of military and family life. These lives have become so entwined in the past years that, in the view of USAF leaders, one cannot function without the other. The 140 spouses attending the symposium heard speaker after speaker attest that the Air Force truly recognizes the contributions made to total-force readiness by the families of our men and women in blue. In addition, they were told that more is being done and will be done to recognize the difficulties facing families.

Mrs. Allen said that she had heard the presentations earlier and had come up with the idea of presenting them to Air Force spouses of all ranks, since it was, she said, the most comprehensive picture she had received of the Air Force's mission, and she felt that all spouses would benefit. The idea was well received, judging by the number of officer and enlisted wives attending; among them were Mrs. Verne Orr, wife of the Secretary of the Air Force, and Mrs. Robert C. Mathis, wife of the USAF Vice Chief of Staff.

The Role Spouses Play

Col. Larry Foley, the Assistant for Air Force Family Matters (AFFAM), opened the meeting. He welcomed the participants and introduced the Chief of Staff. General Allen gave a forceful endorsement of the role spouses play in the Air Force family. He also described a promising future for the Air Force as far as recognition, retention, and benefits are concerned. "There is an air of buoyancy sweeping the country today," he said, "and a realization of changes taking place in the American people. We realize that we have to take steps to face outside threats, and the country recognizes the job we are doing. This was evident in last fall's election, followed in Congress by pay raises, increased benefits, and the proposals in the current budget.

"There is a social revolution taking place all over the country," he continued, "and the Air Force cannot be a society unto itself. We *are* part of the American society and have to keep up with the changes; we have to become more imaginative."

General Allen acknowledged that working wives have had a great impact on family life-styles and that the Air Force had to make adjustments in its operating procedures to allow individuals to function both as family members and members of the Air Force.

These words set the mood and the pattern of the briefings that followed. Lt. Gen. Jerome F. O'Malley, Deputy Chief of Staff for Operations, Plans and Readiness, presented an overview of the Air Force's mission ("Fly, fight, and win"), touching on such subjects as the MX program ("The Air Force's No. 1 priority today"), the air-launched cruise missile, the FB-111 stretched bomber, the ground-launched cruise missile, and AWACS. He noted that, because of the lack of funding for the past twenty years, the Air Force has a problem providing aircraft with spare parts, and that sustainability is in jeopardy because of this. The participants also heard him point out the real dangers of the Soviet threat and the relentless Soviet arms buildup.

Child-Care Program

Lt. Gen. Andrew P. Iosue, DCS/Manpower and Personnel, presented clear explanations of the complex personnel issues facing the Air Force and the actions being taken in response. He said that retention was improving, but noted that much will have to be done to give the men and women in the Air Force salaries comparable to their civilian counterparts.

Great interest was sparked among the participants for the child-care program described by General Iosue. With working mothers becoming the rule rather than the exception, child-care centers at Air Force bases have taken on added importance. Children are not just dropped off for a few hours at these nurseries. Instead, care has been expanded to a full child-care development program, with children spending all day at activities supervised by trained personnel. Two bases—Hahn AB in Germany and Cannon AFB, N. M.—have just completed testing a twenty-four-hour child-care center program, and the results are now being evaluated. In all, 124 Air Force bases have childhood development centers, caring for some 18,500 youngsters each day. More construction funds are needed as this successful program expands.

General Iosue said that the Air Force's poor retention experience has emphasized the importance of a happy family in keeping an Air Force member in the service. One change resulting from that experience is that the Air Force now consults more with service members before ordering them to new assignments. Creation of AFFAM is an-

other response that demonstrates USAF's recognition of the family's importance. AFFAM was established in 1980 in direct response to the need to work with families who are faced with great difficulties in coping with our changing society, the high cost of living, and lack of recognition for their sacrifices and service.

The most immediate questions coming to the minds of symposium participants after hearing about the new trends were: What is being done and how will service families be affected? Subsequent briefings dealt with these issues.

Brig. Gen. Gerald W. Parker, Director of Medical Plans and Resources of the Surgeon General's office, introduced Capt. Stephen Noble, who explained how CHAMPUS will become more effective. Already implemented are proposals to increase well-baby care to include immunizations and the full payment of outpatient surgical fees. Realizing how important increased medical benefits are to families, efforts are under way to seek elimination of the annual deductible fee to families and to individuals, and to raise and periodically update the fee schedule for physicians' claims paid by CHAMPUS. The outlook for a CHAMPUS-sponsored dental program is excellent at this time, and the Defense Department is fully supporting this effort.

Col. Larry Foley, the Assistant for Air Force Family Matters, coordinated the symposium held at Bolling AFB, D. C.

Family Medical

Col. Vance Weiss, a pediatrician and consultant to the Surgeon General, followed with an explanation of the sad but necessary function supported by the Surgeon General's office of a child-abuse prevention center at each USAF hospital. Each center also handles rape and assault and battery cases and works in coordination with professional case workers. Colonel Weiss pointed out that the Surgeon General's office hopes to implement a program assigning every family to a physician at their local USAF hospital. This physician would lead a team of doctors and physician's assistants who would know the family's medical history, would be on call by phone, and would provide early, personalized care to each family member. This would be available to active-duty personnel only. Although space is a problem, some such centers are already being tested, and forty more will be opening this summer.

General Parker spoke briefly about the doctor situation. He said that the Air Force has no overall physician shortage. However, he said, shortages do exist in certain specialties, especially surgical specialties. He also pointed out that the Air Force physicians are seeing about the same number of patients they did in the past, but the number of active-duty patients has diminished, while retired numbers have increased.

Brig. Gen. Clifton D. Wright, Deputy Director of the Directorate of Engineering and Services, introduced his expert on family moves, CMSgt. Elijah E. Roberts. Everyone in the audience listened with obvious delight as Chief Roberts explained how much is being done, including initiatives to improve the quality of packers and to increase the per-pound value of items damaged. Efforts are under way to have badly damaged items, such as TV sets, not just repaired but replaced with a new item of comparable value. A most interesting point was made when Chief Roberts stated that, because of a lack of qualified government inspectors, spouses will be trained to assist as qualified inspectors during packing of household goods.

Chaplain's Study

The last presentation of the morning was made by the USAF Chaplain's office. In the packet presented to each participant was a study sponsored by the Office of the Chief of Chaplains, USAF, entitled "Families in Blue." This comprehensive overview of what Air Force families are facing deals with every aspect of the Air Force family and draws conclusions pointing out achievements and problem areas.

A lively question-and-answer period followed each presentation, showing interested awareness of the issues by the spouses. The conversation carried on well through a luncheon served at the Bolling AFB Officers' Club.

Guest speaker was the Hon. Beverly Byron (D-Md.). Mrs. Byron, a member of the House Armed Services Committee, has shown great interest in the quality of life of the armed forces and has been a consistent advocate of strong national defense. She shared with the audience her recent experience of visiting the Air Force Academy and air bases in the western US. One of the most heartening experiences, she said, was talking with Academy cadets who told her that they have noticed a change in the attitude of families and friends toward them when they go home on leave. They are no longer considered outsiders, and they have pride in the career they have chosen. Mrs. Byron assured the spouses that Congress will do all it can to make the service a sought-after and respected life in our country. ■

"Coming of Age" at Iron Gate

AFA's Iron Gate Chapter held its Eighteenth National Air Force Salute in New York City on March 28. As Chapter President Harold Miller put it that Saturday evening, "This is our 'coming of age,' and we think it particularly significant that this event also marks the beginning of raising our second million dollars for Air Force-related charities."

The evening honored the founding members of Iron Gate, many of whom were on hand. The recipient of the Chapter's Maxwell A. Kriendler Memorial Award was world-famous cartoonist Milton Caniff, who not only has served as Chapter President, but was the designer of both the distinctive Chapter crest and the award (then named the Bronze Eagle Award) he received.

The Air Force-related charities benefiting from the more than one million dollars raised by this event over the years include the Air Force Enlisted Men's Widows and Dependents Home Foundation, the Air Force Village, the Aerospace Education Foundation, the Falcon Foundation, and the Air Force Historical Foundation.

Next year's Air Force Salute will be held on Saturday, March 13.

—By James A. McDonnell, Jr.
Photos by Sid Birns

Milton Caniff, right, creator of Steve Canyon and other memorable comic-strip characters, receives the Maxwell A. Kriendler Memorial Award from Salute Foundation Chairman Francis S. "Gabby" Gabreski. Mr. Caniff is a former president of the Iron Gate Chapter.

Sen. Barry M. Goldwater (R-Ariz.), Chairman of the Board of AFA's Aerospace Education Foundation, visits with Francis S. Gabreski, left; Iron Gate Chapter President Harold Miller, second from right; and Herbert R. Dimmick, right, Chairman of the Salute Committee.

