PUBLISHED BY THE AIR FORCE ASSOCIATION

.....

Hayen

## The Long Reach of On-Call Airpower

TE

MO

## Next Generation Small Loader

**Global Experience** 

#### ATLAS MKII: Proven Performer Worldwide

The Atlas MKII, a tactical main-deck loader capable of transporting all types of cargo and transferring it to cargo-carrying aircraft, has been proven in conflicts and field exercises worldwide.

The Atlas MKII is certified by the RAF to a load/lifting capacity of 42,000 pounds. Its deck is capable of handling all types of pallets and containers, medium- and heavy-stress platforms, aircraft fuselage, and vehicles.

From Italy to Turkey, Saudi Arabia to Norway, Malaysia to France, this equipment is truly the next generation in small loaders.

According to Air Vice Marshall Sturley of the RAF Headquarters 38 Group. "The ATLAS is a highly capable vehicle and dependable asset with a 97% vehicle availability rate."

#### TELEDYNE BROWN ENGINEERING An Allegheny Teledyne Company

Atlas MKII is a product of Aircraft Maintenance Support Services Ltd. and is licensed for production by Teledyne Brown Engineering. December 1998, Vol. 81, No. 12 PUBLISHED BY THE AIR FORCE ASSOCIATION

#### www.afa.org

- 4 Letters
- 10 Aerospace World
- 16 Senior Staff Changes
- **18 Index to Advertisers**
- 19 Verbatim
- 35 Valor
- 79 Books
- 80 AFA/AEF National Report
- 83 This Is AFA
- 86 Reunions
- 86 Bulletin Board
- 88 Pieces of History



About the cover: A B-1B and two F-15Es from the 366th Wing, Mountain Home AFB, Idaho, are part of USAF's on-call force. See "The Long Reach of On-Call Airpower," p. 20. USAF photo by SrA. Greg L. Davis.

- 2 Editorial: Boren–Rudman Takes Its Turn By John T. Correll This commission could lead to major change for the armed forces. Whether that's good or bad remains to be seen.
- 20 **The Long Reach of On-Call Airpower** By John A. Tirpak *Air Expeditionary Forces are extending the concept of long range airpower.*

#### 28 Operating Abroad

Gen. John P. Jumper, USAFE commander, talks about air expeditionary operations from foreign bases.

#### 30 Duel of Doctrines

By Elaine M. Grossman The land forces believe the decisive defeat of the enemy must occur on the ground. The Air Force believes otherwise.

#### 37 Readiness on the Line

By Peter Grier The service chiefs have begun to publicly sound the alarm that the readiness of the armed forces is slipping.





MAGAZINE

42 **Commercial Spacetarers** By Theresa Foley The private satellite business is booming, and the Pentagon and services are watching closely.

#### 49 Dark and Deep

By John A. Tirpak The tilt-rotor Osprey will give the Special Operations Forces the range to reach far into enemy territory.

54 Nickel Grass

By Walter J. Boyne It was justifiably called "the airlift that saved Israei."

60 Gallery of NATO Airpower By Paul Jackson and Kenneth Munson Aircraft in use by NATO air forces.

72 War in the Urban Jungles By James Kitfield The Marine Corps and the Army believe future conflicts will take place in the streets, high-rises, and sewers of the urbanized Third World.

AIR FORCE Magazine (ISSN 0730-6784) December 1998 (Vol. 81, No. 12) is published monthly by the Air Force Association, 1501 Lee Highway, Arlington, VA 22209-1198, Phona (703) 247-5800, Second-class postage paid at Artington, Va., and additional mailing offices. Membership Rate: \$30 per year; \$75 for three-year membership. Life Membership (nonrefundable): \$450 single payment, \$475 extended payments. Subscription Rate: \$30 per year; \$75 for three-year membership. Life Membership (nonrefundable): \$450 single payment, \$475 extended payments. Subscription Rate: \$30 per year; \$75 for three-year membership. Life Membership (nonrefundable): \$450 single payment, \$475 extended payments. Subscription Rate: \$30 per year; \$75 for three-year membership (Soft) and Soft). A standard and Mexico, which are \$9 per year additional). Regular issues \$3 each. Special issues (USAF Almanac issue and Anniversary issue) \$5 each. Change of address requires four weeks' notice. Please include mailing label. POSTMASTER: Send changes of address to Air Force Association. Tool Lee Highway, Artington, VA 22209-1198. Publisher assumes no responsibility for unsolicited material. Trademark registered by Air Force Association. Copyright 1998 by Air Force Association. All rights reserved. Pan–American Copyright Convention. Editorial

By John T. Correll, Editor in Chief

## **Boren–Rudman Takes Its Turn**

■ N recent years, Pentagon planning has been dominated by a rolling series of special defense reviews. The regular planning, programming, and budgeting system has had to operate in whatever leeway was left.

First, there was the Bottom–Up Review in 1993, then the Commission on Roles and Missions of the Armed Forces in 1994–95, followed by the Quadrennial Defense Review in 1996–97, and the National Defense Panel in 1997.

One reason for this string of special reviews is that the nation's political leaders, particularly in Congress, believe that the armed forces are still stuck in a Cold War mentality and will not make any real change—which Congress regards as imperative unless they are pushed to do so.

Now comes the Boren-Fudman Commission, officially, the National Security Study Group, headed by former Sens. David Boren and Warren Rudman. Between 1998 and 2C01, it is charged with performing "the most comprehensive review of the national security environment, processes, and organizations since the National Security Act of 1947."

Although previous defense reviews led to force cuts, they did not induce any fundamental change. The armed services look about the same as they did before, except smaller. The Boren–Rudman Comm ssion differs from its predecesscrs in several respects, though.

It has longer tenure and a more expansive charter than the other review groups did. Its final report, due in February 2001, will "delineate a national security strategy" and recommend "concomitant changes to the national security apparatus."

Previous study groups consisted mostly of defense insiders. The 18 members of the Boren–Rudman Commission are drawn from more diverse backgrounds. They range from former Secretary of Defense James Schlesinger and former Secretary of the Air Force Donald Rice to former Ambassadors Anne Armstrong and Andrew Young to former NATO commander John Galvin to historian Stephen Ambrose and former NBC correspondent Bud Dancy.

The first meeting on Oct. 6 was attended by Speaker of the House Newt Gingrich, who sponsored the legislation that created the group, and by Secretary of Defense William S. Cohen, who appointed the commissioners.

Compared to earlier reviews, the

#### This commission could lead to major change for the armed forces. Whether that's good or bad remains to be seen.

Boren-Rudman Commission is less likely to approach its task with preconceived conclusions. It will also be less vulnerable to capture by the rival service factions. It is entirely possible that this group could produce real change. Whether that's good or bad remains to be seen.

It is not the job cf the commission to write war plans. Its focus will be the National Security Strategy, a White House document that describes in broad terms the nation's interests and how they will be defended. The National Military Strategy derives from that, and so on down the line.

However, the commission could have a direct effect on the organization of the Defense Department, the roles and missions of the services, and the shape cf the defense program, depending on what it decides on five critical pcints.

The Revolution in Military Affairs. Both the QDR and the NDF recognized that a combination of information technology and long-range precision strike has taken us beyond the inevitability of force-on-force attrition warfare. This "Revolution in Military Affairs" outs great reliance on aerospace forces. That is very threatening to those who insist that wars are won or lost by ground forces. They argue, therefore, that technology is overrated and undependable.

Their position has gotten a boost from planning models that rate airpower as less effective than it has proved to be in actual combat and by the manipulation of joint exercises to artificially constrain airpower and give the ground forces a bigger role in the fight. The commission might ask why we undervalue the best thing we've got going for us.

Level of effort. Should US armed forces be prepared to win quickly, decisively, and with as few casualties as possible, or just strong enough to hold parity? If the choice is parity, that means that about half the time, we are going to lose. We are drifting toward parity because the defense budget has been cut too much.

Purpose of the force. It is essential to make distinctions and priorities between missions that occur often but which may not be critical—such as military operations other than war—and vital missions at which the force must not fail, such as fighting and winning the nation's wars.

**Space.** The growing importance of space must be obvious to all. Yet our commitment to use space for more than support and peripheral roles—much less dominate space in wartime—is hedged and underfunded. Some nation w II be the leader in space in the 21st century. Let us hope that it is us.

New regimes of conflict. We can barely imagine warfare in which computers fight each other and when information is used directly as a weapon. We have, at best, a very weak grasp of how to employ such capabilities or defend ourselves against them.

The QDR and the NDP pulled close to some of the answers but then veered away, in part because of internal pressures. The Boren–Rudman Commission will not have that particular set of organizational problems. This could be the defense review that breaks the inflexible grip of tradition and gets it right.

AIR FORCE Magazine / December 1998

WHEN YOU'RE HEADED INTO A MAJOR THEATER, USE THE ENGINE THAT'S HAD A DRESS REHEARSAL.

The F119 is the dependable engine for the F-22, making its derivative the most affordable engine for the Joint Strike Fighter. Eacked by the same top-flight support we've shown on the F-15, F-16, and C-17. Pratt & Whitney. *THE POWER OF READINESS*.



www.pratt-whitney.com

## Letters

#### **Degraded Benefit**

Your editorial ["Degraded Eenefit," October, p. 3] certainly spelled out the problem of degradec retirement benefits for our armed services. It is hard to believe that Les Aspin allowed this to happen when everyone knows that nearly all city workers, state workers, cops, firemen, etc., receive 50 percent after 20 years.

Why would a serviceman or -woman stay in to work 12–16 hours a day during deployments when he or she cculd take a relatively easy city or state job with great retirement benefits? It is time for Congress to undo all the damage our former Secretary of Defense has done before our military is destroyed.

#### David Chigos San Diego

Should, miracle of miracles, both the retirement pay question and the extent of deployments be resolved, would the retention crisis disappear? Not likely. Why? One of the basic reasons people volunteer to serve in the armed services is a belief they are helping to maintain the security of their country. Currently, there is no potential enemy perceived to put the nation's security at risk. Another reason for joining is that it provides a job which, in hard times, encourages people to endure often less than desirable circumstances. This is not so when the economy is humming along and job opportunities abound on "civvy street." And then there is another explanation not often addressed because of the difficulty of assessing why many people make careers in the military services. You can call it a sense of camaraderie, esprit, or what you will, but without it there is no feeling of belonging and people, if they have a choice, will not stay.

The departure of the intangible "belonging" has not just occurred. The current members of the armed services probably wonder what I am talking about, but those who recall military base clubs that were wellattended, and are now empty, and unit off-duty gatherings that are now no longer evident, you know what I'm saying. Unfortunately, it is unlikely that this special sense of belonging will ever be recovered. Having said that, it is all the more imperative the senior leaders of the armed services, in concert, constantly confront Congress until the problems of retirement pay and deployments are eliminated. Current personnel planning, such as deploying reserve units, can only help in the short term. They create other problems.

> Col. Peter E. Boyes, USAF (Ret.) Rancho Murieta, Calif.

#### **The Access Question**

As you correctly pointed out in "The Access Issue" [October, p. 42], the access issue centers on two interrelated components: political "lockout" and military "keep out." The first results from reluctant "allies" unwilling to furnish advance basing, and the second is a result of enemy action tc prevent our operations.

I agree with your assessment that we have thus far not been preventec from accomp ishing a "military operation to which the United States was seriously committed." However I am not as sanguine about prospects for the future and I am concerned that your discussion eventually devolved to a carrier-based air bashing exercise.

In an era where permanent American overseas presence is at a post-World War II low but operational commitments are at an all-time high, the value of rapid response cannot be

Do you have a comment about a current article in the magazine? Write to "Letters," *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. [E-mail: letters@afa.org.] Letters should be concise and timely. We cannot acknowledge receipt of letters. We reserve the right to condense letters. Letters without name and city/base and state are not acceptable. Photographs cannot be used or returned.—THE EDITORS

overstated. If an adversary can prevent the US from committing substantial forces long enough to achieve their objectives in their own backyard, they may see the risk as worthwhile since eviction comes with a high price—a price they may hope the US public will be unwilling to pay. If regional allied leaders can be mollified with prcmises of limited objectives or intimidated with threats of retaliation they may very well refuse basing, especially if, as you pointed out in your report, they see US commitment as halfhearted.

To make matters worse, US national military strategy describes weapons of mass destruction (chemical, biological, nuclear) as this nation's greatest threat. Combined with rapidly proliferating delivery means, such as missiles and expanding terrorist organizations, very real threats to deployed forces are on the rise. But active and passive defense capabilities are poor at best. It is not too farfetched to imagine the threat of a rain of chemically armed missiles or biological contamination of food and water as causing enough concern to at least constrict deployed force levels-or worse, use of such weapons forcing operations out of their range or to cease altogether. There is precedent; we built an entire military "city" in the remote regions of the Saudi desert to avoid the terrorist threat, and we withdrew from Beirut after taking substantial casualties in a terrorist bombing. These lessons aren't lost on our adversaries.

A very necessary answer to this dilemma is national aerospace power. America's greatest single advantage over every other nation on Earth is its aerospace forces—the amalgamated capabilities of carrier-based, theater land-based, and long-range air as well as their supporting space, mobility, and information systems. It's time we understood this and planned to maximize its value—its speed, range, and versatility—to our national military strategy.

To denigrate one vital part of that combined capability is counterproductive because we clearly need it all. This is because of just the kinds of situations the *Air Force* Magazine article describes—situations where for one reason or the other a particular leg of our aerospace power is unavailable. These include denied theater bases, carrier-based forces out of position or in need of replenishment, or long-range air at too great a distance to provide true tactical responsiveness. Is it so difficult to imagine carrier-based air, long range air, and space systems working in concert to alleviate problems of theater access?

If need be, we should maintain a robust national aerospace force at the expense of forces that, because of their inability for rapid global response, contribute little to our most important global combat requirements. But we do not need to play a trade-off game among the elements of our true national asymmetrical advantage over every other nation on Earth—air, space, and information systems—regardless of the uniforms their operators wear.

> Gene Myers Science Applications International Corp. Hampton, Va.

Congratulations on a provocative and well-researched essay. The lockout problems described are real and are likely to become more serious as we enter the next century.

They are not fighter and strike problems alone-the phenomenon is equally applicable to tankers and en route service for strategic airlift. Neither is lockout a service specific problem-it is a national problem which can strike at our very ability to respond to threats to our national interests. Lockout can affect all the services and the entire spectrum of military capability. For example, as your essay pointed out, we cannot support carrier battle groups from CONUS-[the] Navy must have littoral port access to operate in the littorals. As you imply, this issue is too important to be addressed on a partisan basis.

It is illogical, however, to conclude that if the US interest at risk is truly *vital*, our friends will grant us the access we need. Rather, if the interest is *vital*, then, by definition, we must guarantee access. And there is a way to do just that.

Under development for the past six years has been the Mobile Offshore Base. The MOB is a very large floating structure as much as a mile long by 500 feet wide and containing over 3.5 million square feet (80 acres) of climate-controlled storage and working space. [It is] capable of operating up to C-17 type aircraft. This concept was introduced by Adm. [William A.] Owens when he served as vice chairman, Joint Chiefs of Staff. Since then, DoD has invested nearly \$50 million in a science and technology program to study and assess the feasibility of building such a structure. This effort is not scheduled to [be] complete[d] until next year, but the emerging conclusion is that there is no technological reason why a MOB cannot be built.

Clearly, deploying and operating Mobile Offshore Bases will produce fundamental change in the way we employ our military. Equally clear, however, is the conclusion that the nature of the threat and the geopolitical realities we will encounter in the 21st century require such change. MOB makes too much sense not to pursue.

J.B. LaPlante McDermott International Alexandria, Va.

#### **Missile Threats**

"Missile Threats and Defenses" [October, p. 18] needs to tell the whole story. On ballistic missile threats, revised intelligence credits North Korea's Taepo Dong 1 with an estimated range of 3,000 to over 4,000 miles. North Korea can strike Alaska and Hawaii.

The Brilliant Pebbles program for deploying space-based interceptors was ready to move into acquisition in 1992. Had we fully funded Brilliant Pebbles we would have had ballistic missile defenses in place today. But President Clinton canceled the program shortly after taking office in 1993.

On the deployment of a ballistic missile defense, Lt. Gen. Lester Lyles says, "We don't think we can go any quicker." But the Navy acknowledges accelerated funding of its Navy Upper Tier (Navy Theater Wide) program could result in deployment as soon as 2001, not 2003. With upgrades to its interceptor and cuing system, Navy Upper Tier could also provide National Missile Defense coverage at a reasonable cost, perhaps \$2 billion-\$3 billion.

We can quickly build ballistic missile defenses, meeting both theater and ballistic missile threats to the US. Accelerated funding of Navy Upper Tier and a restart of Brilliant Pebbles would let us build that defense. In addition, the Space Based Laser program, now at the point of testing in space, will give us a boost phase defense capability with global coverage.

Brilliant Pebbles could have inter-



Publisher John A. Shaud

#### Editorial

Editor in Chief John T. Correll

Executive Editor Robert S. Dudney

Senior Editor John A. Tirpak

Associate Editor Tamar A. Mehuron

Contributing Editor John L. Frisbee

Managing Editor Suzann Chapman

Assistant Managing Editor Frances McKenney

Director of Production Robert T. Shaughness

Art Director Guy Aceto

Assistant Art Director Cathy Cavanaugh

Research Librarian Pearlie M. Draughn

Editorial Associates Chanel Sartor Chequita Wood

Administrative Assistant Juliette Kelsey

#### Advertising

Advertising Director Patricia Teevan 1501 Lee Highway Arlington, Va. 22209-1198 Tel: 703/247-5800 Telefax: 703/247-5855

Industry Relations Manager Nicola C. Whitlock • 703/247-5800

US and European Sales Manager William Farrell • 847/295-2305 Lake Forest, III.



Circulation audited by Business Publication Audit



Air Force Association 1501 Lee Highway • Arlington, VA 22209-1198

Telephone: (703) 247-5800

Tall-free: (800) 727-3337

Fax: (703) 247-5853

To select documents and receive them by fax: (800) 232-3563

#### E-mail: information@afa.org

Internet: http://www.afa.org/

#### AFA's Mission

- To promote aerospace power and a strong national defense.
- To support the needs of the Air Force and Air Force people.
- To explain these needs to the American people.

#### Telephone calls to (703) 247-5800 or (800) 727-3337:

If you know your party's extension, press 1.

For a customer-service representative, press 3.

Or stay on the line and an operator will direct your call.

#### **Customer Service**

For questions about membership, insurance, change of address or other data changes, magazine delivery problems, or member benefit programs, select the "Customer Service" option.

#### **E-Mail Addresses**

Communications/news media/Crossfeed com@afa.org

Customer Service custserv@ata.org
Eaker Instituteeaker@afa.org
Industry Relations/Advertising irl@afa.org
Information information@afa.org
Magazine Editorial Offices afmag@afa.org
Magazine Lettersletters@afa.org
National Defense and Congressional Issues ndl@afa.org

Aerospace Education Foundation aefstaff@aef.org

Air Force Memorial Foundation ... afmf@afa.org

For individual staff members: first initial, last name, @afa.org (example: jdoe@afa.org)

#### Letters

cepted Iraqi Scuds in the 1991 Persian Gulf War. Space-based lasers will be effective against ICBMs and ballistic missiles with ranges as short as 75 miles.

But if we subscribe to the deployment of a limited NMD using groundbased interceptors we will forfeit the advantages of continuous, global coverage and a boost phase defense capability that space-based BMD will have. If we quickly move to meet the threat of ballistic missile attacks by building ballistic missile defenses in space, we will be able to defend ourselves against theater and long range ballistic missile threats. We are in a race for space.

> James H. Hughes Englewood, Colo.

#### The Berlin Airlift

After reading the article on the Berlin Airlift ["Inside the Berlin Airlift," October, p. 48] I talked with my father, a retired USAF colonel, about his memories of those times.

He had been in charge of warehousing replacement parts and supplies for the radios and electronics used in the planes and on the ground during the lift. The Russians did iam our radio signals during the lift. This required frequently regrinding our radio crystals to different frequencies, which my father had contracted to a German shop in Munich. Since the Russians were short on crystals, it would take them a week or so to catch on and catch up to us. We had lots of surplus equipment left over from the war that was being sold on the open market, so all the radios were first stripped of crystals so that they would not fall into the hands of the Russians.

> David Bruce Grant Austin, Texas

You omitted English bases. I went to Burtonwood AB, just outside Liverpool, UK, in September 1948, to serve the [Berlin] Airlift. We washed coal dust and flour out of the C-54s before maintenance and then performed whatever maintenance was needed.

After the airlift was over, Congress authorized an "airlift device," which was a miniature golden C-54, for those who had served in the airlift. [It was worn] on the German Occupation Ribbon. I was one of those who received the German Occupation Ribbon without ever setting foot on any part of continental Europe.

TSgt. William B. Pinkerton, USAF (Ret.) Pico Rivera, Calif. [The] mention of a P-39 Russian fighter making a pass between the C-54s is correct, since that did happen to the flight I was on. This was [in] the northern corridor, and about midway, crossing into eastern territory. [The author's] opinion that this was an only incident is sadly underestimated.

Other types of interference by unknown sources, and reported by my crew, [included] a broadcast of barking dogs on our communications channel while approaching the turn into the approach to Gatow. This was a point of critical timing, since if you missed the turning point, you would overshoot and enter into eastern territory.

Another type of interference was a duplicate transmission on the same low frequency radio beacon being used for the turning point into Gatow. This signal was of a poorer quality of aural tone and a poorer quality of code identification. When this signal was operating, you could retune the receiver so as to hear each signal separately. Then the compass needle would waver just a little to the left of where the good [signal] should be. A sharp navigator would observe that a fake transmission was being made to lead you out of the corridor and set you up for a navigation error and possible incident.

The interference the aircrews experienced was not just a piece of cake. Lt. Col. James E. Lee, USAF (Ret.) Camp Hill, Pa.

[I] must in all fairness take exception to [Milton's] assumption that the B-29s stationed in England were considered the only deterrent force preventing Russian interference with the Berlin Airlift. The 36th Fighter Group, Fuerstenfeldbruck AB, and the 86th Fighter-Bomber Group, Neubiberg AB, both in southern Germany, could also be included in this deterrence. Although the 36th did not arrive in Germany from the Canal Zone until the fall of 1948, the 86th had been stationed on German soil since the end of hostilities. Together we could be called a formidable adversary, with the 36th's 75 F-80s and the 86th's 75 P-47s.

There have been many published articles about the many sacrifices and hardships by the men connected to the airlift. However, it must also be known that we as fighter personnel were well-prepared and ready and were yet another deterrent.

> SMSgt. Willard R. Baker, USAF (Ret.) Sequim, Wash.

#### **Retention Woes—You Bet**

When I first joined the Air Force in 1975, it sure wasn't for the pay. [See "The Retention Problem Spreads," October, p. 60.] I was earning a whopping \$360 a month base pay. I joined for two reasons. (1) I had absolutely no direction or education in my life and the Air Force offered me both. (2) My dad retired from the Army and I saw what his retirement check allowed him to do each month. [I]n 1968, when my dad retired, his retirement was almost enough to live on.

During my 21 years [in the service], I learned that the military was a way of life that one learned to love and hate at the same time. As a senior NCO, I counseled many young people on the advantages and disadvantages of being in the Air Force. But, later [in] my career it [became] more and more difficult to point out the good things to entice young people to stay.

We [work] long hours, nights and weekends. We [send] people all over the world on a moment's notice. The 179-day TDY maximum [is] a joke. We [give] them substandard housing. We [pay] them one-third what their civilian counterparts make. We [make] it more and more difficult to get quality medical care. We charge them a surcharge at the commissary because Congress won't fund new facilities. We cut out all dental care for dependents. We completely change their uniforms every couple of years. We make promotions the most difficult of all the services. We keep their pay below industry standards by telling them they have other greater benefits than people on the outside.

I guess I could go on and on, but I think you get the picture. My point is, this has been happening for over 20 years. The more Congress and the President have tried to fix it, the worse for all of us it has become. And to the credit of those on the front lines—the NCOs and SNCOs we identified these issues years ago, but to our dismay, our cries have [always] landed on deaf ears. Now the powers [that] be want to bring back the selective re-enlistment bonus and the old retirement plan. And that's going to solve the problem?

I've been retired for two years, now, and I make three times the money I did on active duty. My benefits are better, I see a real doctor (no offense to physician assistants), I leave my job at work when I go home at 5 p.m. each day. My weekends are mine. My retirement plan is better. I get raises, not because I test but because I'm good and my management shows their appreciation for [my] working hard for the company. I've gotten two raises this year alone. All the airmen who worked for me [whom] I've talked to since I've retired, well, what do you think I tell them?

MSgt. David Palmer, USAF (Ret.) Cary, N.C.

Your article on retention is certainly disturbing. Of course, retention is a complex matter with no magic bullet. Pay, retirement benefits, unreasonable deployment, the potential for advancement, [and] quality of life-these are but a few of the vital factors. Anyone interested in the problem should review Gen. Curtis Le-May's actions on quality of life in his book. The old boy may have breathed fire and brimstone, but he went to a lot of trouble to improve the quality of life for the people in his command. [For] example, his effort to procure more and better family housing was the forerunner of Wherry Housing. So, consider this question: If LeMay recognized the importance of quality of life so early, why is it still a deficient area today?

The problem persists because [officials] are not allowed to get at the base root of the problem and solve it! They can only use Band-Aid fixes on the symptoms! Our elected representatives have systematically created and aggravated the problem by withholding the money required to solve it, among other things.

I sincerely believe that the Air Force could and would do a much better job, by adjusting its overall personnel management to modern concepts and to the demands of the high-tech aerospace world we live in, if Congress and other branches of the service would allow us to do so. It is great that the Air Force has the vision for taking advantage of the rapid technological advances, but if we are forced to continue with some of the concepts of the 50s we just find that the people we need the most are not around when we need them the most. Lt. Col. Joe C. Lyons,

USAF (Ret.) San Antonio

A big thank you for the [retention] article. I appreciate the fact that our nation's military and congressional leaders are finally taking note of the retention problem our Air Force faces, but the way they are handling it could use some work.

Let's take a look at the things Congress is throwing money at (as mentioned in the article): a 3.6 percent compensation boost to base pay, updating housing, building education centers, child care centers, and a fitness center. These things affect members in different (trivial?) ways. The new buildings affect people at some bases but not nearly all. Many service members do not even use these facilities. A very large number of military families own or rent houses off base. Even a 3.6 percent pay raise, which affects everyone, is still only that—3.6 percent, well behind our civilian counterparts.

As the article points out, the culprit is [operations] tempo. In order to drive changes that affect one and all, [operations] tempo must be slowed for individuals. Fewer deployments are not usually an option. Less time spent on exercises, or fewer exercises altogether, hurts readiness. Our politicians and military leaders cannot expect to continually call on one person to do the work of four, without things falling apart.

The only sensible way to keep our forces happy (and re-enlisting) is to hire some help. Quit cutting our benefits and maybe people will stay around. Make the military look more lucrative to the new recruits, and maybe more will join. Allocate some more people to fill those heavy rotations, and maybe people might start to smile. Don't tell today's military member, "Hey, we're going to cut your retirement, give you marginal raises, and while we're at it, you're going to miss half of the holidays with your loved ones."

Here's something I'd like to see the expression on Congressman Soand-so's face when the President throws him or her a Kevlar helmet and flak vest and says, "Here you go; you're going to Saudi for four months. Sorry you're going to miss your anniversary and your daughter's birthday. Look on the bright side, though; we're building your base a new fitness center."

> SSgt. Jesse Bunck, Hill AFB, Utah

In response to the pilot retention problem, I believe one thing is being forgotten. Pilots are relatively intelligent individuals, although perhaps not as smart as us navigators. They are thinking long term. A lump sum payment over the course of a couple of years might seem good to some, but there is no long-term security in it. One thing that might keep a pilot who is in that 10-12 year group is to offer him retirement at 16 years' time served. Instead of him saying, "I've got 10 more years of this," he might just say, "Only six more years till retirement; I would be crazy to get out." Although they might only retire with 40 percent of their base pay,

there is security there. This would retain the pilots through those critical years, and I'm sure many would elect to stay on past 16 years. This is an option that I have not heard discussed before.

> Maj. Stephen Shahabian, AFRES Foxboro, Mass.

#### **Air-Breathing Rebuts**

Retired Lt. Col. Duane Cossalter stated in his letter ["Not So, Blackbird," October, p. 7] that the SR-71 was not competitive with satellites and the U-2 and would have been a waste of taxpayer money during the Gulf War. He is mistaken on several points.

I served in the Strategic Reconnaissance Center before, during, and after the war and was involved in taskings of satellites and U-2s, along with [the] SR-71 before it was retired. The retasking times for the U-2 and SR-71 were unique but not that different in terms of timeliness. Retasking of satellites was nigh unto impossible in most instances. More often than not there was no satellite overhead when you needed one, and when one was, the red tape involved was so cumbersome, I would liken it to mating elephants.

Many of the satellites carried sensors of very specific design that often did not fit the desired taskings. The retasking of satellites also invited many more heated arguments due to the number and variety of customers that they served. We were asked numerous times by theater intel officers if it [were] possible to reactivate the SR-71. They repeatedly described satellite responsiveness as almost totally nonexistent.

However, Cossalter is correct on several other points. The SR-71 was very expensive to operate, and an argument over its cost-effectiveness could easily be waged. The exploitation of its product could not match the timeliness of a data link, either. However, the U-2 also flew many "offtether" missions in the Gulf without the benefit of a data link. The same delays in processing that would have been seen in the SR-71 were also present on these sorties, and the theater never complained.

Expensive? Yes. A waste of money compared to satellites? Absolutely not! In fact, based on experience, I'd say the opposite was true.

MSgt. Bob Simmons, USAF (Ret.) Omaha, Neb.

I was assigned to the 9th Strategic Reconnaissance Wing from 1975– 81. My duties included SR-71 sensor tasking, SR-71/U-2 data reduction, and mission planning. I have also worked for Lockheed Martin's Skunk Works.

First, the SR-71 was designed and built in the early 1960s [to] gather Photint as well as Elint over vast areas of possible denied airspace. (This was effectively demonstrated during the Vietnam War.) During the same period, the U-2 was (and still is) limited in range due to the lack of a refueling capability. The U-2 datalink capability was also limited and would not "come into its own" until the late 1980s and 1990s. Satellite coverage and capabilities were also limited during this period. I don't think that one can objectively compare these three different systems.

Second, the slow response time is not, and never was, an issue. The "station time" for crew members varies, depending on the mission but is usually 2.5–3 hours prior to takeoff. I have flown on RB-47s, RC-135s, and C-130 gunships and we all reported about the same time prior to launch. U-2 pilots must also prebreath and suit up. Film processing and exploitation are required regardless of the collection platform.

Third, the data and intelligence information provided to the battlefield commander by the U-2, RC-135, and Joint STARS platforms provided invaluable real-time targeting and battle damage assessment on a continuing daily basis during the Gulf War.

Finally, satellite coverage is efficient, timely, and useful only if you have coverage of the area of interest (or maintain control of the satellite) or only want photos and the satellite can image the target, or if the target is not obscured.

The SR-71 may have been expensive, but [it is] not as costly as designing, building, launching, maintaining, and protecting a satellite.

> Maj. George V. Back, USAF (Ret.) Cleveland

Cossalter mentions that the SR-71 would not be competitive with satellite assets or "even the data-linked U-2s." I'm sure he means after the sats had been maneuvered into the correct orbit and then were able to start surveying the area, weather [permitting]! If satellites were so effective how come [Army] Gen. [Norman] Schwarzkopf asked repeatedly for the SR-71, but these requests were denied by the Air Force? Additionally, after the Gulf War, Schwarzkopf declared that satellites were of little use in Desert Storm. In studies done after the Gulf War, one of the main problems [noted] was the lack of timely intelligence for commanders!

[Cossalter] also states, "Responding to a crisis took too much time (crews had to dress and prebreathe oxygen)." U-2 pilots have to undergo a similar routine (actually an SR-71 pilot goes a half-hour shorter prebreathing routine than a U-2 pilot).

He goes on to state, "Retrieving information was slow (film had to be unloaded, processed, and exploited)." This is also the case with the U-2, when not using an electronic reconnaissance system. In the Gulf War, Army field commanders wanted hard copies of intelligence, so U-2s, in conjunction with electronic missions, flew "wet-film" missions for the Army. They did this using processing equipment developed for the SR-71 before it was retired.

He additionally writes that, "activities happened at such a fast pace that an airplane such as the SR-71 could not react and change flight plans to meet the requirements." Actually the flight plan for the SR-71 can be changed in flight, by the reconnaissance systems officer. How long does it take to retask a satellite and at what cost? Also the SR-71 is able to carry out wet film, digital imaging, [and] electronic intelligence in one flight.

I think Cossalter needs to look again at the SR-71 (and the U-2). He mentions that "many air-breathing reconnaissance assets were of limited value in that conflict" (meaning the Gulf War) "and the SR-71 would have been a great waste of taxpayers' money." He seems to prefer satellites over the air-breathing assets. If the U-2 supplied 50 percent of all imagery intel, and 90 percent of all Army targeting intel, what did the satellites provide? Sounds to me like the air-breathing intel gatherers did a lot better job than the satellites!

Of course, the U-2 had to fly with a fighter CAP, SAM suppressor support, and AWACS, and tanker support for the support aircraft, during the first part of war and not over "high threat" (SAM sites) areas. With the SR-71 none of this would have been a problem, as the SR-71 could overfly Iraq with impunity, imaging in two hours what the U-2 takes eight to image and with just tanker support. Sounds like a cost savings to me.

There is no replacement with the capabilities of the SR-71 then or now in the Air Force inventory. That leaves us with no high-threat overflight capability, made glaringly apparent in the Gulf. Saddam stated that he would shoot down any further U-2 flights over Iraq (luckily he didn't follow through on his threat). The SR-71 could have easily been deployed to a forward operating location, overflown Iraq, and with its newly installed "realtime data link" could have provided imaging before it landed, similar to the U-2 and four times faster.

In addition, with its ability to overfly an area, unannounced, and not on a schedule like satellites, the SR-71 has an ability to gather totally different intelligence than a satellite.

Unlike Cossalter, I think that this is not an "either-or" situation; it is a question of what assets work best in which situation. The SR-71, U-2, and satellites all have their strengths and weakness. They are complementary systems which, when used together, give the decision-makers and military personnel of the US the information needed to make intelligent decisions.

> John Stone Jr. Louisville, Ky.

#### **Thinking Aerospace Part 2**

I cannot ignore the challenge thrown down by Frank Jennings in his letter [September, p. 6]. [His] defense of the term aerospace is learned, clear, and antiquated. Aerospace is a medium that doesn't exist. Air Force forces don't fight in it. Trying to force the emerging space force into an "aerospace" straitjacket has the same semantic value that "amphibious warfare" has-a term for a niche product that is always bounded and of limited value. In contrast, looking at "air and space forces" allows us to visualize and invent new and highly effective forces that maximize the operational and warfighting potential of both mediums while understanding the special advantages and limitations of each. Let's look at the operational arenas in question and see where they differ and how they might complement one another.

Air is a clearly understood operational medium. There is a corpus of knowledge, technical and operational, that stretches back 85 years. We know, for instance, that use of air makes war a four-dimensional affairall three physical dimensions and the overwhelming advantage air gives you in time. We know that air missions are fundamentally short and require a significant infrastructure-something that has driven our foreign policy over the years (remember Wheelus AB in Libya?). And, over the years, we have found out that a number of our dearest assumptions don't hold water. For example, strategic bombing as envisioned by Douhet, Mitchell, et al simply doesn't work. But tactical airpower-the kind so deplored in World War II but so very effective in

every war [in which] we've used airpower—does work and, in fact, works wonders.

Viewed in this light, space is clearly another operational medium. The corpus of knowledge is admittedly smaller and the forces that operate in space are today woefully inadequate to the tasks we wish to thrust upon them. Very reminiscent of the 1920s and 1930s, isn't it? But there are clear differences. Space missions today are long-years, in many cases. The infrastructure is huge but can be concentrated in protected areas and therefore doesn't necessarily drive foreign policy. We don't know yet about the assumptions that we think govern space operations, except the one that says whatever you thought you needed, you'll never get enough. Or did we not lease over 60 percent of our satellite communications transponders for Desert Shield/Desert Storm?

Space operations today are in their infancy and await the technological breakthroughs that we made in air operations since 1903. What will harm the utility of space is limiting it to some artificial definition of aerospace that has no basis in reality. The Secretary of the Air Force and the Chief of Staff recognized this three years ago. When will we?

> Lt. Col. Timothy K. Roberts, USAF

Colorado Springs, Colo.

I enjoyed reading [Jennings' letter]; however, I was disappointed that there was no mention about how the word "aerospace" was actually used by a major command over 30 years ago and is still in use today.

For those who don't know, the Air Defense Command changed its name to the Aerospace Defense Command in 1968 and added two orbiting satellites to [the] command shield to reflect the space mission it already had been doing for several years. On July 1, 1968, the 9th Aerospace Defense Division at Ent AFB in Colorado Springs became the 14th Aerospace Force under ADCOM. Units under the 14th AEROF also used the word aerospace. The 10th Aerospace Defense Squadron at Vandenberg AFB, Calif., was the only all blue-suit unit launching Thor missiles in support of the Defense Meteorological Support Program and in Project 437, the first and only operational anti-satellite program in USAF.

Years later after the deactivation of ADCOM, the North American Air Defense Command changed its name to the North American Aerospace Defense Command. So for those who think aerospace power is a new thing and that the word aerospace is the new buzzword around town, it is not. It is an old word being brought back into light to help bring air and space forces together—something that has been going on for many years.

> TSgt. Rollan B. Yocum Andersen AFB, Guam

#### **Down to Earth Space**

It's always great to see the Space Almanac issue [August], but you really missed the mark with your cover photo. What does the birth of a star "seven thousand light-years away" have to do with the vital role space plays in military operations? You could have pictured space operators providing accuracy prediction models to GPS guided munitions strike planners or illustrated the contributions space systems and operators make to theater missile defense.

Unfortunately, your cover reinforced the image of space operations as a matter for scientists and academicians. I believe we should focus on what space brings to the fight here, not [on] what's going on in some far corner of the galaxy.

> Capt. Peter J. Flores Nellis AFB, Nev.

#### The Robin Olds Record

[Retired] Lt. Col. Edward T. Barnard claimed the 479th Group credited Robin Olds with 24-0-2 victories. [See "Letters," August, p. 8.] Your article ["Guide to Aces," May, p. 73] credited him with 12 victories in World War II. You are both apparently correct. For a time USAAF, at least in Europe, credited ground victories the same as air victories. When ground victories are counted Olds scored at least 24 kills in World War II.

Robert S. Sacchi Sterling, Va.

#### Slow Rolling Retirees

[When you consider] the Federal Employees Health Benefits Program– 65 test, paid-up Survivor Benefit Plan, and other bills in the legislature that address promised benefits for military retirees, it's obvious that flock of non-veteran legislators are trying to outlast those of us who enlisted in the service at the outbreak of World War II. [See "House OKs FEHBP Pilot Program," August, p. 13.]

I'm in my early 80s and others like myself aren't going to be around much longer. Those indifferent legislators will win in the end if they continue their present policy of "I don't care."

Col. Harry L. Zanders, USAF (Ret.) Castle Rock, Colo.

## **Aerospace World**

**By Peter Grier** 

#### F-22 Makes First Supersonic Flight

The F-22 went supersonic for the first time Oct. 10, 51 years to the week after the sound barrier was broken for the first time in the skies over Edwards AFB, Calif.

Lockheed Martin test pilot Jon Beesley flew Raptor 4001, one of two F-22s now at Edwards, to Mach 1.1 at 29,000 feet, while using the afterburner. From takeoff to landing, the flight took about three hours.

"From all indications, the Raptor flew past the sound barrier with ease," said Lt. Col. C.D. Moore, commander of the F-22 Combined Test Force. "This is just one step of many for the program."

The next step for the F-22 program is supercruise flight: breaking the sound barrier without use of the fuelgulping afterburner.

The Air Force wants to start F-22 production late this year with release of money for two representative production test vehicles. Congress has decreed that the Raptor has to complete at least 4 percent of its test program hours before this purchase, however.

That would require an acceleration of the current flying schedule.

#### On Retired Pay, Wait'll Next Year

Congressional leaders deferred a last-minute effort to include a boost in military retired pay in the Fiscal 1999 budget deal that was struck in mid-October.

However, the Joint Chiefs of Staff said that such an increase is one of its top priorities, and it will likely receive serious consideration on Capitol Hill next year.

The desire for change stems from the fact that the current system has three levels of generosity.

Service members who joined the military prior to a 1980 congressionally mandated cut, and who serve 20 years, receive 50 percent of their last year's base pay as their retired pay.

Twenty-year veterans who joined between that point in 1980 and another in 1986, when a second reduc-

#### **On Gulf Duty**

When he declared, on Nov. 11, that the United States "must be prepared to act" against defiant Irac, President Clinton authorized a new Persian Gulf buildup that was conspicuously top-heavy with airpower.

Defense Secretary William S. Cohen signed a deployment order sending 98 land-based warplanes—70 of them USAF aircraft—to the Gulf. There, the Air Force aircraft would join an already large USAF force bedded down in a number of Gulf states.

Sent as a unit was an entire USAF Air Expeditionary Force. It comprised six B-1B heavy ong-range combers; 12 F-16CJ defense suppression aircraft; 12 F-15C/D air superiority fighters; and 12 F-16C multirole fighters.