New Jimmy Doolittle Fellows

The Iron Gate Chapter has sponsored more than sixty Aerospace Education Foundation Jimmy Doolittle Fellows, more than any other individual or organization. Fellows named at this year's Salute, each representing a contribution of $1,000 to the AEF, are listed below.

H. Jerome Berns*
Edward E. Finch*
Dorothy L. Flanagan
Gilbert O. Herman*
Michael J. Kitzman*
H. Peter Kriendler
Brice E. Macartney*
James B. McCarley II*
John T. McCoy, Jr.*
James C. Sparks*
Richard L. Spaulding*
Sheldon J. Tannen*
Joel M. Weiss*
H. D. "Chips" Woodruff*

*Denotes Iron Gate Chapter Founding Member

On hand for the Salute were (from left): Air Force Chief of Staff Gen. Lew Allen, Jr., Secretary of the Air Force Verne Orr, Iron Gate Chapter Secretary and Salute Coordinator Dorothy L. Welker, and Chairman of the Joint Chiefs of Staff Gen. David C. Jones.

General Allen (center) visits with MSgt. and Mrs. George H. Schaefer at the Salute. Sergeant Schaefer was honored as one of the Air Force's seven top recruiters at the Salute. (See p. 94, April '81 issue.)

Top AFAers attending the charity event included (from left): AFA President Victor R. Kregel, Executive Director Russell E. Dougherty, and Chairman of the Board Daniel F. Callahan.

Col. and Mrs. Norman A. McDaniels take time during the Salute to admire a sample of Milt Caniff's WW II comic strip "Male Call." Many examples of Mr. Caniff's strips from over the years were displayed around the ballroom at the Salute for the enjoyment of the more than 1,000 guests.

Mr. Caniff entertained a rapt Salute audience with a demonstration of his work. Using an overhead projector, the crowd watched as, with a few deft strokes and well-chosen words, he evoked a mood that brought back many memories.

The Air Force's Strolling Strings added a touch of musical class for guests at the Salute. Also performing during the charity event were the Air Force Band of the East, from McGuire AFB, N. J.; and the Meyer Davis Orchestra, under the direction of Emery Davis.

CAPITOL HILL

By Kathleen G. McAuliffe, AFA DIRECTOR OF LEGISLATIVE RESEARCH

Washington, D. C., May 26

MX Supported in Authorization

In a record $136.5 billion defense authorization for FY '82, the Senate funded MX as requested at $2.4 billion for research and development.

The bill, however, "fenced" the program by including a provision stating that the funds cannot be obligated until after the President's decision is made on the basing mode and sixty days pass in which both houses of Congress do not adopt resolutions of disapproval.

The House version of the authorization took a decidedly different approach. The bill, not yet debated by the full House, authorizes the $2.4 billion for MX R&D but ensures continuation of the Multiple Protective Shelter basing mode unless the Administration chooses an alternate system and it is endorsed by the House and Senate within sixty days.

House Supports B-1

During markup of the FY '82 Defense Authorization, the House Armed Services Committee adopted an amendment which mandates that the $1.9 billion in procurement funds for the strategic manned penetrator be used only for a B-1 or a B-1 variant. The committee left intact the $302 million for R&D which, concurrent with B-1 development, could be used for R&D of an advanced technology bomber (ATB). The procurement funds could be transferred to the ATB if the President so chooses, but would need the approval of Congress within sixty days.

The Senate funded the multirole bomber as requested, but emphasized that the final choice of aircraft will be subject to disapproval by both houses of Congress.

Budget

The House and Senate adopted the conference report on the First Budget Resolution for FY '82 without much debate. The budget sets defense outlays at $188.8 billion and budget authority at $226.3 billion, the targets proposed by the Administration.

Reconciliation provisions instruct congressional committees to find about $36 billion in cuts in existing programs—both Armed Services Committees are to find $966 million in budget reductions for FY '82. The budget report suggests the reductions be achieved through accelerated sales from the strategic stockpile and an annual cost-of-living adjustment for military retirees.

The budget includes a provision that prohibits enrollment of bills exceeding budget authority targets in the first resolution until after Congress completes action on the binding second resolution and any reconciliation required by it.

Vinson-Trammell in Doubt

The future status of the Vinson-Trammell Act, the only remaining statute limiting profits on contracts for aircraft and naval vessels, is up in the air as a result of separate actions taken by the House and Senate.

The Senate voted for repeal of the 1934 law stating that "the Vinson-Trammell Act serves no useful purpose and imposes an unnecessary regulatory burden on both the government and defense contractors."

The House Armed Services Committee rejected an attempt by Rep. Marjorie Holt (R-Md.) to repeal the statute. The amendment was defeated by a twenty-to-twenty tie vote after Rep. Samuel Stratton (D-N. Y.), chairman of the Procurement subcommittee, acknowledged that the law is obsolete but remains the only legislation controlling excessive profits. He stated his intention to report out legislation on the matter after hearings to be conducted in June.

The Vinson-Trammell Act provisions were suspended until October 1, 1981, according to a vote by the Congress last year. The matter of repeal will be settled in conference.

Cost Growth Accountability

An amendment to the authorization bill offered by Sen. Sam Nunn (D-Ga.) is designed to help control the rising costs of weapon systems in FY '82.

Senator Nunn stated that unit costs of major systems increase at rates far above inflation and add "billions to the budget just to buy the same quantities of weapons that were planned before." The amendment, which passed by a unanimous vote, requires program managers to report quarterly to the service Secretaries on the unit costs of systems in the Selected Acquisition Report; establishes a threshold for cost increases of fifteen percent above the baseline costs previously established for R&D and ten percent for procurement; and requires a report to Congress within thirty days if either threshold is breached. The Congress then has to make decisions on how to proceed.

Although the House bill does not include a similar provision, the Investigations Subcommittee held hearings on the defense acquisition process. In response to a query on the subject of reporting to Congress when programs exceed certain cost levels, the acting Deputy Under Secretary for Acquisition Policy, Robert Trimble, opposed such a move since it would restrict DoD and make it more difficult to manage programs.

The Defense Department, under the direction of Deputy Secretary Frank Carlucci, has proposed initiatives to improve the acquisition process, including reduction of procurement costs, shortening of the acquisition cycle, a better job of designing in reliability of systems, and improvement in the Defense Systems Acquisition Review Council process.

CX Comes Up Short

The CX outsize cargo transporter has run into problems with Armed Services Committee members. While USAF requested $245.7 million in R&D funds for the aircraft, the Senate deleted all but $1 million because of lack of "sufficient information on the pace and direction" of the program.

The House bill transferred $150 million from the requested R&D funds into procurement of "readily available wide-body aircraft for immediate augmentation of airlift forces." A total of $20 million was left in the CX R&D account to keep options open for future development of a CX aircraft. ■

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One of the business sessions at the 1980 AFA Convention

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THE BULLETIN BOARD

By James A. McDonnell, Jr., MILITARY RELATIONS EDITOR

Vietnam Veterans Memorial

In May, in Washington, D. C., Vietnam Veterans Memorial Fund President Jan Scruggs unveiled the winner in the nationwide contest to design a suitable memorial. Selected was the work of a young woman architectural student at Yale, Maya Ying Lin. Her touching description of the planned monument to those Americans killed in the Southeast Asian conflict appears on p. 31.

On hand at the unveiling ceremonies were friends and supporters of the Fund, including Sen. Charles McC. Mathias, Jr. (R-Md.), who first introduced the bill that eventually provided two acres on the Washington Mall for the memorial. That bill subsequently was cosponsored by every Senator, a unique tribute to bipartisan support for the effort.

Also present was Sen. John W. Warner (R-Va.), who is credited with raising seed money for the VVMF drive. As of now, the Fund has raised $1.25 million toward a $7 million goal.

There were 1,421 entries in the design contest, a record for such competitions. The Air Force made hangar space available at Andrews AFB, outside Washington, D. C., for the judging.

An eight-member jury of architects, landscape architects, and sculptors noted in their selection statement that "of all the proposals submitted, this most clearly meets the spirit and formal requirements of the program. It is contemplative and reflective. It is superbly harmonious with its site. Its open nature will encourage access in all occasions, at all hours, without barriers. All who come here can find it a place of healing."

VVMF President Scruggs told AIR FORCE Magazine that he is optimistic that the scheduled dedication date for the memorial of Veteran's Day, 1982, will be met. "We are one fund-raising organization," he said, "that wants to go out of business as soon as possible."

To do this, contribution goals must be realized. AFAers are encouraged to send their tax-deductible contributions to VVMF, P. O. Box 37240, Washington, D. C. 20013.

AFA Executive Director Russell Dougherty, left, helped mark the thirty-fifth anniversary of Strategic Air Command at a recent banquet held at Travis AFB, Calif. General Dougherty is a former CINCSAC. He was joined by Col. Martin F. Lapp, center, Commander of SAC's 307th Air Refueling Group at Travis, and CMSgt. Robert T. Barnes, USAF (Ret.), who designed SAC's patch in 1951.

Agent Orange Studies

In testimony before a subcommittee of the House Veterans Affairs Committee, Lt. Gen. Paul W. Myers, Air Force Surgeon General, stressed that the Air Force is moving ahead strongly on its congressionally mandated study of the exposure of US military personnel to the defoliant Agent Orange during the war in Southeast Asia.

General Myers noted that the term "Agent Orange" came from an identifying orange stripe on the drums in which the herbicide was stored. He pointed out that the Air Force study is concentrating on Ranch Hand people both because of likely heavy exposure to the chemical and because they can be readily identified. Ranch Hand, he explained was the code name given the USAF aircrews involved in spraying operations between 1962 and 1970.

As many as possible of the some 1,198 Ranch Handers will be studied, along with appropriate control people. "Control people" are Air Force Vietnam vets chosen to match as closely as possible by age, occupational category, race, etc., the Ranch Hand group. The main difference is that the control group was not exposed to the defoliant. All will be interviewed in the year beginning next month. The study subjects also will be asked to take an extensive physical examination at a national medical center. Follow-up examinations are planned for three-, five-, ten-, fifteen-, and twenty-year intervals. Total cost of the study is estimated at $35 million in 1981 dollars.

Meanwhile, veterans groups and individuals continue to press for more recognition of the problem. The VA, in response, has awarded a contract to a team of scientists at UCLA. Their work will be evaluated by experts from a range of government and private groups. Dr. Peter Beach, of the White House Interagency Work Group coordinating other government agencies' interest in the prob-

lem, has told this column that records of Army and Marine Corps Viet vets with possible Agent Orange exposure are being moved to a central location for ease of review (subject only to Privacy Act restrictions) by interested veterans groups.

The government, thus, is making a concerted effort to bring the subject out in the open. And, in spite of highly publicized allegations by individual veterans the VA continues to stress that although claims of exposure-related maladies ranging from headaches to cancer and birth defects have been raised, to date "no definite medical link has been established that would substantiate these claims." In any event, the studies are needed either to verify or convincingly lay to rest these assertions.

Pay Raise Postponed Until October

The hoped-for 5.3 percent military pay raise earlier scheduled for July 1 has now been postponed until October 1. President Reagan had supported the July pay boost, but the House Armed Services Committee voted to defer the increase in order to save some $420 million. The Administration then decided to support the deferral.

Numerous military and civilian leaders had stressed the need for the increase. Secretary of Defense Caspar W. Weinberger, Secretary of the Air Force Verne Orr, and Air Force Chief of Staff Gen. Lew Allen, Jr., all made the point before Congress, and on other platforms, that this catch-up raise is "essential" to attract and retain good people. Army and Navy leaders echoed this theme and, in a joint effort with the Army Association and the Navy League, AFA came out strongly for the raise.

AFA noted that military pay lags 14.7 percent behind inflation since the advent of the All-Volunteer Force and that if it "cannot be made comparable . . . the Congress faces the unhappy prospect of examining other ways of manning the armed forces."

Unfortunately, resistance in Congress has been building. Rep. Bill Nichols, chairman of the influential House Subcommittee on Military Personnel and Compensation, is plugging for a 14.3 percent increase effective October 1, which he believes is a better approach. He noted that "clearly, an increase earlier in the year would be more desirable from the point of view of some service members." But he felt nonetheless that the approach of locking in a larger October raise, rather than shooting for the July increase and gambling on a later October catch-up of eleven percent or so would be a more effective parliamentary procedure.

Civil Air Patrol Has Record Year

In 1980, the Civil Air Patrol was credited with saving 115 lives, an impressive record. It also racked up more than a thousand search missions; contributed vital disaster relief support at national, state, and local levels; continued its long-time advocacy of aerospace education; and engaged in a vast array of flight-related and civic activities.

These achievements are noted in the annual report that CAP, a congressionally chartered group, makes to Congress. The 1980 report details a continuing productive track record for this Air Force auxiliary, now in its fortieth year.

The overall objective of CAP is to save lives and relieve human suffering. Faced with lost hunters and hikers to downed lightplane occupants, CAP volunteers mounted 1,175 search missions. The eruption of Mount St. Helens and unusual blizzard conditions during the year also generated CAP volunteer action.

On a quieter but no-less-important front, the CAP Cadet Program, designed to develop and motivate young people to leadership and responsible citizenship through aviation, continued its scholarship, encampment, and flight-training programs. The CAP Falcon Force Kit, a self-contained package of materials for teachers interested in aerospace, was evaluated and approved for distribution to school systems. Also, two new instructional tools—a series of packets entitled "Meet Your USAF" and a large wall chart depicting "Chronology of Aerospace Events"—were developed.

Funding problems of CAP volunteer activities eased somewhat in 1980 with the passage of new legislation authorizing reimbursement of maintenance expenses as well as fuel, lubricants, and communications for private plane owners on Air Force-authorized search and rescue or training and testing missions.

That the problem is not completely solved was pointed out by Rep. Don Young (R-Alaska), who introduced a private bill for the relief of one of his constituents. Congressman Young stated that his CAP volunteer constituent participated in the Coast Guard's search and rescue of two light aircraft crew members, and damaged his airplane during the rescue. The Coast Guard turned down the pilot's claim for reimbursement, noting that since he was a volunteer, there was "no legal basis to compensate him." Congressman Young said, "I find this unacceptable that the Coast Guard would specifically request assistance and then walk away from the responsibility to accept what results from their request. Members of the CAP simply cannot be asked to perform rescue missions for the government under these conditions. They perform too valuable a service. . . ."

Nonetheless, and regardless of what happens to this bill, "Bulletin Board" knows that CAP members will continue to perform admirably.

Lt. Gen. Ira C. Eaker, USAF (Ret.)—aviation pioneer, World War II combat commander, and airpower journalist—was recently presented the Air Force Logistics Command's first "Honorary Logistician" award. General Eaker was presented the award by AFLC Commander Gen. Bryce Poe II, right. Assisting in the presentation ceremony was Air Force Chief of Staff Gen. Lew Allen, Jr., left. The award will be presented to "distinguished persons who, although not professional logisticians, have contributed to increasing the understanding and efficiency of Air Force logistics."

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New VA Head Named

President Reagan has nominated Robert P. Nimmo, former California legislator, as head of the Veterans Administration.

The VA is the federal government's largest independent agency, and there has been concern about the Administration's delay in appointing someone to run it. At one time, three "finalists" even came to Washington for interviews. But whether due to congressional disagreement, veteran group pressure, in-fighting within the Administration, or other circumstances, such prospective nominees dropped from contention. Meanwhile, acting VA chief Rufus Wilson, Deputy Administrator in the last administration, has been keeping VA functioning.

Nimmo, if confirmed, will be the eleventh Administrator of Veterans Affairs. He has been a rancher and businessman much of his life. Following World War II service as a bomber pilot, he returned to active duty with the Army during the Korean conflict, serving with the 7th Infantry Division in Korea. In 1970, he was appointed by then-Governor Reagan to serve as US Property and Fiscal Officer for the state of California.

He acknowledged, following the White House announcement, that he faces a difficult task, since the Administration has proposed a reduction of some three percent in VA's FY '82 budget. "My first priority," he said, "will be to assure people that, while I am committed to carrying out the President's program, I will do it in such a way that no veteran will find his interests and legal entitlements in danger."

At press time, the nomination awaited Senate confirmation.

USO Celebrates 40th Birthday

In celebrating its fortieth anniversary, the United Service Organization added an extra dimension in Washington, D. C., by sponsoring the first international conference on the special problems of service families.

The week's birthday events included a free USO show at the Washington Monument (USO's gift to the capital city) that featured an appearance by Mr. USO himself —Bob Hope. Later in the week, Secretary of Defense and Mrs. Caspar W. Weinberger cochaired a "40s party" benefit gala at the Washington Hilton Hotel.

The family conference, keynoted by Dr. Joyce Brothers, featured noted family problem-oriented speakers and, in a unique approach, included young servicemen and women and spouses on response panels. The conference, raising the question, "The Military Family Faces Life—The Hard Way?" highlighted problems of military families caused by inflation, long separations, and other stressful situations.