Also sent to bulk up the USAF presence were:

■ 12 F-117 stealth fighters.

12 B-52H long-range, heavy bombers

Four F-16CJ defense suppression crait.

Included in this wave of deploying aircraft were two Navy EA-6B jammers and 12 Marine F/A-18 multirole fighters. Additionally, 41 support aircraft—37 fixedwing and four rctary-wing—deployed.

Some 3,000 additional Army soldiers went to the region, as did an additional Navy aircraft carrier and Marine amphibious group. New Patriot air-defense units and personnel and a light infantry bartalion also went.

Addressing a Veterans Day ceremony at Arlington National Cemetery, Clinton explained the deployments in this way:

"A failure to respond could emboiden [Saddam] Hussein to act recklessly, signaling to him that he can, with impunity, develop these weapons of mass destruction or threaten his neighbors. ... [And it] would permanently damage the credibility of the UN Security Council to act as a force for promoting international peace and security."

tion went into effect, will receive 50 percent of the average of their three highest years of salary.

Those who joined after July 31 1986, get only 40 percent of their highest-three-years average.

In a surprise move that occurred during final budget negotiations, the White House supported a proposal by Rep. John P. Murtha (D-Pa.) to raise pensions back to the 50 percent level.

Republican leaders demurred, however, saying they wanted to study the issue at length via hearings next year. They also cited expense: The move could cost up to \$3 billion over the next five years, depending on how cost-of-living increases are hardled.

The disparities in retired pay are a

major contributor to unrest in the ranks and poor retention levels, according to the Joint Chiefs of Staff.

The JCS Chairman, Army Gen. Hugh Shelton, recently told Congress about surveys showing that perceived nequity in retirement is one of the top three reasons people are leaving the service.

#### USAF Has New Operational Doctrine

The Air Force on Oct. 6 released a new operational doctrine for the Expeditionary Aerospace Force of the 21st century.

"Just as technology, world threats, and opportunities change, so must our doctrine," wrote Chief of Staff Gen. Michael E. Ryan in the forward to Air Force Doctrine Document 2,

AIR FORCE Magazine / December 1998

Photo by Rich Lipski / Washington P

"Organization and Employment of Aerospace Power."

AFDD 2 follows release of AFDD 1, "Basic Air Force Doctrine," in September 1997. It takes the aerospace power discussion to the next level of detail, said officials, describing how the service organizes and employs its forces at the operational level of war.

"This publication also outlines how to set up, plan, and execute Air Expeditionary Forces," said Lt. Col. Bob Poyner, chief of the Aerospace Power Division at the Air Force Doctrine Center at Maxwell AFB, Ala.

AFDD 2 can be understood on its own, said officials, though reading AFDD 1 gives an understanding of terms used and a larger conceptual framework.

The effort to develop a new doctrine began at the behest of former Air Force Chief of Staff Gen. Ronald R. Fogleman after his long-range planning summit in 1996.

#### **AEF Bombers Complete Mission**

Three B-2s and three B-52s from the 2d Air Expeditionary Group completed a month-long training deployment to Andersen AFB, Guam, on Oct. 6. The Spirits returned to their home base of Whiteman AFB, Mo., while the Stratofortresses flew back to Barksdale AFB, La.

During their weeks on Guam, the 2d AEG aircraft flew 34 training missions and logged more than 350 flying hours. The bombers flew as far north as South Korea and as far east as Wake Island.



USAF Maj. Kimberly Markland broke the tape as top female finisher of the Marine Corps Marathon in Washington Oct. 25. Markland, 34, a clinical laboratory technician at Lackland AFB, Texas, finished in 2 hours, 49 minutes, seven seconds. The first female Marine came in at 3:11:46. Markland had already qualified for the 2000 US Olympic marathon trials before this, her 10th marathon finish.

Repairs made to the B-2s during the AEF operation showed that stealth bombers can indeed be properly maintained away from home, said officials.

One B-2 suffered damage to some of its low observable tiles, while the other sustained relatively minor damage to its wing leading edge because of a static discharge.

#### **Georges Hits Keesler**

On Sept. 28, Hurricane Georges slammed squarely into Keesler AFB, Miss., after a destructive 10-day ram-





Two V-22 Ospreys at Eglin AFB, Fla., were on display for visitors during a week of preoperational testing in October. As the CV-22, the tilt-rotor aircraft that can take off and land like a helicopter and fly like an airplane, will join Air Force Special Operations Command starting in 2003.

page across the Caribbean islands and the tip of Florida.

The base weather station recorded winds of 112 knots, with gusts over 149 knots. The slow pace of the storm—about five miles per hour caused it to stall over Keesler, flooding the base and blocking area roadways.

No deaths or serious injuries were reported at the installation or nearby along the Gulf Coast.

Approximately 250 base housing units were rendered uninhabitable by wind and water damage, said Keesler officials. Base and community marina docks were destroyed, and electrical power was knocked out. Eight on-base shelters, including the Keesler Medical Center, protected evacuated personnel as the powerful storm passed by.

The unpredictable path of Georges caused the Air Force to move its military aircraft to safe havens across the southeastern United States.

At Keesler, Hurricane Hunters of Air Force Reserve Command's 403d Wing were forced to fly nine of their 10 WC-130 storm tracking aircraft to Ellington Field, Texas. They also sent seven of the wing's C-130Es to Little Rock AFB, Ark.

At Duke Field, near Eglin AFB, Fla., the 919th Special Operations Wing (AFRC) flew six MC-130s to Ft. Knox, Ky.

At NAS JRB New Orleans, La., the 926th Fighter Wing (AFRC) sent eight O/A-10s to Barksdale AFB.

At Homestead ARB, Fla., the 482d Fighter Wing (AFRC) sent its F-16s

#### **Ritter vs. Albright**

The years-long effort by the international community to strip Iraq of its capability to make weapons of mass destruction foundered and was no longer effective, according to Scott Ritter, the former UN official entrusted with the job.

A desire by US officials to placate allies who did not wish to confront Iraq was just one major reason why UN weapons inspection teams lost their edge, said Ritter, former weapons inspector for the UN Special Commission, at a meeting with reporters Sept. 16. Ritter resigned his position in August rather than continue to take part in activities he deemed a charade.

US and allied officials said they "want to achieve disarmament of Iraq," said Ritter. "What [they] are doing is not achieving this."

Ritter's resignation sparked a debate which, among other things, highlighted the Clinton Administration's unannounced change in policy toward Saddam Hussein.

Earlier this year, the White House threatened Iraq with attack when it blocked UN Special Commission (UNSCOM) inspectors from full and free access to suspected weapon sites. Dozens of US aircraft and thousands of troops were diverted to the Gulf region to back up that threat.

Saddam backed down and agreed to access demands—or at least said he would. But the crisis showed both him and the US that France, Germany, Russia, and other key nations were weary of confrontation and had no desire to see cruise missiles fly over the Iraqi desert again.

Rather than convince its friends of the need to back up threats with force, the US adopted an unannounced policy of avoiding brinkmanship. On a number of occasions, intervention from Secretary of State Madeleine K. Albright or other top US aides scuttled UNSCOM surprise inspections, charged Ritter.

In response, Iraq started blocking inspector work. On Sept. 1, Iraqi officials barred inspectors from a location where they have previously tagged missile parts and stored them for observation. Baghdad then halted all cooperation with UNSCOM on Oct. 30. UNSCOM was "hobbled by unfettered Iraqi obstruction and nonexistent Security Council enforcement of its own resolutions," said Ritter.

Albright and defenders of the Administration, clearly stung by the charges, attempted to respond. Ritter, they said, was a low-level worker who did not understand all the dynamics policy-makers had to face. In the words of Albright. Ritter didn't "have a clue about what our overall policy has been."

Top officials had more to consider than whether "old Scotty-boy didn't get in" to a suspected weapon site, said Sen. Joseph R. Biden Jr. (D-Del.) in one memorable comment.

The White House, however, acknowledged the shift in Iraqi policy—what one high official called a "tactical" alteration in approach. They admitted attempts to influence the pace of UNSCOM inspections.

"We did it in order to have the greatest chance of overcoming Iraqi efforts at deception," said Martin S. Indyk, Albright's top Mideast deputy.

Ritter said his resignation from UNSCOM and subsequent public appearances were meant to spark discussion about the implications of the UN's new approach to Iraq.

New details emerged from his efforts, including intelligence information indicating that Iraq built three or four nuclear implosion devices which lacked only a core of fissile material to become atomic weapons—and that Iraq used vehicles painted as Baghdad ice cream trucks to move weapon contraband during the day.

Ritter also said that Saddam Hussein had some success in rebuilding his air force.

They flew more sorties in late 1998 than they did prior to the Gulf War, the former inspector told reporters.

All the fixed-wing aircraft in the Iraqi inventory such as MiG-29s, Mirage F-1s, SU-27s—were flying, he said. Sorties were limited to takeoffs and landings, with a few maneuvers in the middle, and did not venture beyond central Iraq.

"They have spare parts and maintenance and they've got these planes at the point where they can take off and land. Does that say the sanctions are working? I say it's a failure of sanctions," said Ritter.

to Dobbins ARB, Ga. Also at Homestead, Det. 1 of the Air National Guard's 125th Fighter Wing evacuated three F-16s to Jacksonville, Fla.

At MacDill AFB, Fla., four KC-135Rs were flown to McConnell AFB, Kan., and another one to Shaw AFB, S.C.

In the storm's wake Air Force airlifters flew at least 150 missions delivering ice, generators, plastic sheeting, and other relief supplies throughout the affected area. Active, Guard, and Reserve airlifters also ferried medical personnel and supplies. Two North Carolina ANG C-130s transported nearly 100 patients from facilities in Key West and Marathon, Fla.

#### Phoenix Aviator 20 Takes Off

Oct. 1 marked the launch of a test program intended to keep pilots in the Air Force by making them more attractive to airlines at the end of their military careers.

The new Phoenix Aviator 20 effort will guarantee enrollees eligible to retire in 2001 a flying spot in the last two years of their career. In addition, it will provide up to \$1,900 to pay for commercial pilot licenses, written tests, physicals, and other requirements for the transition from the military to the civilian world. Behind PA20 lay the idea that the US pilot force is a national resource, not a focus of competition between airlines and the military, and should be managed as such.

"Revolutionary ideas are required to ensure the high standards of safety and security are preserved in our nation's skies as America struggles to meet this pilot demand," said USAF's Chief of Staff, Gen. Michael E. Ryan.

A new PA20 office at the Air Force Personnel Center at Randolph AFB, Texas, will serve as an information bridge between major airlines and retiring Air Force pilots.

Some pilots eligible to retire in 1999



During a combat employment readiness exercise held in conjunction with the Foal Eagle '98 exercise at Osan AB, South Korea, in October, Capt. Kris Kraiger of the 33d Rescue Squadron role-plays amidst the fire and smoke of a simulated emergency landing of a Black Hawk helicopter.

The objective of the EELV program is to produce cutting-edge expendable launch systems cheaply after the turn of the century. It is meant to replace the current Delta, Atlas, and Titan fleet of medium and heavy launch rockets.

Standardization will be the EELV watchword, with a standard payload interface, standardized launchpads, and standard off-pad processing all helping shave an estimated \$5 billion to \$10 billion in costs over the life of the program, according to a senior DoD official.

#### **DoD Opens Threat Reduction** Agency

Secretary of Defense William S. Cohen announced Oct. 1 the establishment of a new arm of the federal government dedicated to protecting the US and its allies from weapons of mass destruction.

The new organization will be

or 2000 will also receive some transition assistance.

#### Modernization a Must, Chief Warns

The Air Force Chief of Staff, Gen. Michael E. Ryan, said that the Air Force has a balanced, time-phased modernization plan but that any further delays will boost costs and hurt readiness.

In written responses to readiness questions posed by Sen. John McCain (R-Ariz.), the Chief said that, in the near term of 1999, modernization priorities will be the C-17 and space launch ranges. From 2000 to 2002, bomber upgrades and precision guided missiles will be the emphasis. In 2004 and 2005, the F-22 and the Evolved Expendable Launch Vehicle will be among the priorities. Beyond that, the Airborne Laser and Joint Strike Fighter are scheduled to take up modernization money.

"Further delays in these moderrization programs will continue to drive up the cost of supporting our current, aging weapons systems-jeopardizing readiness as costs rise within the constraints of topline funding," wrote Ryan.

#### **EELV Contracts Unveiled**

On Oct. 16 the Air Force announced that it has picked two contractors to develop and build a new series cf large rockets, the Evolved Expendable Launch Vehicle.

Boeing and Lockheed Martin were the EELV winners. Each will receive a \$500 million contract for engi-

in a chemical environment. Here, 36th Fighter Squadron members search for unexploded ordnance after a simulated chemical attack. neering and manufacturing development. Boeing will then conduct 19 launches, and Lockheed will have

Foal Eagle's air mission was to attack enemy artillery pieces, reinforcements

going to the front lines, and key facilities. Such exercises give USAF service

members on the Korean Peninsula a chance to improve their ability to function

nine, said acting Secretary of the Air Force F. Whitten Peters. "Having two domestic sources will

reduce risk and provide assured access to space for both government and commercial payloads," said an Air Force spokesman.

Launch sites will be both Cape Canaveral AS, Fla., and Vandenberg AFB, Calif. Launch activity is scheduled to begin in 2002.

called the Defense Threat Reduction Agency.

The new organization is composed of various old ones rolled together. The On-Site Inspection Agency, Defense Technology Security Administration, Defense Special Weapons Agency, and elements of the Secretary of Defense's staff were all combined to produce DTRA.

DTRA will have about 2,100 employees and a budget of around \$2 billion.

Though the idea for the agency

#### **New Defense Review Panel Gets Started**

The Pentagon announced Oct. 13 the formation of the new National Security Study Group. Headed by former US Sens. David Boren (D–Okla.) and Warren Rudman (R–N.H.), and known informally as the Boren–Rudman Commission, the panel will aim to develop an appropriate US national security strategy for the first quarter of the 21st century.

The effort is expected to take two and a half years. Secretary of Defense William S. Cohen announced the formation and first meeting of the panel.

Plans call for the Boren-Rudman panel to submit three reports. They are to:

Determine the global security environment of the first quarter of the 21st century.

Analyze the character of the nation during that period and develop an appropriate national security strategy.

Recommend alternatives to the current national security apparatus and processes to implement the new strategy.

Invited to participate as members of the Boren-Rudman Commission are:

Stephen Ambrose, historian.

Anne Armstrong, former US ambassador to Britain and head of the President's Foreign Intelligence Advisory Board.

Norman Augustine, former chairman and chief executive officer of Lockheed Martin.

Lynne Cheney, senior fellow at the American Enterprise Institute.

Bud Dancy, former NBC White House and diplomatic correspondent.

John Galvin, retired US Army general and former Supreme Allied Commander Europe.

Leslie Gelb, president of the Council on Foreign Relations.

Gary Hart, former senator from Colorado.

Lee Hamilton, retiring congressman from Indiana.

Lionel Olmer, former undersecretary of commerce and member of the President's Foreign Intelligence Advisory Board.

Donald Rice, former Secretary of the Air Force.

Henry Schacht, director and senior advisor to Lucent Technologies.

James Schlesinger, former Secretary of Defense and former CIA director.

Harry Train, retired US Navy admiral and former commander of NATO Atlantic forces.

Pete Wilson, retiring governor of California.

Andrew Young, former US ambassador to the United Nations.

Executive director is Gen. Chuck Boyd, USAF (Ret.).

came from a defense reform initiative that looked for ways to eliminate duplication and save money, funds for the agency are likely to increase in coming years, said officials.

"This is likely to be, and I'm sorry to say it, a growth industry in the Department of Defense—finding ways to mitigate the spread of dangerous technologies, finding ways to contain the proliferation of weapons to other countries, finding ways to lower the threat to the United States and to our allies" said Deputy Secretary of Defense John J. Hamre.

#### USAF Wants Weapon to Hit Chem, Bio Plants

The Air Force plans to spend

\$16 million over nearly four years to develop a conventional warhead tailored to destroy chemical and biological warfare production facilities.

The program could eventually lead to the production of 10 weapons for operational use, said a notice in the Sept. 9 *Commerce Business Daily*.

Air Force officials said that they want the new warhead to be compatible with a wide range of existing munitions, from the AGM-130 standoff weapon to the GBU-24 bomb. It is intended to create widespread physical damage to factories, said the CBD notice, while limiting collateral damage from released agents. Neutralizing chemicals or high heat from incendiary blasts might be ways of reaching this goal, according to the Air Force, although several techniques may have to be combined before a satisfactory result is achieved.

#### USAF Announces Promotion Policy Change

The Air Force leadership has approved two changes in the Belowthe-Promotion-Zone program for officers.

For majors, below-the-zone promotions will be eliminated. For lieutenant colonels, BPZ opportunities will be increased, beginning with 1999 boards.

The reason for the change is that too many young officers were spending too much time focusing on and worrying about BPZ chances.

Said Lt. Gen. Donald L. Peterson, USAF deputy chief of staff for personnel: "The problem is that even though the number of officers who get promoted BPZ to major each year is less than 2 percent of the eligibles, many officers have concluded, quite erroneously, that success as an Air Force officer can only be measured by BPZ promotion—and the earlier the better. ... We need to refocus on what's really important: development as officers in a career field."

Before the change, up to 5 percent of the total positions available on the majors' boards could go to Belowthe-Promotion-Zone fast burners. Now the whole promotion quota will go to those in and above the promotion zone.

Up to 7.5 percent of the slots open to lieutenant colonel boards previously went to BPZ. That will now increase to 10 percent. The Belowthe-Promotion-Zone allocation for colonel will remain at 15 percent.

#### **THAAD Safe—For Now**

Despite its string of test failures the Theater High Altitude Area Defense missile is not going to be killed at least, not yet.

That is what Deputy Defense Secretary John J. Hamre told lawmakers who support the program in a meeting on THAAD's future this fall.

The US indisputably has to have something with THAAD's capability, said Hamre. The question is, what is the best way to obtain it?

Defense officials are now studying three options for THAAD, Hamre said.

The first is to go ahead with the test program as planned and hope that more stringent ground examinations will prevent the glitches that



## Now the Information Age has a military installation. www.att.com/mil

Point, click, and you're in command. Our new Web site is your worldwide link to all the latest helpful information we provide to all military personnel and their families. It also gives you the ability to create personal Web pages and community centers via chat rooms and bulletin boards. We built it just for you. So check it out and let us know how you like it.

Wherever you're stationed, we stand ready to serve.<sup>™</sup>

It's all within



your reach.

#### Aerospace World



The Joint Strike Fighter X-32A concept demonstrator moved closer to completion as Boeing employees prepared the first composite wing skin for shipment to its final assembly plant in Palmdale, Calif., in November. Boeing is competing to build the JSF under a joint-service concept demonstration contract.

#### Slow Down to Speed Up

The following comes from Air Force Doctrine Document 2-2, "Space Operations," released Aug. 23, 1998.

"It sounds odd, but it is true for a satellite in orbit. How quickly a satellite circles the Earth is determined *only* by its altitude—high altitude circuits take longer to complete than low ones. Any attempt to 'speed up' a satellite by applying more thrust will only push the spacecraft out to a higher orbit, thus increasing the orbital period (the time it takes to circumnavigate the globe).

"To shorten the orbital period, the satellite must be allowed to fall into a lower orbit, which requires braking (usually by firing a propulsion motor in the direction of flight). Satellites in Low Earth Orbit will complete more frequent revolutions around the Earth but cannot 'linger' over any particular point. To cause a satellite to appear to stand still when seen from the Earth requires pushing the craft out to Geostationary Earth Orbit—a geosynchronous orbit 22,300 miles directly above the equator (a difficult proposition in terms of fuel costs).

"Satellites that orbit at that altitude but are not directly above the equator will appear to make figure eights from center lines over the equator. The 24-hour orbital period of any geosynchronous orbit corresponds precisely with the time it takes the Earth to rotate once on its axis."

## **Senior Staff Changes**

CHANGES: Brig. Gen. Craig R. Cooning, from Dir., Contracting, AFMC, Wright-Patterson AFB, Ohio, to Prgm. Dir., MILSATCOM Jt. Prgm. Office, AF Prgm. Executive Office, Asst. SECAF for Acq., Los Angeles AFB, Calif. ... Brig. Gen. Paul W. Essex, from Cmdr., 92d ARW, AMC, Fairchild AFB, Wash., to Dep. Dir., Reaction Force, Allied Central Europe, NATO, Kalkar, Germany ... Brig. Gen. Joseph B. Sovey, from Prgm. Dir., MILSATCOM Jt. Prgm. Office, Asst. SECAF for Acq., Los Angeles AFB, Calif., to Dir., Special Projects, SECAF, Pentagon ... Brig. Gen. Bruce A. Wright, from Cmdr., 35th FW, PACAF, Misawa AB, Japan, to Dep. Dir., Info. Ops., Pentagon.