Sgt. Mark E. Richardson, a correspondence analyst in the Office of the Air Force Vice Chief of Staff, was the Air Force representative. He told AIR FORCE Magazine that the conference was "exciting and worthwhile" and that he thought it "opened the eyes of a lot of people" to problems encountered by military families.

Other events around the country commemorated the birthday of this congressionally chartered voluntary civilian organization set up to serve military people and their families. In Los Angeles, where the USO began in 1940, AFA Far West Region Vice President Liston T. "Zack" Taylor represented the Association at a USO Distinguished American Award Dinner. The award presentation (by the ubiquitous Bob Hope) went to AFA Board Member Lt. Gen. Jimmy Doolittle, USAF (Ret.).

Chief McCoy to Retire

Chief Master Sergeant of the Air Force James M. McCoy, cited as one of the most popular and effective holders of the Air Force's top enlisted slot, is to retire in August after completing almost thirty-one years of service. He came to this post on August 1, 1979, following service as Senior Enlisted Advisor to the CINCSAC.

Chief McCoy's successor will have a hard act to follow. In his term, Chief McCoy, in many instances accompanied by his wife, Kathy, has logged more than 250,000 miles and spent close to 800 hours in the air. He's been to bases around the world, including sites on mountaintops in Turkey and at the Korean DMZ.

The Chief told AIR FORCE Magazine that it's been an "exciting and challenging tour," and that the position of CMSAF is one of extreme importance to the Air Force. "I found that my five predecessors had built up significant credibility," he commented, "and I hope I've contributed to strengthening this. There's no question in my mind as to how neces-

SPEAKING OF PEOPLE

Quality of Life Improves, but Irritants Remain

By Ed Gates, CONTRIBUTING EDITOR

There has been a noticeable change in service members' perceptions in the past year. A check of the letters-to-the-editor column of almost any service journal or military association publication provides the proof—a sharp reduction in gripes from readers contending that their pay and benefits are being eroded.

Throughout the late 1970s, a great many active-duty personnel, their families, and the retired military community seemingly spent much of their time excoriating the government for cutting back established benefits programs and failing to approve new ones. Much of the rhetoric was unjustified, of course. At the head of the chorus were declarations that the politicians in Washington were out to destroy every emolument, from commissaries to the retirement system.

Nothing like that has occurred, nor is it likely to in the future, although minor inroads—on such things as Social Security and the twice-a-year retirement pay boosts—may be made as all citizens are asked to share in the Administration's economic recovery program.

The major reason the gripes have subsided, of course, is that Uncle Sam has responded in the past year with various corrective measures: pay boosts, more housing money, bonuses, etc. And further gains are in the offing. Thus, the improved enlistment, reenlistment, and retention statistics of late 1980 and early 1981 should continue to inch upward. By and large, the members are more satisfied with the way things are going, though many are reportedly still "on the fence" about committing to career service.

Besides winning several major battles, service people have garnered some minor administrative victories via elimination of several unnecessary irritants. One example is the recent halt to charging military personnel and government civilians for parking in federal lots. In various ways USAF has reduced aggravations associated with assignment policies, PCS moves, and other day-to-day business operations.

Elimination of controlled OERs and the drastic curb on the "outs" in the up-or-out formula are other irritant-cutting moves that help reduce complaints and improve the "quality of life" in the Air Force. And the DOPMA legislation erases some long-standing abuses such as the complex dual promotion system. DOPMA also gives enlisted members on TDY per diem equity with officers, thereby erasing another feather-brained practice that should never have existed in the first place.

But other irritating and exasperating rules remain, ones the service has the power to eliminate or modify without approval of higher authority. There's the leadership's refusal to credit enlisted time in its commissioning programs. USAF also declines to appoint senior NCOs higher than second lieutenant, a policy that denies veteran NCOs the "upward mobility" opportunity they should be entitled to. The service thus loses considerable experience to early retirement.

In the area of handling people, some commanders and first sergeants are inclined to rub their troops the wrong way by overstressing short haircuts, still a tender subject in many quarters after all these years. Similarly, members resent the occasional undue pressure management applies to reluctant fund-drive contributors. And the service's preoccupation that members fill the many educational and other squares on their personnel records continues to annoy numerous members unduly.

Congress has fathered more than its fair share of unneeded irritants that distress the military community. Especially irksome is the ceiling it placed on the number of military wives and children allowed abroad. When that ceiling is reached—and the Air Force was dangerously near to it at this writing—and families are delayed or prevented from joining their husbands and fathers, while no similar travel curbs are placed on civilian travelers, an avalanche of protests can be expected. Nothing upsets service people more than being dealt second-class status.

Meantime, service leaders continue to stress quality-of-life improvements. But implicit in their declarations, it would seem, is an insistence that new, unnecessary irritants be shot down before they see the light of day. Yet, what did AIR FORCE Magazine discover recently? As reported in last month's "Bulletin Board" column, it is everyday Air Force practice to furnish, upon request by the general public, including real-estate agents, "the names, grades, and organizations of people arriving or departing a particular Air Force installation."

The result: Families are harassed, their privacy invaded by unsolicited and often overbearing sales people. Irritants like this only aggravate and do nothing to improve the quality of life. Few civilian organizations would think of handing out such information so freely.

The gains for the military recently have outdistanced the losses and shortened the gripe list. But let's not gum up the works by allowing idiotic little irritants to remain in force and new ones to surface. ■

sary this job is in giving the enlisted force an outlet for their legitimate concerns. I feel I've had the total support and encouragement of both the Secretaries I have worked with and General Allen and all the Air Force leadership, and I know my successor will get the same."

A special farewell reception and dinner will honor Chief and Mrs. McCoy at Bolling AFB, D. C., on July 24. Details are available from CMSgt. Sara Sellers, AUTOVON 224-8466 or (202) 694-8466.

Air Force Public Affairs

In numbers that boggle the mind, the just-released Air Force Public Affairs summary for 1980 details an impressive record of activity designed to get the word out to blue-suiter and taxpayer alike.

Brig. Gen. Richard F. Abel, USAF Director of Public Affairs, notes that more than 109,000 news releases were written. These were in addition to more than 740,000 of the familiar hometown releases. Included are hometowners on Army troops following the October 1980 merger that set up the Army and Air Force Hometown News Directorate of AFSINC, a move that saves thirty-five manpower slots.

Other activity included more than 6,000 news-media interviews, 3,900 briefings or news conferences, 700 news-media orientation flights, 27,800 speeches, 150 base open houses (attracting more than 10,000,000 people), 300 flyovers, 18,500 base tours, and eighty-eight Thunderbirds flight demonstrations.

All told, more than 72,900 inquiries from the public were researched and answered. The popular Air Force Orientation Group displayed its wares to nearly 500,000 students in forty-two states; showed its four aircraft exhibits to more than 1,800,000 people; and set up a special MX exhibit for 40,000 people at twenty-three locations in Nevada and Utah. Air Force bands racked up more than 11,000 performances.

General Abel pointed out that, whether dealing with "good news" or "bad news," PA actions "were significant in helping people understand the Air Force point of view."

Enlisted Slots Realigned

In several moves aimed at keeping the enlisted force in balance, the Air Force is doing some juggling of career fields and tours.

Palace Balance II is a recently announced program that will move 147 staff sergeants (and staff selectees) from four overage career areas into fields short of people.

Twenty Air Passenger Service types, sixty-eight Material Facilities workers, nine Reprographic enlisted people, and fifty Recreation Services troops will be selected for retraining. Volunteers will get options for a base of preference and two-year stabilized tours. Retrainees will be offered jobs in up to five shortage career areas, if qualified. However, eligible people in overage skills who think they are qualified for some other shortage area are encouraged to contact Palace Balance officials.

While officials are counting on volunteers in sufficient numbers to accomplish the switch, all those in the above noted jobs will be asked to pick shortage areas they would like, in the event that mandatory retraining is necessary.

In another move, the Air Force has offered a new High Year of Tenure (HYT) extension program for staff through chief master sergeants who volunteer for overseas assignments in hard-to-fill specialties.

HYT people are barred from reenlistment if they have not attained a certain grade by a certain number of years' service. Those nearing this cutoff point are not eligible for overseas. This program would lift that bar

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and offer up to two years' more service for selectees. Headquarters emphasizes that enlisted people cannot volunteer for this program. Rather, they should make known on their official records that they would accept such an extension and overseas assignment, if offered. Headquarters will then make an offer if a vacancy occurs. Unit and base commanders must favorably endorse the individual's request.