SENIOR EXECUTIVE SERVICE CHANGES: Lawrence B. Henry Jr., to Dep. Administrative Asst., Office of the Administrative Asst., Pentagon ... Patricia Kirk–McAlpine, to Dir., Contracting, SMC, Los Angeles AFB, Calif. have dogged past launches. The second is to build a new batch of test missiles, under more exacting quality control conditions. The third option is to meld THAAD with a Navy Theater Wide program, a seaborne high altitude missile defense effort, by developing a common interceptor.

#### Iran and Nuclear Weapons

Iran could be able to deliver nuclear weapons within five years, according to Marine Gen. Anthony C. Zinni, the senior US commander in the Persian Gulf region.

"If I were a betting man, I would say they are on track, [and] within five years they would have the capability," said Zinni, who is commander in chief of US Central Command.

Zinni called worrisome Iran's program to develop nuclear weapons and the means to deliver them, particularly given India's and Pakistan's move into the nuclear club this year.

In addition, Iranians have learned from the Gulf War and developed an "asymmetrical" naval force that might be difficult for the US fleet to deal with, said Zinni. The revamped Iranian navy depends on fast-attack patrol boats, accurate anti-ship missiles, and mine-laying submarines.

In the long run Iran "will be a more significant problem than Iraq," said Zinni.

While there are moderate elements in Iran, such as President Mohammad Khatami, hard-line elements in government continue to resist reforms, said Zinni in an Oct. 21 session with reporters.

"If hard-liners stay in charge, we're going to see ... a country that has weapon-of-mass-destruction capability, a country that still supports terrorism, a country with hard-liners and extremists in charge. That would be difficult," said the USCENTCOM chief at a meeting with reporters.

On reported congressional plans to spend almost \$100 million on military efforts by Iraqi exile groups, Zinni was less than enthusiastic. "I don't see a lot of viability in the [Iraqi] opposition groups," he said.

#### Two Die in F-15E Crash

Two officers from the 366th Wing, Mountain Home AFB, Idaho, were killed Oct. 21 when the F-15E they were flying crashed near McDermitt, Nev., 80 miles southwest of the base.

They were Lt. Col. William E. Morel III and Capt. Jeffrey K. Fahnlander.

The aircraft was assigned to the 391st Fighter Squadron at Mountain Home. The officers were on a night flying training mission at the time.

A safety board is investigating the accident.

#### Lax Accounting Costs DoD

Loose accounting controls are costing the Pentagon millions in fraud and theft, Sen. Charles E. Grassley (R–Iowa) said Sept. 27.

"It's a story about the complete and utter breakdown of financial controls within the Department of Defense," said Grassley.

Releasing a series of General Accounting Office studies on the subject, Grassley highlighted a case in which a low-level accountant at an Air Force base in Texas set up a dummy company, forged vouchers and certifications, and stole \$2 million. Neighbors noticed his lavish lifestyle and turned him in.

Solutions, said Grassley, might include revising vendor payment system access levels and reducing the number of employees with access to the vendor payment system.

#### **News Notes**

On Oct. 1 the Confederate Air Force inducted the second set of honorees for the new American Combat Airman Hall of Fame. Inductees were Maj. Gen. John R. Alison, USAF (Ret.); Col. Rex T. Barber, USAF (Ret.); Brig. Gen. Robert E. Galer, USMC (Ret.); Maj. Jack Ilfrey, USAAF; Col. Walker "Bud" Mahurin, USAF (Ret.); Col. Robert K. Morgan, AFRES (Ret.); and Torpedo Squadron Eight Crew of TBF Avenger BuNo 00380. Unit recognition went to the American Volunteer Group.

NASA turned 40 this year. Congress and President Dwight D. Eisenhower established the National Aero-

#### Pay Up, He Explained

Defense Secretary William S. Cohen delivered the following statement to reporters on Oct. 30, 1998, shortly before he embarked on a week-long tour of Asian nations.

"We believe nonetheless that, in spite of these [economic and financial] problems, Japan and South Korea are still committed to providing the kind of support that is necessary to make sure that their forces are fully capable of defending themselves. ... We also have to remind these countries, South Korea and Japan, that we still fully expect hostnation support, even given the tough times that they have."

#### **Trouble Time in the Tank**

The fall of 1998 was not an easy time for the Joint Chiefs of Staff. Powerful members of Congress all but accused the top uniformed officials of the US military of lying to them about the state of armed forces readiness earlier this year. Meanwhile, reports that the service chiefs were not in the loop when it came to picking potential strike targets in Afghanistan and Sudan raised painful memories of the White House-directed bombing campaigns of the Vietnam War.

The furor over US readiness centered on the relatively upbeat reports the chiefs gave to Congress in testimony earlier this year. At that time, JCS Chairman Army Gen. Hugh Shelton said, "We are fundamentally healthy." Gen. Michael E. Ryan, head of the Air Force, told a Senate panel that "we think we have the right balance" between readiness, modernization, and operations spending. The other chiefs gave similar assessments.

This fall, only a few months later, the chiefs were telling a different story. After a summit with Administration officials to lay out readiness concerns, Shelton spoke for all of them when he testified that "our forces are showing increasing signs of serious wear."

Several senators complained that the chiefs must have known that readiness was a problem in the spring, and that by waiting to announce that fact they had made it impossible to fix it within the normal budget process.

"This is an almost Orwellian experience for me," said Sen. John McCain (R-Ariz.), a member of the Senate Armed Services Committee and a leader of the critical lawmaker group. "Last February ... you came before this committee and gave a dramatically different view of readiness and the requirements that the military needs to maintain our capabilities."

The nation's military leaders, for their part, denied that they had kept quiet about developing problems. Readiness trend lines worsened considerably during 1998, said JCS chief Shelton. He said that the fundamental conclusion presented earlier in the year—that the military remains fully capable of executing the national military strategy—still stands.

"With an acceptable risk," added Shelton, "the risk having gone up."

With respect to Afghanistan and Sudan, the service chiefs appeared to have been deprived of any substantial role, informal or otherwise, in the choice of possible bombing targets or the weapons and tactics to be used in the attacks, according to news reports.

Traditionally, top defense officials would present a range of target options for the White House to choose from, but this procedure has been circumvented. Pentagon officials complain that this has led to some poor decisions, such as mismatches between the type of warheads assigned to some targets and the type of blast necessary to destroy them.

On this issue, former naval aviator McCain weighed in on the side of the uniformed military. "If it's true, it's very disturbing," he said.

nautics and Space Administration on Oct. 1, 1958, largely as a Cold War response to Soviet spaceflight progress.

■ Vance AFB, Okla., recently played host to an Air Force first when the 71st Flying Training Wing became the service's first wing to lease computers. The leased equipment, which includes laptops, servers, printers, and software, will provide greater standardization and more power than equipment purchased piecemeal, said officials.

Nominee Richard Danzig was scheduled to take over as Secretary of the Navy from John H. Dalton at a Nov. 16 ceremony.

■ A congressional cut of \$25 million from the Airborne Laser's requested budget of \$292 million will result in delays of six months to a year in some parts of the weapon's development, Col. Michael W. Booen, program director, said Oct. 1. • On Oct. 5, Whiteman AFB personnel and the US Department of Agriculture Wildlife Services began efforts to move a roost of more than 100,000 blackbirds which threaten flying operations safety at the Missouri installation. The effort uses various nonlethal harassment efforts, such as propane cannons, pyrotechnics, sirens, horns, and distress-call tapes.

The Defense Courier Service, which delivers highly classified material under physical escort, was reassigned to Air Mobility Command on Sept. 30. DCS had been under the wing of US Transportation Command since 1994.

The Congressional Budget Office recommended canceling the DarkStar stealthy Unmanned Aerial Vehicles and investing more money in Global Hawk long-range UAVs in a report released during the first week of October.

#### Aerospace World



SSgt. Ronald Martinez and MSGt. Errol Stewart drag TSgt. Marie Mohammad on a litter through an obstacle course during Top Dollar '98. An Air Force Space Command team from Malmstrom AFB, Mont., won first place in the four-day competition to determine USAF's best comptroller and contracting team.

■ Firebee drones, outfitted with sensors and other equipment already in the Air Force inventory, could be an effective in-theater defense against attacks by cruise missiles, according a study done for the Pentagon's Defense Advanced Research Projects Agency.

The May 13 crash of an F-16C from the 185th Fighter Wing (ANG), Sioux City MAP, Iowa, was caused when five American White Pelicans struck the aircraft, according to a newly released accident report. The plane's pilot, Lt. Col. David E. Lund-quist, ejected safely but sustained major injuries from the impact of the birds.

Two F-4Fs from Holloman AFB, N.M., collided in midair while on a training mission Oct. 14. Aircrew from one aircraft ejected safely. The other aircraft landed safely at Holloman.

On Oct. 19, the Supreme Court declined to hear arguments against the military's "don't ask, don't tell" ban on homosexuals. It was the fourth time the nation's highest court has rejected such a request.

■ The Air Force has determined that several 55th Wing support functions at Offutt AFB, Neb., qualify for conversion to all-civilian workforces. The wing is studying 1,609 positions in civil engineering, transportation, and supply, among other work centers, with a conversion goal of early 2001.

 On Sept. 29, 30 House members sent President Clinton a letter urging him to remove the "acting" from acting Air Force Secretary F. Whitten Peters' job title. "Mr. President, our Air Force needs a leader. In acting Secretary Peters they already have a good one. We respectfully request you nominate him quickly to serve as Secretary of the Air Force," said the letter.

■ Due to declining costs, the cash clothing replacement allowance used by enlisted personnel to defray uniform expenses has been lowered. The basic allowance (for members with three years of service or less) is now \$187.20 annually for men and \$212.40 for women.

The US military does not need all the C-130s that Congress forces it to buy, said Secretary of Defense William S. Cohen in a letter to Congress this fall. Seven such planes were added to the budget this year, over DoD objections, at a cost of some \$400 million.

#### Obituaries

Clark M. Clifford, Secretary of Defense at height of the Vietnam War in the late 1960s, died Oct. 10 at his Bethesda, Md., home. He was 91.

Born in Kansas and educated in St. Louis, the smooth power lawyer virtually defined the role of Washington insider for more than four decades. He began his long association with power as a young White House naval aide in 1944. He became a speechwriter and later special counsel for President Harry S. Truman and helped articulate the Truman Doctrine of resistance to communist expansion in Greece and Turkey. He later served as personal lawyer to President John F. Kennedy, defense chief to President Lyndon B. Johnson, and trusted advisor to President Jimmy Carter.

He said he was proudest of his efforts to extricate the US from Vietnam when he ran DoD after Robert S. McNamara's departure in late 1968 and until Johnson left office in early 1969.

Retired **Col. Glenn E. Duncan**, a World War II Army Air Forces ace, died in Niceville, Fla., July 14.

During World War II, Duncan served as commander of 353d Fighter Group, based in Britain. He is credited with 19.5 kills of airborne German aircraft and destruction of nine planes on the ground. Shot down over Germany during a low-level attack, he made it to Holland and safety without being captured.

### **Index to Advertisers**

Air Time	Insert
AT&T	
Bell Helicopter.	
Boeing	
Chase Durer	Cover III
L–3 Communications	
Motorola	
PC Express	
Pratt & Whitney	
Pratt & Whitney Teledyne Brown	Cover II
AEF's 50th Anniversary Art Collection	
AFA Long Term Care	
AFA Specialty Items	
Industrial Associates	
Video on the History of USAF	

## Verbatim

#### **Overseas Presence**

"In past years, USAF has tended to pay less attention to overseas presence than did the Navy. The emerging situation [in regional theaters] suggests that USAF should broaden its thinking in this arena. USAF forces may at least be required to perform a host of new missions in outlying areas. Beyond this, USAF forces may come to play a larger role in overseas presence than is the case today, and its overseas deployments may increase.

"Alternatively, other services may experience declining overseas commitments in ways that shift the spotlight toward the Air Force. If the future emphasis of overseas presence is to be quick power projection, USAF forces are clearly well-suited to playing a major role. Thus, the future agenda for US overseas presence offers the Air Force important opportunities if it is willing to rise to the challenge.

"How could the future agenda affect specific USAF plans and programs? ... [F]uture requirements for stationing US forces overseas could necessitate more than the 20 fighter wings now in the USAF posture. ... [N]ew or expanded overseas air bases and infrastructure may become critically important in the coming years. ... [F]uture overseas missions may place a greater premium on long-range operations."

From a November 1998 RAND study, "Changes Ahead: Future Directions for the US Overseas Military Presence," by Richard L. Kugler.

#### **Powder Keg**

"For many Russians, angst about their future is compounded by suspicion about the US' strategic intentions. The Russian press has carried numerous articles suggesting that, under the guise of "partnership," the US is pursuing a hidden agenda not only to keep Russia weak but to bring about its fragmentation. ...

"Nothing could be further from the truth. The US supports a unitary Russian state, within its current borders. The violent breakup of Russia would be immensely dangerous and destabilizing. When Czechoslovakia split in two in 1992, it was called the velvet divorce. But multiple divorces among, and perhaps within, the 89 regional entities of Russia would almost certainly not be velvet. The horror that has unfolded over the past several years in the Balkans might be replayed across 11 time zones, with 30,000 nuclear weapons in the mix."

Strobe Talbott, deputy secretary of state, in a Nov. 6, 1998, speech at Stanford University, Palo Alto, Calif.

#### What He Was After

"At various times from at least as early as 1993, Osama bin Laden and others, known and unknown, made efforts to obtain the components of nuclear weapons. ... At various times from at least as early as 1993 Osama bin Laden and others, known and unknown, made efforts to produce chemical weapons."

From text of a Nov. 5, 1998, federal indictment returned in New York against Saudi terrorist leader Osama bin Laden.

#### We Know the Feeling

"It is astonishing, as well as dismaying, that some of our national custodians feel morally impelled to impugn American science in the public's eye. ... Professor Gerald Holton, physicist and historian of science at Harvard University, [has] described how the Smithsonian Institution blindsided the American Chemical Society. This affair had received far less publicity than the notorious Enola Gay exhibit at the National Air and Space Museum. ... But, in many ways, it is a more telling example of the kind of politics that seems to predominate at the Smithsonian.

"In 1989 ... the ACS commissioned the Smithsonian's National Museum of American History to design a permanent exhibit on 'Science in American Life.' The ACS scientists naturally expected an exhibit celebrating the triumphs of American science and did not imagine that this needed to be spelled out in the contract. Five years and \$5 million later, what the scientists got was an exhibition that presented American science as a series of moral debacles and environmental catastrophes: Hiroshima and Nagasaki, *Silent Spring*, Love Canal, Three Mile Island, and the explosion of the space shuttle."

*"Fleeing Science and Reason," by Christina Hoff Summers, in the September/October* The American Enterprise.

#### **Frequent Resort**

'Our credibility in dissuading ... rogues from attacking our interests, from developing and then using nuclear, chemical, and biological weapons, is diminishing before our eyes and the eyes of the world. ... Ironically, the lack of a strong military leads only to its more frequent use. The Reagan Administration sent forces abroad 18 times to tamp down crises: the Bush Administration, 14 times. So far in the Clinton Administration, ... forces have been deployed some 50 times. These are costly deployments. Haiti alone cost \$2 billion. Bosnia is well over \$9 billion per year by the most conservative accounting and still climbing."

John F. Lehman Jr., navy secretary 1981–87, writing in the October 1998 American Spectator.

#### **Cruising With Clinton**

"When US leaders who are ill at ease with US power hear the word 'duty,' they reach for their cruise missiles. Those weapons provide telegenic, antiseptic action-at-a-distance. They make possible illusory decisiveness, without follow-through. The Clinton Administration has used them as a substitute for serious policy regarding Iraq and terrorism. Now cruise missiles may be fired to express ersatz seriousness about Serbia's actions in the province of Kosovo. Someone the New York Times identifies as 'a senior Administration official who requested anonymity'-one can see why-said, 'We are at last serious.' ' Political commentator George F. Will, writing in the Oct. 10, 1998, Chicago Sun-Times.

Air Expeditionary Forces are extending the concept of long range airpower.

# The Long Rea

Armed for bear, twc F-15Es and a B-1B from the 366th Wing at Mountain Home AFB. Idaho, head out on a quick-reaction mission. The AEF concept is recasting traditional notions of long range airpower.

# ch of On-Call Airpower

By John A. Tirpak, Senior Editor



Bombers once defined strategic airpower—nuclear or conventional—but they are becoming more integrated into the "deploying" force. Here, a B-52H tanks up from a KC-10 en route to Diego Garcia.

S wIFTLY delivering fire and iron on distant targets constitutes a signature capability of the Air Force. Not long ago that capability—requiring speed, mass, and long reach was seen as residing primarily in the fleet of heavy bombers and fighterbombers. These long-legged aircraft continue to play a vital role, but Air Expeditionary Forces have broadened and deepened the concept of long range airpower.

Through AEFs, USAF is working to revolutionize the way it responds to crises. The national military strategy requires the US to be able to fight and win two Major Theater Wars that might occur at more or less the same time. Much of the responsibility for carrying out this task—especially in the early going—would fall on the Air Force.

The Pentagon's Quadrennial Defense Review in 1997 said that the power to rapidly halt an enemy's advances short of objectives in two theaters in close succession is "absolutely critical" and that "failure to halt an enemy invasion rapidly can make the subsequent campaign to evict enemy forces from captured territory much more difficult, lengthy, and costly."

The "halt phase" is the focus of much AEF planning.

Speed is of the essence in this strategy, and Air Force officials have spent the last few years refining the way that the service will meet the test. The challenge is twofold: Be able to arrive quickly, ready to fight. Then, be able to follow up the initial blows with attacks that can be sustained for as long as it takes to do the job.

#### **Global Power Missions**

In a part of the world in which no air units already have been put in place, heavy bombers would still provide the fastest response to aggression. USAF's B-1B, B-2A, and B-52H bombers, from a cold start at their home bases in the continental United States, could attack virtually anywhere on Earth in 18 hours.

The heavy bombers, armed with new types of munitions that could destroy hundreds of armored targets on a single pass, would be able to stop an enemy column on the march and, armed with new precision weapons, destroy time-critical enemy command-and-communications nodes, infrastructure, and other targets.

Lt. Gen. Ronald C. Marcotte is the commander of 8th Air Force, headquartered at Barksdale AFB, La., which is responsible for all USAF bombers. He said that the crews of all three types of heavy bombers practice such Global Power missions on a regular basis. The 30-to-40-hourlong missions entail a launch from the continental US, flight to a spot halfway around the world, and a return to home base.

According to Marcotte, the Air Force's bomber force could sustain these kinds of missions, at a high sortie rate, for weeks, if need be. The bomber fleet practices "all options" with regard to how they may be used in combat, added Marcotte, who noted that bomber employment is very "scenario-dependent." Missions are affected by "availability of the forward operating location, type of bomber available, ... and other factors," he said. "Obviously, if you forward locate, it improves the sortie rate [and] you can react much more quickly."

Increasingly, that's just what is happening.

The force of heavy bombers, which during the Cold War focused heavily on nuclear operations and had limited involvement in planning for conventional operations, more and more is being integrated with other kinds of theater forces, particularly in AEFs. This has been done to help coordinate attacks and to make the most effective use of the bombers' greatest assets—huge payload, high speed, long range, and, in the case of the B-2, stealth.

According to Marcotte, bomber officials still pay "very close attention" to the nuclear war commitment. Beyond that, he said, learning to operate within AEFs is "the No. 1 priority for the foreseeable future." This is, he added, "the focus of what we do."

#### "In Your Face" Airpower

This step is favored by Gen. John P. Jumper, currently the commander of US Air Forces in Europe but also viewed by many as the father of the AEF concept. According to Jumper, heavy bombers at home station, ready to attack anywhere in the world, are an impressive strike instrument sure to provide some degree of conventional deterrence, but the forward deployed AEF, possibly including bombers, provides a more immediate, "in your face" deterrent.

As a package of airpower tailored to the situation at hand, the AEF can be deployed quickly to show that the US is "willing to put aircraft forward ... on the ground, to share risk with a nation under duress," Jumper explained.

With some mixture of fighters, attack airplanes, heavy bombers, tankers, airlifters, air defense suppression airplanes, and other types, an AEF can deploy to a forward base, arm airplanes, and strike enemy targets in force within a few

AIR FORCE Magazine / December 1998

days. The AEF's first bombers could hit targets within 24 hours, but fighters could deploy and do the same within 48 hours, according to the Air Force. Such quickness begins to put a fighter-heavy AEF on a par with bombers alone for speed of response.

Success can be attributed in part to successful change in the fleet of heavy bombers. The bomber force, once thought too dependent on extensive home support facilities, has demonstrated that it, too, can be a deployable force, Marcotte asserted.