Air Force also is looking for highly qualified master sergeants (or E-7 selectees) as volunteers for first sergeant duty. It will sweeten the deal for selectees with base-of-choice assignments and two-year stabilized tours. SMSgt. Gus Culwell, who monitors this program at AFMPC, notes that there has not been a single nonvolunteer needed to fill a first sergeant requirement overseas during the past two years. He'd like to keep it that way. Contact the Palace First team at AFMPC, Randolph AFB, Tex., or call AUTOVON 487-4454 for details.

USAF Aero Clubs Doing Well

USAF's Aero Clubs, a popular Morale, Welfare, and Recreation (MWR) activity, have completed two consecutive years without a fatality, a "first" that officials point to with pride. At press time the string was intact.

Noting that flying hours were down slightly due to the reduction in VA funding for flight training that went into effect last October, the Air Force emphasizes that the clubs are in sound financial condition. Two were shut in 1980 because of low participation, but three new ones have been established. There are forty-nine clubs, with close to 7,000 members.

Clubs operate 355 aircraft, including fifty-five new ones recently entering the fleet under the Aero Club Fleet Modernization Program. This program, which allows central funding for avionics equipment installed on club-purchased aircraft, has upgraded the fleet from twenty-five percent modern (five years old or less) to forty-one percent modern.

Officials told AIR FORCE Magazine that, although they don't keep specific data on civilian rental fees, they believe that Aero Club rental rates are significantly below those charged by similar civilian clubs. Cited was a Cessna 172, which the Randolph AFB Aero Club rents for $20 per hour, including fuel. A similar civilian rental in the San Antonio area could go as high as $35 per hour.

Will rising fuel costs and inflation cut back significantly on club activity? Officials don't think so. In fact, they've shown their confidence by institution of several new programs. One is the Factory Maintenance Training Program. Central funds are used to send Aero Club mechanics directly to the factories for specialized training. Twenty-one wrench-jockeys have taken advantage of this program to date. Additionally, a new Aero Club Manager's Orientation Program has provided twenty managers intensive training for three days at AFMPC.

Air Force/Army Exchange Senior NCO PME Students

In an unprecedented move, the Army and Air Force, beginning next month, will exchange students for senior NCO professional military education.

In August, two Air Force senior NCOs will attend the twenty-two-week course US Army Sergeant Major Academy Class at Fort Bliss, Tex. Two other NCOs will follow in January 1982.

Two US Army NCOs will attend an upcoming Air Force Senior NCO Academy course at Gunter AFS, Ala. The purpose of this exchange program is to broaden the perspective of students in both schools and improve understanding of each service's roles and missions.

Those selected will be on PCS status and encouraged to take their families. Graduates can expect assignments to joint-service assignments or Air Force positions that entail coordination with Army units.

Short Bursts

VA has **increased its maximum interest rate** on guaranteed home or condominium loans. Noting the former interest rate was too low to induce private lenders into the program, VA has raised it to 14.5 percent. Mobile-home buyers get an increase in their guaranteed rate to seventeen percent.

Noting that almost **forty percent of the officer force is now in the grade of lieutenant,** ATC Commander Gen. B. L. Davis recently called for open communication between junior and senior officers. Addressing junior officers at Lowry AFB, Colo., he said, "We need to share our concepts and perspectives . . . no matter how our

ideas may differ or coincide. . . ."

AFA and the Aerospace Education Foundation have instituted a new national award **for energy conservation.** Named for retired Gen. Edwin W. Rawlings, who conceived and sponsored the award, it will honor annually a technician and a supervisor who have done the most to advance the cause of energy conservation. A permanent plaque will hang in the Pentagon. The first recipients will be honored at September's National Convention.

Air Force Accounting and Finance Center has kicked off a **test program to provide more efficient and responsive pay services** to retirees. The six-month test will station a finance technician, especially trained in retiree matters, on bases near retiree population centers. The technician, backed up by direct computer link to the AFAFC in Denver, will provide over-the-counter service to retirees. Test bases are Bolling, McChord, MacDill, McClellan, and Randolph.

CHAMPUS has issued a **new Fact Sheet on "The Effects of Other Health Plans."** It does a good job of explaining the often-complicated reimbursements when both CHAMPUS and other health plans are involved. It notes, for example, that if a sponsor has coverage through employment that includes other family members—even though this requires an additional premium—the other members must treat this coverage as primary to CHAMPUS. Copies (FS-7) should be available through Base Health Benefits Advisor offices.

VA has a good thing going with its **silver recovery program from photographic waste.** Last year, VA spent $185,000 on the program and recovered silver worth nearly $14 million.

The Air Force **cautions against the word "dependents."** A new change to AFR 5-1 states: "Use the terms 'family members' or 'spouse' instead of 'dependents,' if legally acceptable."

Effective this month, the ZIP code for Randolph AFB, including AFMPC, **is changed from 78148 to 78150.** If you want to avoid delays in dealing with MPC, use the right ZIP.

The Air Force Systems Command NCO Academy and Leadership School, at Kirtland AFB, N. M., **lays claim to being in longer continuous operation**—twenty-five years this year—than any other NCO Academy. In that time, it has graduated more than 15,000 NCOs and won three Air Force Outstanding Unit Awards. Any challengers to AFSC's longevity claim?

Senior Staff Changes

PROMOTIONS: To be **Lieutenant General:** James E. **Dalton.**

To be **Major General:** Richard A. **Burpee;** Melvin F. **Chubb;** Click D. **Smith,** Jr.

To be **Brigadier General:** Melvin G. **Alkire;** Thomas J. **Hickey;** Richard E. **Steere.**

To be **AFRES Major General:** Donald A. **McGann.**

To be **AFRES Brigadier General:** George D. **Leadbetter.**

RETIREMENTS: B/G James F. **Culver;** M/G George M. **Douglas;** Gen. Robert E. **Huyser;** M/G John H. **Jacobsmeyer,** Jr.; M/G William L. **Nicholson** III; L/G Freddie L. **Poston;** L/G Stanley M. **Umstead,** Jr.

CHANGES: M/G (L/G selectee) James E. Dalton, from Cmdt., Industrial College of the Armed Forces, Fort McNair, Washington, D. C., to Dir. of the Joint Staff, OJCS, Washington, D. C. . . . **L/G Hans H. Driessnack,** from Comptroller, Hq. USAF, Washington, D. C., to Ass't Vice C/S, Hq. USAF, Washington, D. C., replacing retiring L/G Marion L. Boswell, and to Senior USAF Member, Military Staff Committee, UN, New York, N. Y. . . . **Col. (B/G selectee) George D. Leadbetter,** from Vice Cmdr., 14th AF (AFRES), Dobbins AFB, Ga., to MA to Cmdr., 8th AF (SAC), Barksdale AFB, La.

B/G Donald J. Licker, from MA to Staff Judge Advocate, Hq. SAC, Offutt AFB, Neb., to MA to IG, Hq. USAF, Washington, D. C., replacing retired M/G Joseph M. F. Ryan, Jr. . . . B/G James R. Milligan, from Cmdr., 302d TAW (AFRES), Rickenbacker AFB, Ohio, to MA to Cmdr., 9th AF (TAC), Shaw AFB, S. C. . . . **M/G Richard K. Saxer,** from Dep. for Tactical Systems, ASD, AFSC, Wright-Patterson AFB, Ohio, to Vice Cmdr., ASD, AFSC, Wright-Patterson AFB, Ohio, replacing retired M/G Robert A. Rushworth.

B/G (M/G selectee) Click D. Smith, Jr., from Dep. Dir., General Purpose Forces, DCS/RD&A, Hq. USAF, Washington, D. C., to Dep. Dir. for Logistics (Strategic Mobility), J-4, OJCS, Washington, D. C., replacing retired M/G Charles C. Irions . . . **Col. (B/G selectee) Richard E. Steere,** from Dep. for Propulsion, ASD, AFSC, Wright-Patterson AFB, Ohio, to Dep. for Tactical Systems, ASD, AFSC, Wright-Patterson AFB, Ohio, replacing M/G Richard K. Saxer . . . **M/G Jasper A. Welch, Jr.,** from Special Ass't to C/S, Hq. USAF, Washington, D. C., to Ass't DCS/RD&A, Hq. USAF, Washington, D. C., replacing M/G (L/G selectee) James R. Brickel. ■

AFA NEWS

Chapter and State Photo Gallery

By Dave Noerr, AFA AFFAIRS EDITOR

Gen. Robert T. Marsh, USAF, Commander of Air Force Systems Command, left, was the guest speaker at a recent luncheon meeting of the Charles A. Lindbergh Chapter in Westport, Conn. Discussing the luncheon program with General Marsh is Lindbergh Chapter President Alton G. Hudson. At right is Gen. William J. Evans, USAF (Ret.), former Commander in Chief of USAFE and Commander of Allied Air Forces Central Europe.

The Cape Canaveral Chapter, Fla., sponsored a gala dinner for AFA's National Board of Directors at the Board's winter meeting in Melbourne Beach, Fla. The dinner included a keynote speech by Lt. Gen. George Keegan, USAF (Ret.), and the presentation of a charter to the newly formed West Palm Beach Chapter. Those present at the dinner included (seated, from left): General Keegan; Charles D. Briggs, President of the Cape Canaveral Chapter; and AFA Board Chairman Daniel Callahan. Standing, from left: John deRussy, National Vice President for the Southeast Region; Lee Terrell, Florida State AFA President; Gerald Waltman, President of the newly formed West Palm Beach Chapter; Herm Hauck, Vice President of Florida State AFA's Southeast Region; and Joseph R. Falcone, National Vice President for the New England Region. (USAF photo by SSgt. Jerry M. Ballard)

Maj. Harry Johnson, an instructor pilot at Hill AFB, Utah, gave a presentation on the F-16 Fighting Falcon to a recent meeting of the Greater Seattle Chapter. Those present included Chapter Vice President Alwyn Lloyd, left, and AFA National Director Sherman Wilkins, right.

At a recent meeting of the Jack Manch Chapter, Staunton, Va., Orland "Jack" Wages, left, received the Chapter's Outstanding Member Award for 1981 from Chapter President Daniel F. Kowats. Mr. Wages serves currently as Secretary of the Chapter and as Secretary for Virginia State AFA's Executive Committee. Mr. Wages has also served as president of the Manch Chapter and the Virginia State AFA.

CALENDAR OF EVENTS

July 10–12, **Michigan State AFA Convention,** Detroit . . . July 17–19, **Ohio State AFA Convention,** Youngstown . . . July 17–19, **Pennsylvania State AFA Convention,** Hershey . . . August 13–16, **California State AFA Convention,** Vandenberg AFB . . . August 14–16, **Missouri State AFA Convention,** Springfield . . . August 21–24, **Colorado State AFA Convention,** Colorado Springs . . . September 14–17, **AFA National Convention,** Washington, D. C. . . . October 2–4, **Arkansas State AFA Convention,** Fayetteville.

Alabama Gov. Fob James, center, recently accepted membership in AFA's Montgomery Chapter. Those attending the membership presentation in Governor James's office included (from left): Air University's Senior Enlisted Advisor CMSgt. Danny Johnston; Brig. Gen. Richard A. Ingram, AFA's membership drive chairman for Maxwell AFB, Ala.; Governor James; James S. Gaskell, President of the Montgomery Area Chamber of Commerce; and Montgomery Chapter President James B. Tipton.

At the recent Iron Gate Chapter's Eighteenth National Air Force Salute, noted cartoonist and former Iron Gate Chapter president Milton Caniff received the Chapter's Maxwell Kriendler Memorial Award for his work in enhancing the image of the military service man and woman through his popular comic strips such as Steve Canyon. *With Mr. Caniff at the Salute are Iron Gate Chapter Secretary Dorothy Welker, right, and AFA National Headquarters staff member Dorothy Flanagan, who was also named an Aerospace Education Foundation Jimmy Doolittle Fellow at the Salute.* *(See also article on p. 102.)*

At his retirement dinner in Minneapolis, Maj. Gen. John R. Dolny, left, Special Assistant to the Commander, North American Air Defense Command, received an AFA Citation from AFA National Treasurer Jack Gross. Some fifteen ANG and AFRES general officers attended the retirement dinner for General Dolny.

MAC Commander in Chief Gen. Robert E. Huyser, left, was the guest of honor and featured speaker at a recent meeting of the Spirit of St. Louis Chapter in Missouri. General Huyser received a plaque during the meeting from Chapter President Richard A. Gerber, center. Also attending the meeting was Missouri State AFA Vice President Vincent A. Bauman, right.

AFA NEWS PHOTO GALLERY

The Air Force Academy's Class of '81 recently held its 100th Night Dining Out, in celebration of the remaining 100 days until graduation. Those attending the festivities included (from left): Brig. Gen. R. D. Beckel, new Commandant of Cadets at USAFA; Cadet David Studebaker, and his date Doreen Smith; Lt. Gen. Kenneth L. Tallman, retiring Superintendent of the Academy; and Mrs. and Col. Phil Hawkins, USAFR, President of AFA's Dallas Chapter.

LEFT: The Northeast Region Conference, held recently at Clark Summit, Pa., attracted more than 100 members from twenty-seven chapters in the three-state region. Lt. Gen. Jerome O'Malley, DCS/Operations, Plans and Readiness, spoke on Air Force defense needs at the dinner conclave. RIGHT: Those attending the Conference included the Tri-State AFA Presidents (seated, from left): Jack Kruse, New Jersey State AFA President; Pennsylvania State AFA President Jack Flaig; and New York State AFA President Thomas Hanlon. Also attending were (standing, from left); Charles Tippett, AFA's Director of Data Processing; J. Deane Sterrett, National Vice President for the Northeast Region; AFA Director of Communications Robin Whittle; and Dave Noerr, AFA Assistant Executive Director for Field Organizations.

LEFT: The newly formed Lake Region Chapter of Winter Haven, Fla., was recently presented its charter at a special dinner meeting. AFA Board Chairman Daniel Callahan, center, presented the charter to Lake Region Chapter President Tim Tyler, right, and Chapter Vice President George Burrus. RIGHT: Special guests at the Lake Region Chapter dinner included (from left): AFA National Director Martin Harris and Mrs. Harris; Mrs. Kitty Hauck; and Florida State AFA Vice President Herm Hauck.

The Air Force Association and its educational arm, the Aerospace Education Foundation, support the goals and programs of the Air Force Reserve Officer Training Corps (AFROTC) and Air Force Junior ROTC (AFJROTC). Support is also provided through the ROTC's professional and fraternal society, the Arnold Air Society, and its auxiliary Angel Flight. While the various functions relating to this support emanate from AFA National Headquarters in Washington, D. C., a considerable number of AFA state and chapter organizations are involved on a local level with their own programs relating specifically to local ROTC and JROTC units.

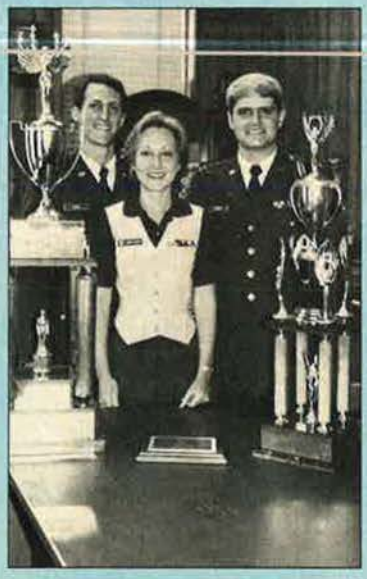
At the recent Annual Awards and Commissioning Ceremony of University of Pittsburgh's AFROTC Detachment 730, Cadet Charles A. Eldering (right) received AFA's Outstanding Aerospace Education Senior Cadet Award. The award was presented by Dan Carapellucci, Vice President of the Greater Pittsburgh Chapter.

Cadet James A. Godard, left, received AFA's ROTC Award during a recent Dining In and Awards Ceremony held in Greensboro, N. C. Cadet Godard, a member of AFROTC's Detachment 605 at North Carolina A&T State University, received the award from Lt. Col. Arthur J. Foster, USAF (Ret.), President of AFA's Triad Chapter.

The Illini Chapter, Champaign, Ill., sponsored a luncheon to recognize the outstanding AFROTC student in this spring's graduating class at the University of Illinois. Cadet Maj. Arnyce Pock, center, received the special Chapter award from Illini Chapter President Kyle Robeson, right. Also attending the presentation luncheon was Cadet Pock's mother, Lora Pock.

Cadet Lee Jane Ballard was honored as AFROTC Detachment 770's Outstanding Aerospace Education Student during Clemson University's Honors and Awards Day. Worth Allen, President of South Carolina State AFA, presented the AFA Award recognizing Cadet Ballard during the ceremonies.

Bradford Page, Treasurer of the Texas Alamo Chapter, recently presented the Texas AFJROTC State Championship Trophy to the Samuel Clemens High School AFJROTC Drill Team at the conclusion of the Fifth Annual AFJROTC Invitational Drill Meet held at Lackland AFB, Tex. Accepting the Trophy on behalf of the Drill Team is Cadet Commander Lt. Col. Sharon Althouse. Cadet Althouse was also selected as the "Best Drill Team Commander" at the Meet.