"We've proved, of course, that we can forward deploy," he said, citing recent B-52 short-notice excursions to Diego Garcia, B-1B deployments to Bahrain, and the B-2 exercises in Guam. The B-2 deployments were particularly important, having disproved claims of critics that the B-2's exotic stealth materials couldn't be maintained in an austere, forward location.

Marcotte said that the deployments have been learning experiences, which have helped identify which support items must go forward with the airplanes and what can safely be left behind. In addition, "we've done site surveys at our most likely deployment locations" to determine what items will need to be pre-positioned for future deployments.

Their range also gives the bombers the option of either staying home, going forward, or heading to some intermediate location, depending on The Panel to Review Long Range Airpower, headed by former Air Force Chief of Staff Gen. Larry D. Welch, struck a nerve last spring with its observation that the Air Force has no plan for long range airpower beyond upgrades and modifications to the existing fleet.

As a result of the Welch panel's report, Congress ordered the Air Force to prepare a bomber roadmap and hand it over to lawmakers next spring.

Air Force Chief of Staff Gen. Michael E. Ryan said the lack of a bomber roadmap was not an oversight by the service. It was premature, he said, to look to the next aircraft while introducing a brand-new bomber with unprecedented capabilities, especially given the uncertainties over whether the B-2 line would be reopened. Several intervening studies about bomber and munitions requirements further delayed the process of "looking at the next generation, 20 to 30 years away."

The bomber roadmap will include "munitions, capabilities, bombs on the airplanes, and future requirements for long-range aircraft," Ryan said. The roadmap will tell whether "there's a B-3 out there someplace."

"Sometimes time is of the essence," Ryan said, "either from a reconnaissance standpoint or a force application standpoint. And if you have something that positively has to be there overnight, I think we need to look at faster ways to do it."

Ryan said his "gut" feeling is that the requirement will be stated as "rapid response at intercontinental ranges," suggesting the next craft to do the mission might be a hypersonic craft, a spaceplane or transatmospheric vehicle.

Whether that means a spaceplane or a B-3 or smaller aircraft with long range "doesn't make any difference," Lt. Gen. Ronald C. Marcotte, 8th Air Force commander, said. "It's the concept of Global Reach, Global Power."

the sensitivity of the situation, Marcotte said.

#### Making a Statement

The typical AEF is made up chiefly of fighter airplanes, which can be portrayed as a defensive instrument. Bombers make a "more overt, aggressive political statement," he observed. Besides political considerations, bombers might need a different operating location because of their need for more ramp space.

Current Air Force plans call for organizing and keeping ready two



Leave it home: AEFs are trying to deploy with fewer and fewer people, to save airlift, save time, and reduce the strain on the force. "Reachback" to Rear Air Operations Centers offers real-time answers from the real experts.

AEFs at all times. Most of the time, one would be deployed forward to some austere site and one would be on-call in the United States for any contingency that might occur. If it were necessary to deploy both AEFs, a third would be formed up and made ready.

Because of the critical requirement for deployment speed, the Air Force has looked at any and all means to whittle down the size of its deploying units. Only a bare minimum of spare parts, maintenance personnel, force protection assets, and crews go on a deployment. This practice not only reduces the number of cargo transports necessary to move an AEF inherently reducing the scope of the deployment and the time needed to do it—but it also reduces the turbulence in the force by reducing TDY.

Jumper does not think the Air Force has reached the limits of compression. He envisions the typical future AEF as being a minimalist force, "living under the wing" at a barebones runway, able to get in and when the mission is over—out within hours. It's a job the Air Force actually did very well in the 1950s, he remarked, and he's anxious to restore USAF's proficiency.

The Air Force believes that the whole force needs to be lighter, leaner, and more lethal, if it is to do its job properly in the years ahead. Jumper maintains that, in an ideal world, an AEF commander—or a Joint Forces

#### **Deterrence and Contingency Operations**

Information, Surveillance, and Reconnaissance. Increase situation awareness, tailor operations tempo, gain information superiority, and improve responsiveness. ISR assets can help deter an aggressor by letting him know the US is interested and watching closely.

Show of Force. Highly visible deployment of aerospace power on short notice can deter crisis. Example: Dispatch of an AEF to Kuwait in 1997, which deterred hostile Iraqi actions.

Forced Entry. Establish local air superiority to permit injection of ground or naval power or aerospace power directly to restore stability. Example: Operation Just Cause in Panama in 1989 featured forced entry airpower delivering surface forces.

Aerial Occupation. Employ air and space forces to prevent hostile forces from operating effectively in specific areas. Example: No-fly zones established over Iraq following the Gulf War.

Raids. Rapid projection of aerospace combat power into hostile space to secure information, confuse the enemy, or attack key targets. Example: 1981 Israeli airstrike against Iraq's Osirak nuclear reactor.

Coercion. Deterring an enemy from performing hostile action or compelling an enemy performing such an action to cease. Example: Operation Deliberate Force in 1995 to force Bosnian Serbs to remove heavy weapons from designated exclusion zones.

-From Air Force Doctrine Document 2, "Organization and Employment of Aerospace Power," September 1998.

Air Component Commander, in a Smaller-scale Contingency or Major Theater War—would deploy to the war zone carrying little more than a small man-portable satellite dish, a laptop computer, and a printer.

With this goal in mind, the Air Force recently conducted Expeditionary Force Experiment 98, the first of what is planned to be many annual lab sessions for creating the force of the future. The goal is to sharpen the emphasis on moving forward only what is absolutely necessary—and getting even greater effectiveness out of what does move forward.

#### The Power of Reachback

Numerous experiments were carried out in EFX 98, run in September at Eglin AFB, Fla. Eglin stood in for an airfield in an allied country under attack. A major goal was to see how small and light the Air Force could make the forward Air Operations Center—which manages air tasking orders, passes intelligence, and coordinates US and allied forces. To run the AOC, only 115 commandand-control personnel deployed forward with the AEF commander, Lt. Gen. Lansford E. Trapp Jr.

However, they had some assistance, acquired courtesy of a concept called "reachback." Supporting them were about 300 people at a Rear AOC established at Langley AFB, Va. Using video teleconferencing, the Internet, radios, telephones, and other means of data transfer, the forward-based people could see and hear their counterparts at Langley and from there, could "lay hands on" and "reach back" to get the best subject matter experts all over CONUS, according to Lt. Col. Rocky Kimpel, deputy director of EFX 98.

Kimpel noted that the 1991 Persian Gulf War required the management effort of nearly 2,000 people based in Riyadh, Saudi Arabia. It would be "a nightmare" if, in a similar conflict, a large forward-based AOC took a hit from a missile or car bomb, which would effectively decapitate the allied war effort, Kimpel noted. The Gulf War AOC was underground and well-protected, but in other theaters, such facilities might not be available. A smaller AOC, backed up by the Rear AOC at Langley, is easier to hide, protect, move, and reconstitute, if necessary, he said.

The Rear AOC at Langley can accommodate hundreds of terminals in a building reminiscent of NASA's mission control in Houston, and the parking lot outside has been wired with cables and electrical lines so that the facility can be expanded with tents and trailers in a real war.

Not only does employing reachback sharply reduce the amount of cargo and people that must be airlifted forward, but many people who otherwise would have to deploy can stay at their home base. This reduces the stress of deployment on individuals, allowing them to work from a place where everything they might need to give the full answer is at their fingertips.

In remarks to reporters as EFX 98 was wrapping up, Gen. Michael E. Ryan, USAF Chief of Staff, said that the "distributed" command-and-control effort worked "in some cases ... very, very well."



The mix in any given AEF will depend on the mission, but the No. 1 rule is to get out of town fast. The Air Force is becoming proficient at deploying a fighting force forward and being ready to put iron on target within 48 hours.

The impetus for reachback comes from several sources. First, the world is witnessing a boom in telecommunications high technology, making the systems of Gulf War vintage seem almost primitive by comparison.

More important, however, is the changed operational outlook. Gen. Richard E. Hawley, commander of Air Combat Command, pointed out that the Persian Gulf buildup was a huge logistic effort that took a long time to get forces in place and operational. "In the world we're looking at," said Hawley, "we think we'll have to be more agile than that and must be able to set up a commandand-control capability to employ aerospace power on very short notice."

That's why the reachback concept is so important, said Hawley. Instead of deploying thousands of people and tons of equipment, small bits and bytes of information will move between command centers.

The concept of reachback gets major attention in the Air Force's new operational doctrine manual, "Organization and Employment of



Regional CINCs are warming up to the AEF, coming to count on USAF to provide almost overnight, sustainable airpower. Here, an F-117 on a recent deployment to Kuwait is towed past its Gulf War handiwork.

Aerospace Power," published this fall. It stated, "Reachback, for both additional forces and materiel, will become increasingly important for reducing the deployment footprint, thus preserving critical lift."

#### **War-Winning Operations**

**Destruction.** Maximum long-term damage to targets such that the enemy cannot recover in immediate future or for the duration of the conflict. Example: Operation Desert Storm.

**Disruption.** Temporary incapacitation of enemy strength, preventing deployment of assets. Example: 1944 Allied air attacks on Panzer division trying to contain Allied landings in France.

**Diversion.** Attacks against targets that compel an enemy to shift forces from offensive to defensive duties. Example: World War II strategic bombing campaign against Germany.

Delay. Direct or indirect attack on advancing or retreating enemy forces to slow or stop their movement. Example: Fall 1950 USAF air interdiction campaign that lengthened amount of time for North Korean troops to reach the Pusan perimeter.

**Deception.** Actions to mislead an enemy about operations. Example: Operation Bolo in 1967, when USAF F-4s, masquerading as F-105s, lured North Vietnamese MiG-21s into battle and defeat.

Halt. Combination of destruction, disruption, diversion, delay, and deception that denies an enemy the ability to employ his forces in an offensive. Example: Israeli air attacks that stopped Syrian offensive on Golan Heights in 1973 Mideast War.

**Deployment/Sustainment.** Interruption of a commander's ability to conduct operations over time. Example: World War II Allied air interdiction that prevented German Field Marshal Erwin Rommel from obtaining reinforcements and resupply.

Information Operations. Both air and space reconnaissance and surveillance to provide accurate information to US planners or information warfare. Example: Operation Desert Storm, in which Iraqi air defenses were blinded and communications destroyed.

-From Air Force Doctrine Document 2, "Organization and Employment of Aerospace Power," September 1998.

#### En Route Planning

EFX 98 also spotlighted another "get-fast" initiative—en route planning. The experiment, in fact, began on the run. The AEF commander, Trapp, deployed immediately following the "go" order, using USAF's Speckled Trout electronics experiment airplane as a kind of flying AOC.

Trapp was able to stay in constant contact with all his forces during his transit time, which he used for evaluating targeting information, issuing orders, and crafting the air tasking order. Previously, JFACCs have had largely "dead" time in transit, able to communicate but not do much substantive planning or decision making based on real-time data.

This en route Expeditionary Operations Center was an EFX initiative developed by the operational units and the AEF Battlelab at Mountain Home AFB, Idaho. It provides intelligence and weather analysis, mission planning capability, air defense integration, aircraft status monitoring, and command post functions.

The en route EOC has a "roll-on, roll-off" capability. Built on a standard aircraft pallet, it was loaded onto a specially equipped KC-135R Stratotanker at Mountain Home at the beginning of EFX 98. The aircraft was outfitted with a phased array communication antenna to receive large amounts of data at global distances. Once unloaded, it formed the core of the forward AOC.



A bomber roadmap is to be completed in the spring; it will detail how the fleet will be upgraded with new weapons and capabilities and, ultimately, replaced. The B-2 is not likely to be the last word in intercontinental warplanes.

Similarly, two B-1B bombers took off from Mountain Horne for the notional allied nation, armed for a strike, but without any targeting information. The targeting data were passed to the bombers in transit, and the bomber crews programmed their weapons en route.

However, just minutes before the B-1s were to "release" weapons at previously planned aimpoints, officials ordered changes in the targets and pumped new data into the system. Both airplanes recast their targeting and scored "shacks," or direct hits, on the objectives at Eglin.

In-flight targeting changes were also tested with fighters. Such a capability is vital for rapid response to a fast-changing battlefield or in missions such as Scud hunting.

#### Hacked

Other experiments included information warfare defensive operations. The latter was particularly important—though its conclusions are classified—because an enemy able to cut off the flow of information or corrupting the information being passed back and forth from CONUS could achieve significant disruption of the AEF's operations. Simulated hacking of the system was conducted and studied.

"A lot of these things ... pushed the envelope," Ryan said. However, EFX "gives us a jump start on the next iteration of capabilities" necessary for AOCs and AEFs. Trapp said the exercise was useful in "changing the mind-set" of the Air Force. "Where you're located ... shouldn't matter if you're hooked together through this global grid ... of information," he said.

Nevertheless, he asserted that no one believes the time of running a war by remote-control is at hand. The JFACC needs to see and feel the situation firsthand in order to make good decisions, he said.

How small can a deployed AOC get? The size of the forward AOC, Jumper said, should be dictated "more by the representational requirements—the hand-holding, the presence of the other services, the coalition partners—than by command-and-control requirements."

Ryan said that regional commanders in chief are becoming more accepting of AEFs.

While they would prefer having dedicated forces on hand under their command, USAF is successfully demonstrating that an AEF on call in CONUS is "almost as good" as having one already deployed, Ryan said. "They understand we have worldwide tasking, and ... they go to the head of the list if they have a problem."

Hawley, the ACC chief, said he saw a turning point in the concept of AEFs last summer, when US forces, having quickly deployed to the Persian Gulf region to deal with Iraq's recalcitrance on UN weapons inspections, were ordered home again. A Defense Department spokesman, Hawley recalled, told the national media that the Air Force could return to the Gulf with substantial striking power within 48 hours.

"That tells me that we have gained acceptance, at the senior levels of our government, of our concept of having forces on alert in the States, ready to deploy and respond with meaningful combat power in a short period of time," Hawley asserted. "We think it's the right way to use airpower."

#### What Is Attrition Reserve?

Today, USAF has 196 bombers, 126 of which are available for combat. Others are in test, training, depot maintenance, or the status called attrition reserve.

The attrition reserve was created in the early 1990s as a way to pay for needed upgrades to the bomber fleet. By not flying some airplanes, not buying spares for them, or not assigning f ight or ground crews, the Air Force saved money for upgrading the bombers with new munitions and avionics.

In practice, however, Air Combat Command continues to try to maintain attrition reserve aircraft at the same rates as the combat-coded ones, cycling them n and out of flight status from time to time in order to age the fleet at a uniform rate and to prevent maintenance problems.

As a result of the attrition reserve, as well as shortfalls in funds for operations and maintenance, spares, and ground crews, bomber mission capable rates have fallen.

In Fiscal 1996, 1997, and 1998, bomber mission capable rates averaged 58.2 percent, 58.5 percent, and 56.4 percent, respectively. Worst off is the B-1B fleet, for which the standard is 67 percent; in Fiscal 1998, it averaged 50.9 percent, and the cannibalization rate hit 97 percent. The B-52H averaged 78 percent against an 80 percent standard. No mission capable standards have been set yet for the B-2 fleet, only half of which has been delivered.

ACC plans to "buy back" some airplanes in the attrition reserve, increasing the number available for combat. About 20 B-1Bs are to be returned to full combat status by the end of 2001. The B-2 fleet will gain 12 airplanes for a total of 21— of which about 15 will be ready at all times. Twenty-three B-52Hs are to be retired in the same perioc.

## STE



- JCS-approved as the solution for interoperable secure voice and data communications.
- NSA-certified for operational use.
- In production and available now.
- Certified as the instrument of choice for the Theater Deployable Communications (TDC) Program.



Contact Steve Haas for ordering information and technical data. Tel: 609-338-4942. Fax: 609-338-2741. E-mail: steve.a.haas@L-3com.com Or visit our website: www.L-3com.com/cs-east/programs/infosec/ste.html The USAFE commander talks about air expeditionary operations from foreign bases.

erat

Gen. John P. Jumper is commander of US Air Forces in Europe. Before this assignment, he was deputy chief of staff for air and space operations (1996-97) and commander of 9th Air Force and US Central Command Air Forces (1994-96). He is the principal figure in development of Air Expeditionary Forces. On Sept. 15, he met with the Defense Writers Group in Washington. Here is some of what he said.

#### Access to Overseas Bases

"Any country that is worried about its survival is not going to stall on [granting USAF forces] access [to its bases]. But our job, in the meantime, is to posture ourselves so that our presence is valuable to those who are going to need our help. I'm not sure we have always taken that sort of a look at it before, but this is the way in the new expeditionary air force that we have to think about it.

"We have to think about [the] cultural and diplomatic end of this ahead of the game—that, along with exercises and a helpful presence, [like] some of the sort of things we've done in Bahrain, where we've gone in and helped the F-16 maintenance people and the Bahrain air force achieve new efficiencies that they hadn't been able to do before in the maintaining of the airplane.

"This is very valuable to them. Little things like that make you valuable to a country."

#### **Missile Threat to Access?**

"In the short term, ... I don't see the numbers of missiles out there that would be able to take out ... an airfield [being used by USAF units]. We struggled for years in the Cold War [to develop means for] taking out Warsaw Pact airfields and finally decided [that], with all the might of the United States—[using] conventional weapons—you really can't do it.

"With a few Scuds, can you take out an airfield? No, you cannot. You can contaminate with chemical weapons, but that is what we practice for."

#### **Dealing With Chemical Attack**

"We were vulnerable to it during the years of the Cold War. We practiced the art of doing our business in

AIR FORCE Magazine / December 1998

# Abroad

chemical protection suits the whole time, for 30 years, that I [have been] in the Air Force. When I was a wing commander at Eglin AFB [Fla.] in 1988, we practiced generating airplanes in chemical gear. I'd prefer to forget those summer days in chemical gear, but the fact of the matter is that all services have practiced doing these sorts of things through the Cold War."

#### Defending US Access

"None of the [US armed] services are sitting still and quietly watching other nations build missiles and not [doing] anything about it. Just like any other threat that emerges, yes, we are dealing with this. ...

"Now the question is, how do you defend yourselves against this sort of missile problem? ... Is it an easy problem? No.

"The policy of this nation is that we are going at it from many different directions, through the technologies being built [for] theater missile defense and offense, to include the airborne laser. ...

"It is interesting to note that there are technologies that can do things like delimit terrain, even in the desert. If you digitize the terrain and you put the right limits and filters in there, and look at [areas] where [you] could really launch a Scud missile—... places that have access to roads, that have access to good hiding spots, where the terrain meets certain requirements, et cetera—... you'd be surprised at how few places there are.

"It is things like that [which] tell us where to search, where to focus [our] capabilities, where to put [our] Joint STARS search pattern, where to take the picture from the U-2 from many, many miles away, [how] to identify that and take care of it."

#### **Levels of Access**

"The best example [of gaining local access] is Desert Shield. Secretary of Defense Dick Cheney personally went into the area, took irrefutable evidence of a vital threat to the nation [Saudi Arabia], which perhaps at that point was not fully accepted, and received the response, 'We need to go deal with that threat.'

"In NATO, it tends to be different because ... access [and] interoperability [are] the code word[s] of the Alliance. So, when we talk about going into the Czech Republic or Poland or even the Partnership for Peace missions—Bulgaria, et cetera—you are welcome. ... We practice servicing each other's airplanes. Their technicians can work on our airplanes. Our technicians work on theirs. There is a different spirit in the Alliance that gets you around these sorts of problems."

#### **Getting Lighter**

"[The Air Force wants to become] lighter and leaner in the commandand-control world. Those of you who recall the Gulf War [know] we had this compact little package of about 2,000 people that we put down in the basement of the Royal Saudi Air Force headquarters in Riyadh. That is what it took, in those days, to run a 2,000-to-3,000-sortie-a-day air campaign, which is what Desert Storm was.

"What we want to get to is the ability to get that number down [by] orders of magnitude. ... I want the joint force air component commander to be able to deploy forward with an 18-inch [satellite] dish, a laptop computer, and a printer and, if he had to, be able to do his job with not much more than that."

#### Forward to the Past

"The Air Expeditionary Force idea was born of a need to be able to react quickly. It was to get us back to the rapid part of deployment. It is something we actually did very well, back in the mid-1950s. ... In the mid-1950s, [the job of 19th Air Force] ... was to pick up and rapidly deploy anywhere in the world. They did so to Turkey, Lebanon, and other crises around the world. We were very much into the business of light, lean, lethal, rapid deployment.

"The [development of the] AEF was about getting back to that sort of discipline. It put a force on the ground that was a deterrent force that could transition to a fighting force that was small enough to be lethal but not so large that it took away a CINC's ... ability to make a further decision."

#### **Reaching Back**

"Where will this take us in the future? I think it takes us to a place where a lot of the work that we saw done in Desert Storm in the basement of the Royal Saudi Air Force building might be done in some central location like Langley AFB [Va.], where you are doing the data base manipulation, you are doing the computation, and running out the air tasking order—[doing it back here] so you don't have to have all that equipment forward.

"Those people who are living at Langley, helping you fight your war somewhere in the Middle East, are wearing fatigues, and their body clocks are on that other theater's schedule to do that job. They even belong, perhaps, to the person who is deployed forward as the joint force air component commander, but they are doing their job in a place that practices that sort of stuff day in and day out." The land forces believe the decisive defeat of the enemy must occur on the ground. The Air Force believes otherwise.

# Duel of Doctrines

N early 1996, a band of action officers at Air Force headquarters decided that it was time to make a few waves. Their objective was not trivial. These officers—members of the Plans and Operations directorate—elected to protest a blueprint prepared by Army Gen. J.H. Binford Peay III, head of US Central Command, for fighting a major war in Southwest Asia.

At issue was the general's "strategic concept" for his theater, put forth in a paper used as the basis for moredetailed war plans. USCENTCOM circulated a draft, and when the USAF officers read it, they were incensed.

They saw that CENTCOM had propounded a war scenario that closely resembled Iraq's 1990 invasion of Kuwait and threat of an attack on Saudi Arabia. Amazingly, however, Peay postulated that airpower would be *less effective* than it was in the 1991 Persian Gulf War. Rather than assuming that technological advances over five years had strengthened airpower, he assumed the opposite that airpower's contribution would fall below the Desert Storm standard.

This was a shock to the officers. In the wake of USAF's Gulf War successes, the Air Force had, if anything, become even more confident that airpower could be used in a dramatically expanded way—to slow, halt, and perhaps even defeat an enemy before allied ground troops could arrive on scene. In many instances, argued the officers, an air campaign could bring aggression to a decisive halt, where the enemy no longer has the capability to advance and his strategic options are exhausted. The paper made it clear that Peay disagreed with this notion, to put it mildly.

In his concept of how the next war would unfold, aircraft battered invading forces for a couple of days. But then, for reasons unstated, the Air Force stopped the attack, husbanded resources, and largely held its fire for weeks. In the interval, Army troops deployed to the region, prepared for battle, moved into position, and then launched a counteroffensive—all with massive air support.

#### "Boots on the Ground"

Peay's message was none too subtle: The principal business of warinflicting decisive defeat on the enemy-could be carried out only by land forces-"boots on the ground"not air forces.

The Air Staff officers delivered a message of their own, filing a formal notice of "nonconcurrence" with CENTCOM's paper. With this action, the Air Force gave its first clear signal that it would no longer accept the traditional view that it should act, at all times, as a support arm of US surface forces. The officers argued that, in many cases, airpower would be the best instrument for carrying out the main thrust of a war, especially in light of the US public's sensitivity to the loss of soldiers under ambiguous circumstances in far-off places.

Though bureaucratic politics forced the Air Force to withdraw the protest, Peay was compelled to write an air campaign into his strategic concept. It was presented as an alternative to—or "excursion" from—his basic plan, which continued to use a

#### By Elaine M. Grossman

major land engagement as its basic organizing principle. The Air Staff officers maintained that CENTCOM plans needlessly put US soldiers and Marines at risk and continued to chip away in what has become a longrunning contest of service visions.

Such actions once were considered audacious, but they have multiplied and diversified in recent years, fueling a revival of sorts within the Air Force itself. Joint war plans in the two principal theaters-Southwest Asia and the Korean Peninsula-haven't changed much; in the view of Air Force partisans, they continue to devote too much scarce airlift to hauling ground troops to the fight and not enough to supporting the application of airpower. However, the Air Force has made some strides in the world of strategy and doctrine.

One instance of this came recently from the highest Pentagon levels. The Defense Department's 1997 Quadrennial Defense Review for the first time put the Pentagon on record as supporting a vigorous "halt phase" of war, which the Air Force believes will require the application of significant airpower.

The final QDR report declared the US must be "able to rapidly defeat initial enemy advances short of their objectives in two theaters in close succession, one followed almost immediately by the other. Maintaining this capability is absolutely critical to the United States' ability to seize the initiative in both theaters and to minimize the amount of territory we and our allies must regain from the enemies."

In this initial stage, immense force from the air would be brought to bear against an enemy's invading troops and centers of power. The goal would be to stop an attack even before Army or Marine forces could reach the war zone in great number.

The earliest and still main proponent of this concept, retired Air Force Maj. Gen. Charles D. Link, was the USAF Chief of Staff's point man on the QDR. In Link's view, the employment of airpower early and decisively shapes up as the most effective way to prosecute a war in modern times.

#### Horse and Horseman

"Too much of our military is still focused on the enemy's will and trying to find ways to break his will," Link explained, "when, in fact, what we have the capacity to do, if we just understand it, is to take away his means of exercising his will. If I can kill his horse, I don't care if he likes to ride."

In Link's view, airpower provides not only the most effective military instrument but also the most ethical, in that it holds out the most promise of saving lives—on both sides.

Not long after the QDR delivered its approving verdict on exploiting the halt phase, Link summed up the situation with these words: "If one



F-16s refuel as they head toward a target during the Persian Gulf War. Despite the many successes of airpower in the Gulf, CENTCOM's leader contends airpower in future battles will be less effective—technological advances notwithstanding.

has the capacity to find, fix, and attrit enemy military capabilities from the air, then one owes it to the nation to develop and exploit that capability."

A decisive halt, airpower proponents believe, could provide a "culminating point" at which the theater commander has a number of options to further disable the enemy regime, ranging from a ground offensive to continuation of the air campaign.

Not even airpower's strongest advocates see the matter in absolute terms. They freely acknowledge the strengths of airpower do not make ground or naval forces irrelevant or necessarily make airpower the preferred solution in all cases. "When airmen talk about the use of airpower being 'low risk,' they're not saying 'no risk,' " Link said in a recent interview. "It's a relative thing, and so you have to look at airpower options as just those—options."

Airpower options might also save money, proponents say. During the QDR deliberations, Gen. Ronald R. Fogleman, then Air Force Chief of Staff, raised the politically contentious prospect that the defense budget may not be able to provide enough forces to prosecute two nearly simultaneous Major Regional Conflicts, as called for in national strategy, unless the US made heavy early use of airpower and took many of its ground forces from the Army National Guard and Army Reserve.

Fogleman said, "Clearly, the possibility exists that, while you're engaged somewhere in the world, some other adversary can decide to take advantage of that. So the issue in my mind is, do you try to sustain an entire second MRC's worth of forces and capabilities, and do you do that, say, only in the active force? Do you do it with active and Guard types of forces?"

Trying not to rock the boat too much, Fogleman avoided saying it was the Army to whom he was referring. If the combat troops in the active Army were not needed for weeks or even months after the Air Force and Navy launch an extended halt phase, perhaps more ground forces could be put in the Guard and Reserves, his thinking went. The Army was not taken with the idea, given that combat missions are regarded as the lifeblood of the active component.



These Marines prepare for urban warfare in an exercise at Fleet Activities Yokosuka, Japan. Army and Marine Corps leaders maintain that Smaller-Scale Contingencies will become a prominent feature in the future.

Despite Fogleman's reticence, the message came through clearly at the Pentagon: Not only did Defense Secretary William S. Cohen include an endorsement for a decisive halt phase in the QDR's newly reworked defense strategy but he also, through his senior deputies, launched a serious effort to change the way the Army leadership uses its Guard and Reserve forces.

#### Thumbs Up for JV 2010

The Air Force sees Joint Vision 2010, the "conceptual template" for future combat laid out by Army Gen. John M. Shalikashvili, former Chairman of the Joint Chiefs of Staff, as a warfighting construct in which it can make the most of its strengths.

"Full spectrum dominance," the sine qua non of future warfighting in JV 2010, "depends on the inherent strengths of modern air- and spacepower—speed, global range, stealth, flexibility, precision, lethality, global/theater situational awareness and strategic perspective," stated the Air Force in its 1997 publication, "Global Engagement: A Vision for the 21st Century Air Force."

The service vision goes on to lay out the key capabilities and characteristics of the future Air Force: air and space superiority, global attack, rapid global mobility, precision engagement, information superiority, and agile combat support.

The bureaucratic battle goes on, with periodic clashes of service viStaff, Vice Adm. Dennis C. Blair, supported the Air Force's position on the creation of a joint doctrine for countering air and missile threats. All three other services were expected to protest Blair's decision—which supports the notion of an air defense commander with the ability to go after targets theater-wide—at the level of the Joint Chiefs of Staff in a formal tank session. Many defense experts think the airpower medium has the ability to give adversaries great pause even when used in a more limited context.

give adversaries great pause even when used in a more limited context. The Navy, for its part, tends to embrace this view enthusiastically and puts it in the context of providing presence in world hot spots.

sions. In September, the Air Force

scored a victory in the struggle to get

policy-makers to recognize airpower's

potential. The director of the Joint

Retired Adm. Leighton W. Smith Jr., a former NATO commander, spoke about this matter last summer at a Washington, D.C., conference titled, "Dueling Doctrines and the New American Way of War." Smith served as commander of NATO south forces and headed the initial Implementation Force assembled to enforce the peace in Bosnia after the 1995 Dayton peace accords. Smith recalled, "The fact of the matter is that we put together one hell of an effective air operation." To Smith, the payoff of airpower's effectiveness was that when he issued threats, they were believed. "Airpower has a

great persuasive force," he told the audience.

#### The Counterattack

The Air Force's new vision of warfare and of the role that it should play in future conflict has provoked frequent attacks. The main challenge comes from the Army, supported by the Marine Corps. These services argue with mounting intensity that what will matter most in future conflicts is boots on the ground, not advanced aircraft and precision guided weapons.

The Army conceives of itself as "the force of decision." In its "Army Vision 2010" paper, the service argues that land power makes permanent "the otherwise transitory advantages achieved by air and naval forces."

Within the Army, officers feel they have a special mission to bring America's wars to a successful termination—a role that, in their view, is not shared by the other services. Thus, ground-force partisans believe that everything else, including airpower, should be made subordinate to the requirements of success in the land battle and that airpower's role is to support them.

Furthermore, the Army and Marine Corps, with considerable support from some officials within the Pentagon, emphasize a need to prepare less for Major Theater War and more for Smaller-Scale Contingencies and for Military Operations Other Than War.

Army leaders contend that increased demand for these operations on the lower end of the spectrum of crisis suggests that missions should be rethought with more emphasis given to the troops carrying rifles. Air Force proponents, for their part, maintain that these missions, though important, are lesser in nature and should be subordinated to the demands of theater war. The objective of US military forces is full spectrum dominance, not marginal advantage, they say.

Among the more prominent proponents of the ground force vision are Army Maj. Gen. Robert H. Scales Jr. and recently retired Marine Corps Lt. Gen. Paul K. Van Riper. Both have appeared in many venues around Washington, offering up intriguing counterpoints to the Air Force perspective.

In Van Riper's vision of the fu-

ture, the greatest US security problems will arise not chiefly from some heavily armed regional aggressor but rather from nontraditional and irregular forces such as terrorists, drug traffickers, and organized crime forces. In judging the best way to cope with these problems, he says, the US should emphasize the likelihood of Smaller-Scale Contingencies, forcible entry operations, urban warfare, peacekeeping missions, and the like. As a result, he concludes, the emphasis should be on training and equipping Marines and soldiers for ground operations.

"Airpower can do a lot, but it can't do it all," Van Riper said in a paper presented at the Dueling Doctrines conference. "Those who wear the 'muddy boots' cannot be forgotten in your deliberations. They will still be necessary in the 21st Century."

#### **Friction Forever**

Scales' view, though it differs from Van Riper's in some important respects, echoes the Marine's skepticism of the utility of airpower and high technology as a sufficient answer to the wars of the not-toodistant future. He—and Van Riper argues that there has been no fundamental change in the nature of war, that "friction" will still bedevil actual operations, that high-technology solutions have potentially great weaknesses, and that imposing the will of the US on an adversary requires, ultimately, troops on the ground to close with the enemy and destroy him in decisive battle.

These commentators and others dispute Link's tendency to downplay the importance of breaking the enemy's will to fight—that is, the Air Force general's belief that one should try to "kill the horse" rather than go after the rider.

Critics argue that a variety of factors might make it difficult or even impossible to find, much less to destroy, "the horse." Stationing mobile missile launchers in residential areas or employing lowtechnology modes of communication immune to electronic jamming or interception, continue to pose serious targeting challenges, they contend.

In addition, they say, an enterprising adversary can continue to cause problems for US forces even after his strategic targets apparently have been decimated. The critics note that Iraqi leader Saddam Hussein was able to suppress rebellions to his north and south even after taking a fearful pounding in the Gulf War. "It's not the horse that's going to kill me," said one US military officer. "It's the enemy."

#### The OODA Loop

The late Col. John R. Boyd, a leading Air Force intellectual who retired in the 1970s, frequently stated that he saw enormous potential in airpower but saw no need to limit war to a single medium. Boyd, a



An Iraqi hardened shelter destroyed during the Gulf War. Giving airpower a larger role in US war plans has not won overwhelming endorsement. The National Defense Panel report was particularly unenthusiastic.

AIR FORCE Magazine / December 1998

leader of the military reform movement in the 1970s and 1980s, was renowned for his elaboration of the "OODA Loop"—Observe, Orient, Decide, and Act—a concept for anticipating and crippling an enemy in a fast-paced battle. For Boyd, destroying an adversary's will to fight was essential to ending the war, and understanding and undermining an enemy's "critical nodes" with rapidfire attacks was one important facet of that effort.

While last year's QDR bolstered the Air Force view of warfighting doctrine, it also trimmed some of the forces that service leaders believe are key to its ability to dominate the skies in future conflicts.

The review cut procurement of the F-22 air superiority fighter from 438 to 339 aircraft, chopped the buy of the Joint Strike Fighter from 2,978 to 2,852 aircraft, and reinforced an earlier decision to cap B-2 stealth bombers at 21.

The National Defense Panel, formed to conduct a review of the Pentagon's QDR, seemed, in its December 1997 findings, uninspired by the potential of airpower and questioned the cost, quantities, and future warfighting effectiveness not only of the Air Force's F-22 fighter but also of the multiservice Joint Strike Fighter and Navy F/A-18E/F without suggesting more attractive alternatives.

Air Force officials felt uneasy about the NDP's failure even to mention the halt phase; the final NDP report contained not a word about the issue. Chairman Philip A. Odeen explained that the panel "didn't feel [it] could endorse that particular approach because we don't think it has been demonstrated yet."

For all the Air Force's popularity with the public and its modest behind-the-scenes successes in the Pentagon's interservice war of words, its leaders acknowledge that the service has a long way to go before it can meet its true potential. To make its vision a reality, USAF will have to deal with a number of major challenges. Airpower experts differ about which are most critical for the Air Force to meet in the near and long term. Here, however, are some of the issues frequently mentioned:

Control of the USAF budget. Last year the Office of the Secretary of Defense gave the Air Force an additional \$1 billion for its Fiscal 1999



Long-range aircraft, such as this B-2, would play a major role in the early attrition of enemy capabilities. USAF believes an air campaign will render an enemy incapable of advancing and severely limit his strategic options.

budget, but the money came with strings attached. The Air Force wanted the addition on readiness, but OSD nixed the plan, saying it should go into modernization accounts.

USAF has been trying to catch up on underfunded operations and maintenance accounts ever since, stacking its "wish list" to Congress with readiness priorities like base support, spare parts, depot maintenance, and crew training.

Despite widespread Air Force support for the new F-22 air superiority fighter, some service officials lament the aircraft's high cost and primary role. Budget pressures are new coming down on the new Joint Strike Fighter. It is F-16s the service needs to replace in great number in coming years, they say, and the service in the just-completed Fiscal 2000 budget round felt compelled to put the JSF on the chopping block—before the Defense Secretary demanded JSF stay on the books.

Human intelligence cutbacks. In the context of the ever-sharpening accuracy of guided munitions, an important question is whether the Air Force might find itself very precisely hitting the wrong target.

Officials in all services decry the reduction of resources devoted to US human intelligence. They say it has taken a toll on the quality of intelligence and level of understanding the intel community has attained in several potentially hostile nations. While satellite capabilities have grown, they are not by themselves sufficient, these officials say.

Military officials rue the decades of cutbacks in the US human intelligence systems. Of the services, the most seriously affected may be the Air Force, with its need to understand exactly which enemy facilities serve as the key nodes to attack.

"Good Humint is absolutely critical," says Brig. Gen. David A. Deptula, who as a lieutenant colonel directed air campaign targeting in Desert Storm. "You can't hit what you don't know."

According to Deptula, the Air Force's inability to rapidly destroy Iraq's mobile Scud launchers was not so much a failure of airpower as it was a failure of human intelligence to compensate for the inherent limitations in sensors. "You have to have good intel to have a gcod air campaign—or any other campaign for that matter," says Deptula, now commander of a joint task force enforcing the no-fly zone in northern Iraq.

**Doctrine-averse attitudes.** Getting Air Force officers to actually read and understand official USAF doctrine poses a major challenge. Retired Air Force Col. Rich Meeboer, the senior planner who challenged the CENTCOM commander's concept paper in 1996, warns that Army officers, who "live and die on doctrine," dominate the joint world.

The Air Force "can't effectively compete" in the world of joint experimentation and shrinking budgets unless it can point to a piece of paper that clearly lays out how USAF intends to fight wars. The view of Meeboer, now a defense consultant in Virginia, may surprise those who believe dollars or politics are all that stand in the way of Air Force success. However, he says that as Congress and the Pentagon place increasing emphasis on joint solutions it is the doctrine-rich Army that stands to gain most.

Influence on Capitol Hill. These days, say defense analysts, it's not enough to have a good story. A service must have influential friends to give voice to and fund its vision of warfare.

The Army, Navy, and Marine Corps have formidable allies in all the right committees of Congress, while the Air Force, the youngest and least traditional of the military services, relies mostly on friends in industry to press lawmakers for selected modernization funding. As many see it, the service needs more advocates in Congress who can articulate its many priorities and the vision that unifies these parts.

Intra-Air Force Schism. Over the past 18 months, reports were emanating from the Defense Department that officers in the Air Staff's Air and Space Operations directorate and Plans and Programs directorate were playing tug-of-war over control of planning for major initiatives, like preparations for the next QDR in 2001.

Recently the two directorates took a major step to settle the discord, signing an agreement to split up the work and establish a working group to oversee planning for upcoming DoD reviews. The two directorates are now working "very diligently" to strengthen their ties, said one USAF officer, "because there was such a schism." While only time will tell, there appears to be growing recognition that the Air Force cannot stand for much in the joint environment when it fails to keep an eye on central objectives.

Elaine M. Grossman is senior Pentagon correspondent for Inside the Pentagon in Washington. This is ther first article for Air Force Magazine.
Valor

By John L. Frisbee, Contributing Editor

# Lance Sijan's Incredible Journey

Alone in enemy territory with no food or water and unable to walk, Capt. Lance Sijan refused to give up.

ON the night of Nov. 9, 1967, Lt. Col. John Armstrong, commander of the 480th Tactical Fighter Squadron based at Da Nang, South Vietnam, rolled his F-4 into a bomb run. The target was Ban Loboy Ford on the Ho Chi Minh Trail in Laos. In the backseat was 25-year-old Capt. Lance P. Sijan, flying his 53d combat mission.

Armstrong pickled his six bombs at 8:39 p.m. Almost immediately, the aircraft was engulfed in a ball of fire as the bombs detonated a few feet below the F-4. Neither the FAC controlling the mission nor Armstrong's wingman saw chutes. But there was one chute. Sijan ejected and was drifting toward a flat-topped, heavily forested karst formation. For Sijan, recollection stopped as the 195pound captain crashed into the towering trees.

Sometime the next day, Sijan regained consciousness in a haze of pain. He had suffered a compound fracture of the left leg, a crushed right hand, head injuries, and deep lacerations. Most of his survival gear was gone. He tended the broken leg as best he could, then lapsed again into unconsciousness.

The following morning, a flight of F-4s picked up the sound of Sijan's beeper, and a search-and-rescue operation got under way. Throughout the day, Sijan maintained contact with the rescue force, but several attempted pickups were thwarted by NVA gunners. At 5 p.m., a Jolly Green chopper made it in directly over Sijan. In a desperate attempt to crawl through tangled vines to the chopper's penetrator, Sijan lost contact with the rescue force. As darkness fell, the SAR operation was called off.

Early the next morning, the search resumed, but Sijan's radio batteries were depleted. Failing to make contact, the SAR team was recalled. Sijan was on his own. If he were to survive, he must make his way down the steep karst to water and an open area where he could warm the radio batteries and call in a chopper. With a crude splint on his shattered leg and only the thumb and forefinger of his right hand functioning, Sijan began the most incredible journey in the history of Air Force survival efforts.

For several days, Sijan, lying on his back, pushed himself over the sharp rocks with his good right leg, a few painful inches at a time. His only source of moisture was dew licked from foliage. There were many falls down the steep slope and periods of unconsciousness and delirium. First his clothing became shredded, then the skin on the back of his body, until he was inching along on raw flesh. At last he found water and pressed on, inch by agonizing inch.