For only the second time in history, the top Arnold Air Society and Angel Flight units in the nation were selected from the same school—Auburn University in Alabama. The national trophies are awarded to those units that best exemplify the highest standards of campus and community service and best demonstrate support of Air Force and national goals. Pictured with the trophies are (from left): Cadet Paul Clark, Commander of the Arnold Air Society squadron; Brenda Robbins, Commander of Angel Flight; and Capt. Paul Lemmings, USAF, advisor for both Auburn University groups.

THIS IS AFA

The Air Force Association is an independent, nonprofit, aerospace organization serving no personal, political, or commercial interests; established January 26, 1946; incorporated February 4, 1946.

OBJECTIVES

The Association provides an organization through which free men may unite to fulfill the responsibilities imposed by the impact of aerospace technology on modern society; to support armed strength adequate to maintain the security and peace of the United States and the free world; to educate themselves and the public at large in the development of adequate aerospace power for the betterment of all mankind; and to help develop friendly relations among free nations, based on respect for the principle of freedom and equal rights for all mankind.

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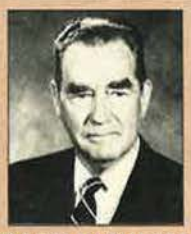
Dallas, Tex.



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Arnold Air Society
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Do You Need To Supplement Your CHAMPUS Coverage?

Get AFA's new

CHAMPLUS

AFA's new CHAMPLUS program *really* picks up where CHAMPUS leaves off. Plus features give you basic protection in areas many programs don't cover at all . . . and *extra* protection against severe, prolonged illnesses or injury that could otherwise cost *you* $5,000 . . . $10,000 . . . or more *from your own pocket.*

Full coverage for AFA retired members under 65 and their eligible dependents.

Dependent coverage for AFA active-duty members.

Coverage is *guaranteed* for eligible members.

Next page, please, for complete information

AFA CHAMPLUS ... New, Strong Protect

When a Single Accident or Illness Could Cost *You* Thousands of Dollars, You Need AFA CHAMPLUS . . . for *Strong* Protection against Costs CHAMPUS Doesn't Cover!

For military retirees and their dependents . . . and dependents of active duty personnel . . . more and more medical care is being provided through the government CHAMPUS program.

And, of course CHAMPUS pays 75% of allowable charges.

But today's soaring hospital costs—*up to $500 a day* in some major metropolitan medical centers—can run up a $20,000 bill for even a moderately serious accident or illness.

Your 25% of $20,000 is no joke!

AFA CHAMPLUS protects you against that kind of financial catastrophe *and* covers most of your share of routine medical expenses as well.

HOW AFA CHAMPLUS WORKS FOR YOU!

WHO IS ELIGIBLE?

1) All AFA members under 65 years of age who are currently receiving military retired pay and are eligible for benefits under Public Law 89-614 (CHAMPUS), their spouses under age 65 and their unmarried dependent children under age 21 (or age 23 if in college).
2) All eligible dependents of AFA members on active duty. Eligible dependents are spouses under age 65 and unmarried dependent children under age 21 (or age 23 if in college).

EXCEPTIONAL BENEFIT PLAN

(See chart at right)

FOUR YEAR BASIC BENEFIT. Benefits for most injuries or illnesses may be paid for up to a four-year period.

PLUS THESE SPECIAL BENEFITS . . .

1) Up to 45 consecutive days of in-hospital care for mental, nervous, or emotional disorders. Outpatient care may include up to 20 visits of a physician or $500 per insured person each year.
2) Up to 30 days care per insured per year in a Skilled Nursing Facility.
3) Up to 30 days care per insured per year and up to 60 days lifetime in a CHAMPUS-approved Residential Treatment Center.
4) Up to 30 days care per insured per year and up to 60 days lifetime in a CHAMPUS-approved Special Treatment Facility.
5) Up to 5 visits per insured per year to Marriage and Family Counselors under conditions defined by CHAMPUS.

YOUR INSURANCE IS NON-CANCELLABLE

As long as you are a member of the Air Force Association, pay your premiums on time, and the master contract remains in force, your insurance cannot be cancelled.

ADMINISTERED BY YOUR ASSOCIATION . . . UNDERWRITTEN BY MUTUAL OF OMAHA

AFA CHAMPLUS insurance is administered by trained insurance professionals on your Association staff. You get prompt, reliable, courteous service from people who know your needs and know every detail of your coverage. Your insurance is underwritten by Mutual of Omaha, the largest individual and family health insurance company in the world.

AFA OFFERS YOU HOSPITAL BENEFITS AFTER AGE 65

Once you reach Age 65 and are covered under Medicare, AFA offers you protection against hospital expenses not covered by Medicare through the *Senior Age Benefit Plan* of AFA Hospital Indemnity Insurance. Members enrolled in AFA CHAMPLUS will automatically receive full information about AFA's Medicare supplement program upon attainment of Age 65 so there will be no lapse in coverage.

AFA CHAMPLUS BENEFIT SCHEDULE

Care	*CHAMPUS Pays*	*AFA CHAMPLUS Pays*
	For Military Retirees Under Age 65 and Their Dependents	
Inpatient civilian hospital care	CHAMPUS pays 75% of allowable charges	CHAMPLUS pays the 25% of allowable charges not covered by CHAMPUS.
Inpatient military hospital care	The only charge normally made is a $5.00 per day subsistence fee, not covered by CHAMPUS.	CHAMPLUS pays the $5.00 per day subsistence fee.
Outpatient care	CHAMPUS COVERS 75% of outpatient care fees after an annual deductible of $50 per person ($100 maximum per family) is satisfied	CHAMPLUS pays the 25% of allowable charges not covered by CHAMPUS after the deductible has been satisfied.
	For Dependents of Active Duty Military Personnel	
Inpatient civilian hospital care	CHAMPUS pays all covered services and supplies furnished by a hospital less $25 or $5.00 per day, whichever is greater.	CHAMPLUS pays the greater of $5 per day or $25 of the reasonable hospital charges not covered by CHAMPUS.
Inpatient military hospital care	The only charge normally made is a $5.00 per day fee, not covered by CHAMPUS.	CHAMPLUS pays the $5.00 per day subsistence fee.
Outpatient care	CHAMPUS covers 80% of outpatient care fees after an annual deductible of $50 per person ($100 maximum per family) is satisfied.	CHAMPLUS pays the 20% of allowable charges not covered by CHAMPUS after the deductible has been satisfied.

NOTE: Outpatient benefits cover emergency room treatment, doctor bills, pharmaceuticals, and other professional services.

There are some reasonable limitations and exclusions for both inpatient and outpatient coverage. Please note these elsewhere in the plan description.

Against Costs CHAMPUS Doesn't Cover

APPLY TODAY!
JUST FOLLOW THESE STEPS

Choose either AFA CHAMPLUS In-patient coverage or combined In-patient and Out-patient coverage for yourself. Determine the coverage you want for dependent members of your family. Complete the enclosed application form in full. Total the premium for the coverage you select from the premium tables on this page. Mail the application with your check or money order for your initial premium payment, payable to AFA.

Get AFA's new

CHAMPLUS

QUARTERLY PREMIUM SCHEDULE

Plan 1—For military retirees and dependents

In-Patient Benefits

Member's Attained Age	*Member*	*Spouse*	*Each Child*
Under 50	$19.03	$23.30	$11.00
50-54	$23.78	$29.10	$11.00
55-59	$30.13	$36.90	$11.00
60-64	$39.65	$48.55	$11.00
In-Patient and Out-Patient Benefits			
Under 50	$26.80	$31.05	$27.50
50-54	$33.48	$38.80	$27.50
55-59	$42.43	$49.18	$27.50
60-64	$55.83	$64.73	$27.50

Plan 2—For dependents of active duty personnel.

In-Patient Only	None	$ 8.80	$ 4.40
In-Patient and Out-Patient	None	$35.20	$22.00

Note: Plan II premiums are listed on an annual basis. Because of the very low cost, persons requesting this coverage are asked to make annual payments.

LIMITATIONS

Coverage will not be provided for conditions for which treatment has been received during the 12-month period prior to the effective date of insurance until the expiration of 12 consecutive months of insurance coverage without further treatment. *After coverage has been in force for 24 consecutive months, pre-existing* conditions will be covered regardless of prior treatment.