Forty-five days after he parachuted into the forest, Sijan saw ahead the open area he had been looking for. He dragged himself over a bank and fell unconscious in the middle of the Ho Chi Minh Trail, three miles from his starting point.

The young captain regained consciousness in an NVA road camp, his formerly athletic body little more than a skeleton partially covered by transparent skin. He was given some food and water but no medical attention. In spite of his pitiful condition, his mind focused constantly on escape. When some strength returned, Lance Sijan overpowered a guard and dragged himself up a trail, only to be recaptured and punished.

Sijan was moved to a temporary prison near Vinh, where he was beaten severely but refused to give any military information. The guards, who had never seen a human in such ghastly condition, refused to touch him. Sijan was put in the care of Maj. Bob Craner and Capt. Guy Gruters, an F-100 Forward Air Control crew that had been shot down near Vinh. The latter had been in Sijan's squadron at the Air Force Academy. In his lucid moments, Sijan gave them the details of his long, painful journey.

Several days later, the three were

loaded on an open truck for a three-

loaded on an open truck for a threenight trip to Hanoi in the chill monsoon rains. At Hoa Lo Prison, they were put in a damp cell. Sijan, who had contracted pneumonia and was near death, asked his cellmates to prop him up on his pallet so that he could exercise his arms in preparation for escape from that grim, impregnable bastion.

On Jan. 22, 1968, Capt. Lance Sijan died. When the POWs were freed in early 1973, Craner and Gruters recorded the details of his long fight for freedom and his resistance to torture. Later, they were major sources for Malcolm McConnell's book, *Into the Mouth of the Cat.* On March 4, 1976, President Gerald Fcrd presented the Medal of Honor posthumously to Sijan's parents, and on Memorial Day of that year, a new dormitory at the Air Force Academy was dedicated in his memory.

Sijan's will to survive with honor was an inspiration to other POWs during the dark days of the Vietnam War, as it should be to all of us. He demonstrated, as few have, the almost limitless capacity of the human spirit to triumph over the depredations of fate and the malevolence of lesser men.

First appeared in December 1986 issue.

The Air Force Association and The Aerospace Education Foundation Present

# 50<sup>th</sup> Anniversary Art Collection

The Air Force Association's Aerospace Education Foundation is offering fine art prints of 16 original paintings by some of America's finest aviation artists commemorating the 50th Anniversary of the United States Air Force.



Sting of the Black Viper Rick Herter



Combat Lancer Jack Fellows



Beautious Butch Mark Waki

These fine art prints depict significant events and aircraft in the Air Force's illustrious 50-year history. Each of the 1,000 limited-edition fine art prints will be signed by the artist and one or more historical figures associated with the painting.

Prints may be purchased either individually for \$95 plus shipping or as a set for \$1,195 plus shipping. We accept Mastercard, VISA, or money orders.

For more information, visit the AEF Homepage at www.aef.org.

Call 1-800-727-3337, Ext. 4869 Fax: (703) 247-5853 E-mail: MNauheimer@aef.org

The service chiefs have begun to publicly sound the alarm that the readiness of the armed forces is slipping.

# By Peter Grier

HE Air Force says that, to save money, it has had to skimp on runway maintenance at a number of installations and that cuts on aircraft tires are increasing as a result. At some fighter bases, aircraft maintenance personnel are pulled away from other critical duties to check the airfields up to four times a day for bits of pavement and other debris that could be sucked up into jet engines. The threat of such foreign object damage has become so severe that it led to the cancellation of six training flights in a single day at Nellis AFB, Nev.

Within Pacific Air Forces alone, the cost to fill the shortage of individual protective equipment for chemical-biological warfare is \$7.2 million. Air Force wide, the rate of cannibalization—taking parts off one airplane to fix another—is up by 58 percent since 1995.

The Marine Corps says it cannot afford new tires for the Humvees and 5-ton trucks of expeditionary forces. It's buying retreads instead. The Navy says that it is concerned about its stocks of modern munitions. Tomahawk cruise missiles are in particularly short supply.

As these examples show, the US military's readiness now appears to be sliding quickly downhill. The situation has reached the point where the chiefs of all the services have started to publicly sound the alarm

in Congress and in encounters with top Clinton Administration officials.

Lawmakers generally agree that more money is needed to keep the armed services in fighting trim, but some complained earlier this fall that they had been taken by surprise at a Sept. 29 hearing when they detected a sharp change in tone from the nation's uniformed leadership about the extent of readiness problems.

The military's can-do attitude, plus the reluctance of lower ranks to tell the brass bad news, made this situation worse than it needed to be, according to Sen. John McCain (R–Ariz.), a leading member of the Senate Armed Services Committee.

# The Silent Men

McCain and others on Capitol Hill were disturbed that the chiefs did not emphasize the readiness problem earlier. "All of us know these problems did not arise in the last seven months," he said. "They've been going on for a number of years."

The basic elements of the developing readiness crisis have been well-known since the mid-1990s. They include the demands of a high operations tempo, underfunded operations and maintenance accounts, and the exodus of key personnel drawn by the money and benefits of the civilian economy and, in many cases, disenchantment with Administration policies. Each of the armed services suffers its own unique mix of readiness problems, but general risks affect them all, according to a readiness report compiled by McCain and his staff. These risks include:

The optempo illusion. Laymen might think that deployment on a real-world mission, to peacekeeping duty in Bosnia or no-fly zone enforcement over Iraq, would be the best training that a US military unit could ever receive. In fact, almost the opposite is true. Large amounts of varied training—as opposed to a routine of overflights, or patrols—are needed to keep readiness rates at a high level.

The Air Force, though much smaller, handles an optempo four times greater than it experienced in the Cold War, and much of that activity stems from routine flights enforcing no-fly zones over Iraq and monitoring the airspace around and over Bosnia.

The Navy, for its part, now deploys from home port more than 50 percent of its fleet on any given day, up from about 37 percent in 1992. That fact has contributed to a decline in nondeployed readiness in the sea service, according to the Chief of Naval Operations, Adm. Jay L. Johnson.

At the same time, the life turbulence caused by extended deployments has become the No. 1 reason that personnel of all levels are leaving US



military service. "Family separation" was the top choice among reasons for leaving cited by departing Navy sailors in 1997, for instance.

Increasing depot maintenance backlogs. All of the services have seen in recent years a steady climb in the backlog of weapons and major parts awaiting depot repair, despite the fact that the size of the force has shrunk during that time.

The Defense Department backlog now has reached \$1.6 billion, compared to \$420 million in 1991, according to McCain's report.

The Air Force slice of this backlog is projected to hit \$323 million in Fiscal 1999. The problem particularly affects ground communications equipment special purpose vehicles, some component repair, and readiness spare packages. Aircraft and engine overhaul and missile repair receive priority, thus the 1999 backlog is projected to include only 25 aircraft and 106 engines.

The extent of the depot jam-up, however, means that any unexpected problem can quickly escalate into a major headache. A technical surprise, for instance, recently affected the engines on F-15Es based at RAF Lakenheath in Britain. Because of the depot backlog, the Air Force told McCain's staff, "The F-15E squadrons at Lakenheath remained at a low state of readiness for over a year."

Underfunded quality-of-life programs. Money needed to make life better for the men and women of the US armed services is increasingly tight these days. The estimated 14

38

percent pay shortfall, when measured against comparable civilian jobs, is only part of the story.

Reductions in military retired pay have made it more difficult to retain qualified personnel, according to the chiefs. So has the institution of the Tricare health care system, which service chiefs described as falling short of their troops' needs and wants.

Said Gen. Dennis J. Reimer, the Army chief of staff, in his reply to McCain's questions: "The loss in medical benefits when a retiree turns 65 is particularly bothersome to our soldiers when making career decisions."

A recent poll of Air Force pilots who have indicated a desire to leave the service found that a perceived decline in quality of life trailed only high optempo as a reason to separate from the service. A survey by the Air Force Chief of Staff found that only 26 percent of Air Force enlisted personnel judge the retirement system as fair and equitable.

Underfunded base maintenance and repair. Weapons may deliver the blow, but buildings, piers, barracks, and runways are important underpinnings of US military power as well. According to McCain's report, maintenance of this infrastructure has been squeezed in recent years as all the services struggled to balance the needs of modernization, operations, and repairs.

At Dyess AFB, Texas, the B-1 avionics shop's air-conditioning and electrical power are not adequate for workers to perform their mission. Hundreds of avionics "black boxes" are having to be shipped off base for repairs.

Leaks in the roof in the communications systems repair facility at Offutt AFB, Neb., have caused delays in repairs for Air Force air traffic control equipment. The only enlisted dining facility at Edwards AFB, Calif., was recently closed due to deteriorating sanitary and health conditions.

Air Force commanders are having particular trouble with aging water and sewer systems.

"A notable example is a failure in the Minot AFB [N.D.] water system in late spring 1998, which resulted in the base running out of drinking water," officials told McCain's staff. "A 40-year-old line ruptured, result-

# Cost of Recruiting a New Airman Average cost per recruit in 1997 dollars

(Includes recruiter and staff pay, leases, supplies, vehicles, advertising, and other costs.)



AIR FORCE Magazine / December 1998

ing in base water tanks draining to less than 20 percent of capacity."

The Army projects it can pay for only 58 percent of base repair needs in 1999. The Marines say their current budget would pay for the replacement of typical base systems once every 200 years.

Underfunded weapons modernization. For years, tight budgets have meant that service weapons procurement accounts have been squeezed. With major new systems purchased during the buildup of the early 1980s still on hand, the Pentagon leadership was content to save what money it could from a "procurement holiday" while planning on a spending ramp-up at some unspecified point in the future.

That point is now here. Many major systems have now reached, or surpassed, retirement age.

"We have reached a critical point in the life cycle of our ground and aviation equipment," said Marine Corps Commandant Gen. Charles C. Krulak. "We are facing virtual block obsolescence of crucial items."

The average age of a Marine amphibious assault vehicle exceeds its programmed life span by seven years. Marine CH-53D helicopters are 30 years old on average, well past the end of their projected service life.

For the Air Force, the average age for all aircraft in the fleet will be 20 years in 2000. In 2015, it will be 30 years, even taking into account planned purchases of F-22s and Joint Strike Fighters. The age of the Air Force aircraft fleet has



never been anywhere near that high, said officials.

Replacing systems may be expensive—but so is not replacing them. As technology-laden weapons such as fighter aircraft age, they become more expensive to maintain, driving up maintenance budgets. Depot maintenance for the oldest F-15s in the Air Force inventory, A/B models averaging 21 years old, costs about 40 percent more than similar upkeep for newer F-15Es.

The McCain report concludes that equipment readiness rates are now being kept up only because of dedicated service personnel who work 12- to 16hour days, on overlapping shifts, seven days a week, to keep things going.

The study's list of critical modernization needs is an extensive one, including improved strategic lift, precision guided munitions, bomber force upgrades, fighter aircraft, and



AIR FORCE Magazine / December 1998

space initiatives for the Air Force; troop and amphibious lift, amphibious vehicles, and fire support for the Marines; improved fighter/strike aircraft, mine warfare, interoperability and battle management, and increased shipbuilding rates for the Navy; and force digitization, increased lethality of ground weapon systems, and improved attack and other combat helicopters for the Army.

Underfunded munitions stocks. Purchase of new munitions has suffered the same budget woes as weapons procurement. In general, all the services have simply redefined their stocks on hand as adequate to supply a force structure that has steadily gotten smaller anyway, according to McCain's readiness report.

Ryan, the Air Force Chief of Staff, wrote that "we lived off the surplus from the 40 percent drawdown of our forces in the early '90s," although munitions funding is no longer adequate. In two cases—30 mm ammunition and LUU-2 flares—low munitions levels have lowered mission ready crew status, according to the Air Force.

The Navy is worried about low stocks of modern precision guided weaponry, particularly the Tomahawk Block III missile. Its munitions inventories are such that some units receive only one training missile per year of expensive leading edge weapons.

Budgetary sleight of hand. The delicate balancing act required to try and keep today's military ready while preparing for the future leads to budget trade-offs which are not acceptable, according to the McCain study.

Take the funding of real-world operations, such as the deployment

to Bosnia. While Congress will theoretically pass supplemental appropriations legislation to cover the cost of such add-ons, in practice more money goes out than comes in. The Army will only get about 90 cents back for every dollar it spends in Bosnia, for instance, according to service estimates.

The Air Force suffers the same problem. In Fiscal 1996, the Air Force spent \$779 million on snap operations and got back \$712 million, for a \$67 million shortfall. In Fiscal 1997, the service spent \$852 million and received \$827 million, for a \$25 million gap.

"The shortfalls were sourced from other USAF programs," notes an Air Force response to a question on the subject.

Another budget trick that may hurt readiness is the military's tendency to spend savings before they are achieved. Out-year budget plans are particularly prone to such wishful thinking. The Army, for instance, has already programmed \$10.5 billion worth of savings to be gained from unspecified management efficiencies into its Future Years Defense Program.

"[T]hese are risks associated with this budget," Reimer noted in February, when outlining his spending plans to the Senate Armed Services Committee.

# Still Formidable

All the service chiefs insist that their forces are still able to carry out their missions if the nation calls. Forward deployed units, and those now carrying out missions for the nation in far corners of the globe, get almost all of the money, parts, and weapons they need.

The problem is decay around the edges, as nondeployed units begin to suffer.

"Since 1996, we have experienced an overall 14 percent degradation in our operational readiness of our major operational units," Ryan told the Senate Armed Services Committee on Sept. 29. "This is especially true of stateside units who are prioritized lower than the overseas and engaged units."

"My greatest concern is for our people. ... We are losing too many of our experienced people now," continued Ryan.

Other services see similar problems. The Navy is experiencing its lowest nondeployed readiness rates for carrier air wings in a decade. The Army said it needs \$3 billion to \$5 billion more added to its FYDP to mitigate readiness risks.

The Clinton Administration said that it now agrees with the chiefs that the situation has now reached the point where budget additions are needed. About \$1 billion in extra readiness funds was tacked onto a Fiscal 1999 supplemental spending bill in September.

Civilian officials now promise readiness funds will go up in future years. Whether they go up enough is another issue.

If the estimates from all the service chiefs are added together, the US military will need upwards of \$27 billion more per year for the next five years to address its readiness and other problems.

All this does not necessarily mean that the US military is on the verge of returning to the bad old days of the 1970s and its hollow force readiness problems. There are some similarities between the situation today and that which was seen in the post-Vietnam era, said McCain. A backlog in depot maintenance formed then, too. Spare parts dried up. The force was not modernized.

# It's People

However, he noted, there is a big difference: people.

In the late 1970s, said McCain, the military had a huge drug problem, a significant racial problem, and took in many recruits with low educational levels. Decades of effort to repair and bolster the allvolunteer force have helped reverse those trends and given the US military its best human capital in several generations, according to the senator.

"There's a dramatic difference in the quality of the men and women who serve, which I think should serve as a reassuring note to many of us," said McCain.

He is worried that any increase in budgets might be wasted, as lawmakers continue to insist on using defense appropriations to fund pet projects that create jobs and payrolls in their own districts. The military needs to restructure itself to face post-Cold War challenges, said the senator, but that does not mean he believes readiness money should be withheld until Congress and the Pentagon clean up their respective acts.

He concluded, "You can't allow some of these problems to go unaddressed."



Peter Grier, the Washington pureau chief of the Christian Science Monitor, is a longtime defense correspondent and regular contributor to Air Force Magazine. His most recent articles, "The State of the Force" and "The International Perspective," appeared in the November 1998 issue.



When the Government needs true global communication, it turns to Motorola for Iridium<sup>®</sup> solutions.

The location is remote, the conditions unknown. No terrestrial or wireless infrastructure is yet established. You need to coordinate, execute, and respond to rapidly changing situations.

By using Motorola's Satellite Portable Telephone and Satellite Pager, and subscribing to Iridium<sup>®</sup> service for secure<sup>\*</sup> and non-secure voice communications, you'll be connected to anyone, anytime, virtually anywhere. For the convenience of a cell phone, the flexibility to operate



"Secure feature scheduled for 1999,

MOTOROLA, and Satellite Series are trademarks of Motorola, Inc.
 Iridium and the Iridium logo are registered trademarks and service marks of Iridium IP LLC.
 1998 Motorola, Inc.

from pole to pole (and virtually anywhere in between),

the mass communication capability of group paging, and the engineering expertise to solve your unique communications challenges, contact Motorola for your Iridium solutions.

100 -00	
1000	

To order the Motorola Satellite Series<sup>™</sup> of products and subscribe to Iridium service, call Motorola Worldwide Information Network Services at (602) 726-1000 or toll free at (877) 449-0601. Visit our website at: http://m-wins.motorola.com





The private satellite business is booming, and the Pentagon and services are watching closely.



**By Theresa Foley** 

# Commercial Spacefarers

HERE'S no question about it; the satellite industry is in boom times. Twenty percent annual growth rates for the commercial satellite industry have delivered a wide range of new choices to consumers who want mobility and information. First came Global Positioning System for the public, then Direct-To-Home television. Now, consumers will be able to buy a \$3,000 Iridium telephone or a \$1,000 Orbcomm receiver. Beyond that, new satellite-delivered Internetmultimedia products and services will be available before long.

US Space Command, the Defense Information Systems Agency, and virtually all the services are keeping a close eye on the commercial side of the space business. They believe it carries major implications both for military strategy and for actual use, as military forces plan to piggyback on commercial systems when possible.

Statistics indicate that the trend will continue for the next several years as hundreds more communications satellites are deployed in a variety of orbits for many purposes. The Satellite Industry Association says that, in 1998, commercial satellite manufacturing revenues will surge to \$6.3 billion, nearly double the \$3.6 billion stemming from government satellite business. US Space Command analysts say that, from 2000 onward, space infrastructure could contribute \$121 billion to the US economy each year.

In September, the Teal Group, a consulting firm based in Fairfax, Va., predicted that 1,017 commercial communications satellites, valued at \$50 billion, would be launched in the next 10 years. Teal said that 1998 was a peak period for commercial satellite launches, and another would come in 2002–03 when replacements for first-generation mobile satellites and new broadband multimedia satellites would be launched.

In terms of numbers launched, the largest segment of the industry will be mobile communications satellites—449 in all, or 44 percent of the total, the Teal study found. Broadband multimedia satellites—384 of them, or 38 percent of the total will be the second largest segment. Increasingly, multiple satellites will be launched on individual rockets, meaning that the number of launches will not keep pace with the number of satellites.

# The Fuel

Fueling the boom is the seemingly insatiable demand by consumers for mobile communications, Direct-To-Home satellite TV, and Internet access. Teal analyst Marco Cáceres attributes the growth to a "boom in demand for telecommunications services worldwide and the development of new satellite technologies."

Eric Le Proux, managing director of Euroconsult, a Paris-based group that has studied the satellite industry for many years, cites "the emergence of new geographical markets and the deregulation of the telecom and TV industries" as other factors behind the growth. Euroconsult predicts that, during the period 1998-2007, the number of satellite launches will increase 365 percent over the previous decade. It says the growth can be chalked up to the rise of commercial satellites.

The days when satellites were limited to a narrow role in the \$600 billion-a-year telecom business have ended. For their first four decades, communications satellites were used mainly as 22,300-mile-high repeater stations, beaming television or other signals from one point on Earth to broad geographic regions while using relatively simple "bent pipe" transponders. The situation really began to change in the 1980s, with the emergence of proposals for new satellite systems such as the 66-satellite Iridium global mobile telephony constellation.

Iridium and brother systems, such as Globalstar and ICO Global Communications, fly in more complicated Low or Medium Earth Orbits rather than at Geosynchronous Earth Orbit altitude. They orbit in networked constellations, sometimes employing intersatellite links, to provide global instead of regional coverage.

Today, the entire space business is being altered by a fundamental factor: the discovery by satellite builders that the real money lies not in manufacturing a \$100 million spacecraft but in providing vital services to telecommunications operators and consumers. As a result, all three major US satellite manufacturers—Hughes Electronics, Loral



Space & Communications, and Lockheed Martin—are either in the satellite services business or are working hard to get there. All three plan to be in the global satellite business and no longer limit their market to the US, as was the case only two or three years ago.

As the manufacturers move into operations, they should realize much higher profit margins. On the operating side of the business, the trend is to offer integrated services instead of pure capacity leasing. The result has been a huge expansion in the number of players in the satellite business.

In 1977, five operators earned a total of \$300 million in revenues, according to Euroconsult. By 1997, the operating field had grown to 45 with \$6.5 billion in revenues. Euroconsult expects satellite service revenues to reach \$30 billion-\$40 billion by 2007 and forecasts 25 percent of that huge sum coming from new applications such as mobile, broadband, and satellite-delivered radio.