EXCLUSIONS

This plan does not cover and no payment shall be made for:

a) routine physical examinations or immunizations

b) domiciliary or custodial care

c) dental care (except as required as a necessary adjunct to medical or surgical treatment)

d) routine care of the newborn or well-baby care

e) injuries or sickness resulting from declared or undeclared war or any act thereof

f) injuries or sickness due to acts of intentional self-destruction or attempted suicide, while sane or insane

g) treatment for prevention or cure of alcoholism or drug addiction

h) eye refraction examinations

i) Prosthetic devices (other than artificial limbs and artificial eyes), hearing aids, orthopedic footwear, eyeglasses and contact lenses

) expenses for which benefits are or may be payable under Public Law 89-614 CHAMPUS)

APPLICATION FOR
AFA CHAMPUS SUPPLEMENT INSURANCE

Group Policy GMG-FC70
Mutual of Omaha Insurance Company
Home Office: Omaha, Nebraska

Full name of Member _____
Rank Last First Middle

Address _____
Number and Street City State ZIP Code

DATE OF Birth _____ Current Age ____ Height ____ Weight ____ Soc. Sec. No. _____
Month/Day/Year

This insurance coverage may only be issued to AFA members. Please check the appropriate box below:

☐ I am currently an AFA Member. ☐ I enclose $13 for annual AFA membership dues (includes subscription ($9) to AIR FORCE Magazine).

☐ I am over 65 years of age. Please send information on AFA's Medicare Supplement.

PLAN & TYPE OF COVERAGE REQUESTED

Plan Requested (Check One)	☐ AFA CHAMPLUS PLAN I (for military retirees & dependents)	
	☐ AFA CHAMPLUS PLAN II (for dependents of active duty personnel)	
Coverage Requested (Check One)	☐ Inpatient Benefits Only	
	☐ Inpatient and Outpatient Benefits	
Person(s) to be Insured (Check One)	☐ Member Only	☐ Member & Children
	☐ Spouse Only	☐ Spouse & Children
	☐ Member & Spouse	☐ Member, Spouse & Children

PREMIUM CALCULATION

All premiums are based on the attained age of the AFA member applying for this coverage. Premium payments are normally paid on a quarterly basis (see table for rate table). Upon request, however, they may be made on either a semi-annual or annual basis.

Quarterly premium for member (age ____) $_____

Quarterly premium for spouse $_____

Quarterly premium for ____ children @ $____ $_____

Total premium enclosed $_____

Requests for active duty dependent coverage under Plan 2 should include annual premiums.

If this application requests coverage for your spouse and/or eligible children, please complete the following information for each person for whom you are requesting coverage.

Names of Dependents to be Insured	Relationship to Member	Date of Birth (Month/Day/Year)

(To list additional dependents, please use a separate sheet.)

In applying for this coverage, I understand and agree that (a) coverage shall become effective on the last day of the calendar month during which my application together with the proper amount is mailed to AFA, (b) only hospital confinements (both inpatient and outpatient) or other CHAMPUS-approved services commencing after the effective date of insurance are covered and (c) any conditions for which I or my eligible dependents received medical treatment or advice or have taken prescribed drugs or medicine within 12 months prior to the effective date of this insurance coverage will not be covered until the expiration of 12 consecutive months of insurance coverage without medical treatment or advice or having taken prescribed drugs or medicine for such conditions. I also understand and agree that all such pre-existing conditions will be covered after this insurance has been in effect for 24 consecutive months.

Date _____, 19____ _____
Member's Signature

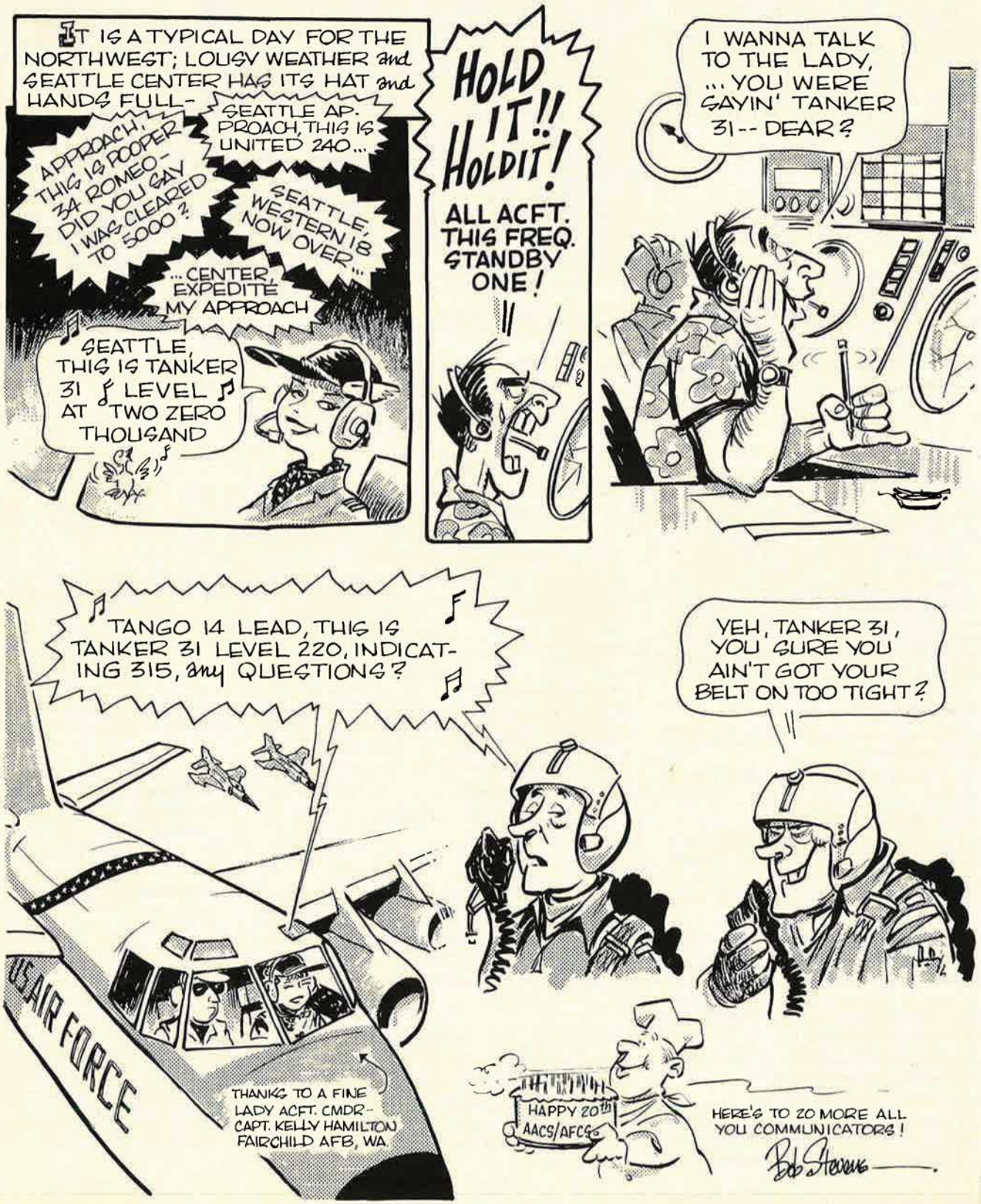
NOTE: Application must be accompanied by check or money order.
Send remittance to:
Insurance Division, AFA, 1750 Pennsylvania Ave., NW, Washington, D.C. 20006.

Form 6173GH App.
7/81

Bob Stevens'

"There I was..."

NOW THAT WOMEN PILOTS ARE COMING OUT OF THE ATC PIPELINE-INCLUDING THE HALLS OF THE USAF ACADEMY-MILITARY FLYING STORIES HAVE AN ADDED DIMENSION (LADIES, THAT STATEMENT DOES NOT NECESSARILY MEAN *WIDTH*, EITHER!)



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because someone asked Sperry.

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Our unique single-faced dome radar provides hemispheric coverage with a stationary antenna. This hemispheric coverage antenna system eliminates switching target surveillance and tracking from one face to another. And dome radar is less costly and more reliable than standard radar.

And we're applying multi-faced phased array technology to a range of shipboard radars to make them compatible with future threats.

Beyond phased arrays, our millimeter wave radar is being applied to lightweight fire control systems. And we're working on developments in low sidelobe microwave antennas, adaptive signal analysis, radar systems analysis, unattended surveillance radar, anti-radiation missile alarm sensors and advanced signal processing techniques.

For more information on what we're up to in radar technology, just ask us...we understand how important it is to listen.

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Combat proven.

Among the new generation of supersonic fighters, only one has undergone the ultimate test, combat, and come out a winner. The F-15 Eagle.

The F-15 hunts down targets with its advanced guidance and tracking systems at mach 2.5 speeds. Any foe that dares oppose it faces an awesome arsenal of the latest weaponry. With unprecedented maneuverability and sophisticated countermeasures, it eludes enemy attack.

The F-15 Eagle. The winner.

F-15 Eagle

MCDONNELL DOUGLAS