# Internet in the Sky

Teledesic, one of the new proposed systems, is a 288-satellite constellation that would operate in the Ka-band region of the radio frequency and provide "Internet-in-the sky" links to schools, factories, homes, and offices. Daniel Kohn, Teledesic marketing director, says, "The killer application for us will be land extension [of terrestrial broadband systems] in the first few years. The customer will be telecom providers."

Teledesic plans to begin operating in 2003. Motorola and Boeing are partnered with Kirkland, Wash.based Teledesic, which needs at least \$9 billion to build its system. The venture was founded with money from telecom billionaires Bill Gates and Craig McCaw and thus is viewed by financial analysts as having a good shot at succeeding.

Following in the footsteps of Teledesic and Iridium are dozens of other projects. These would use satellites for:

Mobile services, not just to telephones but also to laptop computers and other small devices.

• Internet services to consumers and businesses under a new category called broadband or multimedia satellites.

• Rural telephony, where a satellite dish and pay phone are installed in remote villages in places such as Asia and Latin America, allowing several hundred villagers to share a phone, offering many the opportunity for the first time.

Several factors have converged in the last few years to make these projects more viable.

On the international trade front, an agreement on telecommunications struck in 1997 by the members of the World Trade Organization is gradually opening up markets all over the world to competition and new entrants. As the WTO agreement opens these markets, the new satellite companies have an opportunity to do business in countries that formerly had tightly controlled, monopoly telecommunications services.

On the technology side, Defense Department investment in advanced satellite technologies—in particular, projects such as Milstar—has provided companies like Motorola, TRW, Hughes, and Lockheed Martin experience that is being used in the commercial projects.

On the financial front, the public markets and private investors have pumped roughly \$16 billion in the last four years into satellite projects on the promise of extraordinarily high returns on investment, once the high cost of development has been paid.

# Extraordinary Risk

The market is just learning a fact of life long known to government space managers: Along with their ubiquitous nature and "instant infrastructure" advantage over terrestrial alternatives, satellites and rockets carry extraordinarily high risk.

With three highly visible launch failures during the summer and economic crises in several countries, satellite ventures fell out of favor temporarily with investors. The failures in mid-1998 included a PanAmSat Galaxy IV loss in orbit, a Delta III accident in August that blew up Pan-AmSat's Galaxy X, failure of several of Iridium's 70-plus satellites to operate correctly after launch, and the devastating loss of 12 Globalstar satellites in mid-September on a single Russian–Ukranian Zenit rocket.

Stock values in the satellite sector plummeted after years of strong upward growth. Investment has temporarily dried up, but until late summer, satellite investments had delivered phenomenal returns, thereby luring in even more investment. In 1997, satellite stocks brought shareholders, on average, a 64.8 percent return in the Mobile Satellite Sector and 54 percent in the fixed satellite sector, excluding the Asian satellite companies, which had poor returns due to the economic crises there.

Carol Goldstein, Morgan Stanley executive director, said that 1998 has been "much more volatile" than at any time in the recent past. The mobile satellite stocks were down 6.6 percent for the year by early September and fixed satellite stocks had lost 35 percent of their value since the start of the year.

By the end of July 1998, satellite financings for the year had slowed to a cumulative \$6.2 billion, which was far behind the \$14.4 billion raised in the first seven months of 1997, according to Stephane Chenard, an analyst with Euroconsult.

Analysts say the satellite industry is poised for sizable expansion, despite the risks and problems encountered this year.

In the mobile satellite category, market leader Iridium was to enter commercial service Nov. 1, followed

AIR FORCE Magazine / December 1998

by Globalstar in late 1999 and ICO in August 2000.

Iridium shapes up to be the goldplated service, with its charges reaching about \$3,000 for the satellite telephone handset and \$4.50 to \$9 a minute for telephone calls. Globalstar is to be considerably less expensive, with telephones priced under \$1,000 and calls at \$1.50 a minute, plus a service provider markup.

The market for global MSS is estimated to be 25 million subscribers by 2005, according to Iridium, a venture that claims to be able to break even at 600,000 users. Merrill Lynch estimates that subscribers will reach 32 million by 2007 with revenues of \$31.6 billion in the sector.

At least two other firms, Mobile Communications Holdings, Inc., and Constellation Communications, Inc., plan to enter the MSS business but are years behind the three market leaders. In 1998, MCHI and Constellation claim to have begun building their first satellites, but both ventures need to raise considerably more money to complete their development and get into business.

The "little LEO" business also was gearing up this fall for first commercial services with the market leader, Orbcomm, completing its 28-satellite constellation with launches in August and September. For \$1,000 or less, Orbcomm offers a communicator device that combines GPS signals with a short data messaging capability, allowing a user to transmit location and a message from anyplace on the planet for a few pennies. Orbcomm CEO Scott L. Webster says small Orbcomm cards, about the size of a matchbook, will be available for \$100-\$200 within a year.

# **Military Potential**

The miniaturization will enable Orbcomm's communications capability to be embedded in many portable devices for use in industry, by sports enthusiasts, for travelers, and with an obvious appeal to the military. Orbcomm should have the market to itself for about three years before competing systems from Final Analysis, E-Sat, and LEO One can start operations, according to Merrill Lynch. Those three systems are licensed to operate but in the fall were still raising money to build their systems.

The little LEO ventures are relatively inexpensive to deploy, costing several hundred million dollars compared to the billions needed for MSS or broadband.

Direct-To-Home satellite television reaches 9 million US homes currently. Hughes' DirecTV announced its 4 millionth subscriber in September and expects to reach its break-even point in early 1999. Familiar names like DirecTV, EchoStar, and Primestar have demonstrated that satellite television can compete successfully with cable television. Overseas, virtually every large nation has one or more DTH operators, with more introduced each year. Although ana-



lysts have been disappointed in general with the DTH business because subscriber numbers have consistently fallen short of projections, the application will continue to grow and fuel the demand for geostationary satellites. One recent study reports that subscribers will total 55.4 million by 2002, five times the number in 1997.

Rural telephony is emerging as an area where satellites finally are proving their value. Teledensity, or the number of phone lines per 100 persons in a country, is very low in most developing countries, and an estimated 500 million telephone lines are needed around the world in remote towns and villages. In the past, high costs, which could run \$20,000-\$60,000 for all the equipment needed to install a single telephone connection, kept satellite dishes from use as single or multiple line phone connections. However, in the last two to three years, suppliers such as Hughes Network Systems and Gilat Satellite of Israel, have brought the cost of Very Small Aperture Terminal-based telephone installations down to under \$3,000.

In a dozen countries, satellite rural telephony projects have begun operating in the last year or so, demonstrating that, when they share a phone, even villagers in Latin American or African nations can afford enough minutes per month to make them economically justifiable. The calls are costing from a penny to 15 cents a minute, or higher, and sometimes are subsidized, but early evidence is showing that satellite costs for this application can be low enough to work.

Euroconsult says hundreds of thousands or millions of satellite rural telephones could be needed as more countries deregulate, the number of competing carriers multiplies, and technology on the satellite side continues to improve and cost less.

# **Satellite Radio**

Digital Audio Radio Services, yet another new satellite endeavor, uses geostationary satellites. The pioneering venture in this field is WorldSpace, which launched the first of its four satellites Oct. 28 on an Ariane rocket. WorldSpace's AfriStar satellite in early 1999 will introduce satellite radio into Africa, the Middle East, the Mediterranean, and parts of southern Europe. Two other WorldSpace satellites— AsiaStar and AmeriStar—will extend coverage to Asia, Latin America, and the Caribbean later in 1999.

In the US, satellite-delivered radio will become available in 2000 after CD Radio and American Mobile Radio Corp. launch their competing satellite systems. Merrill estimates that nearly 54 million subscribers will use the satellite radio services by 2007, with revenues in the \$8.7 billion range.

Much of the projected growth for satellites is based on proposals for a new breed of satellites—broadband, multimedia systems that would deliver high-speed data. The explosive growth of the Internet and an underlying demand for more data services in general are behind some four dozen proposals for new satellite systems that would augment terrestrial transmission methods like fiber optic cables, telephone lines, cable TV networks, and wireless terrestrial systems.

Intelsat, which with 19 satellites currently in geostationary orbit has become one of the world's largest satellite operators, finds that "Internet via satellite is the fastest growing service ever," says Susan Gordon, an Intelsat official.

She added, "Customers say they prefer satellites over terrestrial for the ease of implementation. We think GEOs are the medium of choice for applications like multicasting and caching," two new Internet-servicerelated techniques of managing and storing web data.

Virtually all the existing satellite operators plan to serve the multimedia market in some fashion, as do new entrants such as Teledesic and SkyBridge, a French-backed project that plans an 80-satellite system to start operating in 2001.

# **Techno Darwinism**

The demand has drawn out at least 42 satellite proposals, representing 1,100 satellites at a cost of \$114 billion to build, according to Roger J. Rusch, president of TelAstra, a Palos Verdes, Calif.-based consulting company. Rusch and other analysts say the market likely will support only three to five of the systems, so most of these will remain paper satellites.

The proposals are wide-ranging. They include geostationary and nongeostationary constellations and operating in a variety of bandwidths. Some are licensed, others are not. Some of the systems involve numerous satellites and global coverage, while others are more limited in scope, covering only one region and costing much less to deploy.

Teledesic, SkyBridge, and systems proposed by Hughes, General Electric, and Lockheed Martin are leading the broadband satellite pack. Most of the projects aim to be up and



running in the 2001–03 period. Other companies, like Loral, are testing broadband waters early by offering services over existing satellites and deferring decisions on investing in new dedicated broadband satellites. Loral's CyberStar company is offering corporate networking services over Loral's Skynet satellites.

Rusch warns that the broadband satellite sector has many problems to overcome before operations can start. Rain fade will interfere with the higher frequencies such as Kaand V-bands, forcing the use of larger dishes and resulting in service outages in some places with a lot of rainfall. The technical challenge of developing small, relatively cheap terminals that can track fast-moving, low satellites for consumer applications could drive equipment costs up and set back the companies with low Earth orbiting systems. The billions of dollars required to build the satellites still must be raised, and investors are not likely to sink money into the broadband satellites until the mobile satellite systems like Iridium prove to be profitable.

Even more-visionary satellite applications are emerging for later in the first decade of the new century. A next-generation mobile phone system requiring dozens more satellites in Low Earth Orbit to follow Iridium is being planned by Motorola under the name Iridium Next, or INX. Motorola has been secretive about the project, for competitive reasons, but is believed to be designing a system that would allow the small handheld phones to perform many more functions than the basic voice, paging, and very slow data transfer of the first-generation Iridium.

Horizons, a geostationary satellite system that would allow laptop computers to connect via satellite from anywhere in the world, is another mobile venture sponsored by Inmarsat, the global maritime satellite organization. But Inmarsat will have to privatize, as it plans to do next April, before it can proceed with the new venture.

# High Military Interest

Military interest in the new communications satellite ventures is keen.

Air Force Lt. Col. Edward Alexander, staff assistant for satellite communications systems in the Defense Department's C<sup>3</sup>I Systems Office, says DoD is taking advantage of the commercial satellite market on two levels.

"We're reaping a tremendous dividend in new systems that we didn't have to pay a lot of development costs for," he noted. "We used to lead the commercial market in development and engineering, but that has flip-flopped. We are now able to buy satellites off the production line that are much more capable and can be flown much sooner. We're looking at three to four years rather than seven to 10" to develop a satellite.

"In addition we do a fair amount of leasing, and as there are more players in the marketplace, it is driving down rates," he said.

So far, the Defense Department has signed on for only limited use of the new satellites. The Pentagon is buying some 2,000 terminals for the Iridium system and building its own "gateway" ground station to access the system. Orbcomm has orders for 600 terminals for vehicle asset tracking from DoD, with the prospect to grow to 50,000.

"With a \$100 million investment for the Iridium gateway, we can use the 66-satellite system" that cost about \$5 billion to develop, he says. "For the next big class of commercial satellite—broadband systems like Teledesic and SkyBridge—we are looking at a similar scenario to leverage a system on orbit and just receive services."

Numerous DoD studies have concluded that, in the long run, it is cheaper for the military to own its own satellites than to rely on commercial services, but in the short term, military communications managers are finding that commercial satellites can fulfill immediate requirements within available budgets. Alexander points out that by law, contractors can only make 12 percent profit on a satellite DoD buys, but for commercial transponders, the markup is not regulated and can be 30-50 percent. DoD users who need communications that are nuclearhardened or with anti-jamming features will have to be carried on Milstar or the Milstar Follow-On system since alternatives, whether they are military or commercial, will not have the costly protection features. For that reason, Alexander said, he sees commercial systems serving as an adjunct to DoD satellites, not as a replacement.

"Due to the declining congressional budgets for defense spending and the explosive growth in information. DoD has had to look at moving a good percentage of its day-today communications traffic from military systems to commercial systems," says Mary Ann Elliott. She is president and CEO of Arrowhead Space and Telecommunications of Falls Church, Va., a company that provides domestic and international satellite communications capacity to US military and other users. DoD information managers want to provide digital information, including detailed digital battlefield maps, to all participants in a conflict.

"This requires expansive amounts of bandwidth. They are looking at utilizing the mobile satellite systems, but increasingly, they are looking at Ka-, V- and Q-bands," Elliott says.

Although Elliott believes the military will find using commercial systems more expensive than owning its own, she said DoD and the services are being forced to go commercial because Congress won't allocate funds for new military satellite systems and because the services have been unable to define, fund, and build communications satellites in a timely fashion. As evidence, Elliott cites the \$18 billion investment in Milstar, with its limited capacity and low data rate.

Already DoD buys some commercial satellite capacity through brokers like Arrowhead and Comsat, which holds a sizable contract from DISA to provide commercial satellite services. The Defense Department also is considering paying up front for a commercial space segment before it is used so that the commercial operators will consider special requirements like hardening of satellites against radiation or attack.

Elliott says DoD will have to deal with internal conflicts as it uses increasing amounts of commercial satellite services. "The government has to realize it is just another user on a commercial system, and not even a major user," Elliott remarked.

Theresa Foley, a freelance writer living in Florida, is a former editor of Space News. Her most recent article for Air Force Magazine, "Corona Comes In From the Cold," appeared in the September 1995 issue.



1998 Bell Helicopter Textron, Inc./ Boeing Helicopters.

# The CV-22 Tiltrotor. CSAR.

Flies like an airplane, lands like a helicopter. It offers a whole new approach to Air Force Combat Search And Rescue.

This expeditionary aircraft is fast. Survivable. And sure to get in, get the job done and get out.

BELL BORING ALLISON The Tiltrotor Team A JOINT SERVICE PROGRAM

Before you can say, "Mission accomplished."

The tilt-rotor Osprey will give the Special Operations Forces the range to reach far into enemy territory.

By John A. Tirpak, Senior Editor

When the CV-22 finally reaches Air Force Special Operations Command, it will do more than simply replace some aging aircraft. It promises to transform the way APSOC operates and how it thinks about its mission. In fact, the Osprey's impact might be felt beyond the Special Operations Forces.

The CV-22 is the Air Force version of the new Osprey tilt-rotor, an entirely new breed of aircraft that is neither pure airplane nor pure helicopter but has features of both. The Osprey takes off and lands like a helicopter, lifted by two huge rotors on the tips of its wings. Once in flight, the rotors can tilt forward, turning the aircraft into a high-speed turboprop. Over the years, many have attempted to develop such a hybrid, but the Osprey is the first aircraft offering sufficient reliability and utility to be of practical military value. The aircraft is about half the size of a C-130 transport.

The rotors can again be tilted toward 90 degrees for either a vertical landing or a rolling landing if it is heavily loaded. The Osprey will be able to take off and land within the exact same space as the H-53 Super Jolly series of helicopters it will replace and do it more stealthily and quietly than any previous large rotorcraft.

Assuming that it successfully completes its flight test program—and all signs are that it will—the aircraft will begin operational Air Force service in about five years. Military leaders expect the Osprey to remain in the inventories of at least three US armed services halfway into the next century.

"This aircraft is so revolutionary, ... we have no idea of [its] boundaries," said Air Force Lt. Col. Jonathan Jay, CV-22 program manager. "This aircraft is going to have capabilities that we're [now] unaware of."

The Osprey is being developed by a contractor team of Bell and Boeing, under the overall direction of the Marine Corps. The Corps has a desperate need to replace ancient CH-46 Sea Knight helicopters, many of which are already five years beyond their planned retirement points. The



A V-22 in helicopter mode for takeoff. The Osprey is the first aircraft ever to combine vertical takeoff and landing with long range, high speed, and a big payload—just the ticket to give SOF units a quick, covert ride to the action.

Marine Corps version, called the MV-22, will ferry troops, supplies, and small vehicles from amphibious assault ships to landing zones ashore.

The Marine Corps may have the lead, but the Air Force has viewed the Osprey, with its ability to fly fast and far and land vertically, as a natural for SOF activities.

# Resurrection

Unlike helicopters, the CV-22 won't need to be disassembled and loaded into a large cargo jet to get overseas; with a single refueling, it will be able to self-deploy and fly



The Osprey is a big aircraft, at nearly half the size of a C-130. Its extended range will reduce the number of refuelings needed, permitting retirement not only of the MH-53 force it will replace but of some MC-130 tankers as well.

2,100 nautical miles on its own to get to the action.

It will also be able to fly from a ship or forward staging area over a distance of 500 nautical miles with 18 troops and then return without need of refueling. Indeed, it was largely on the strength of the V-22's promise as an SOF platform that Congress forcibly resurrected the program in 1989. The Pentagon canceled it to save money, but lawmakers demanded its return to the defense program.

Current Air Force plans call for the service to acquire 50 CV-22s. USAF will piggyback on the Marine program, paying only for the aircraft it buys and for the development of the special features the AFSOC version will require.

These features include extra fuel tanks in the wings, terrain-following and terrain-avoidance radar, a more detailed digital map, an inflight refueling probe, and the Suite of Integrated Radio-frequency Countermeasures, or SIRC. The USAF model will also have additional "buckets" of chaff and flares as well as two additional radios. Later in the program, a gun will be added as part of a preplanned product improvement program.

The Navy, too, will buy a search and rescue and utility version called HV-22, but the 48 aircraft it has in mind would come at the end of the V-22 production run. The V-22's wings rotate and its rotors fold for compact stowage aboard ship. All



Combat controllers like these from the 23d Special Tactics Squadron, Hurlburt Field, Fla., can hardly wait to see what new capabilities can be squeezed from the CV-22, which can out-carry, outrun, and outlast their MH-60G.

three types will come with a forward-looking infrared system.

Today, the Army is the only US armed service that is not involved in the program. It formerly was a partner with the other services, and it viewed the V-22 as the eventual replacement for the aging CH-47 Chinook helicopter, but it bowed out in the 1980s because it lacked the money for a long-term effort.

In Air Force plans, the CV-22 is earmarked for what AFSOC calls the "long range covert-penetration" mission. The mission is handled today by the MH-53J Pave Low III helicopter, a heavily modified version of the H-53 series designed in the 1950s. The Pave Low III is used to fly at treetop level or lower to get commandos deep inside enemy territory and out again. It can carry small vehicles—jeeps, motorcycles, or all-terrain vehicles—and operate in all types of weather.

However, the Pave Low lacks long range. For most missions, it requires multiple refuelings from another AFSOC aircraft, the MC-130P. The introduction of the 50 CV-22s will give the force the long legs it always has lacked and, at a stroke, will permit the Air Force to retire 80 AFSOC aircraft—Pave Lows, tankers, and some MH-60G Pave Hawks, which complement the Pave Low but lack its lifting power or range.

# **Deep and Dark**

The long-range covert penetration

mission is an important one, having unique requirements. To do it, AFSOC forces operate "in the hours of darkness," Jay said, noting, "That's when we operate very well and our adversaries tend not to."

Operating in nighttime darkness, Pave Lows and Pave Hawks find holes in an enemy's radar coverage, slip through, and go to the objective over the path least likely to attract attention. Refuelings—performed in blackout conditions at breathtakingly low altitudes—are inherently risky.

For very long missions deep inside enemy territory, the aircraft have to hide during the day, continuing their mission at night. It is not easy to keep these machines under wraps. With their array of extra tanks, FLIR turrets, radomes, infrared countermeasures, antennas, and other gadgetry, the SOF choppers are unlikely to be mistaken for civilian aircraft, even at a distance.

Air Force special operators have concluded that the CV-22 will vastly simplify the mission. It offers "double the radius and double the speed" of the MH-53J, Jay noted, adding that this adds up to "doing things faster, without refueling, and offering us more flexibility" to undertake missions previously considered not feasible or simply out of range.

Jay cited a case in point: Operation Eagle Claw, which is better known as Desert One, the disastrous 1980 attempt to rescue US hostages held in Iran. "If you recall Desert One," Jay said, "that operation was to have taken a couple of days," including on-ground and aerial refuelings, as well as daytime hiding layovers. With the CV-22, he said, AFSOC could do the entire mission "in one night." The Osprey could fly at 300 knots and even incorporates some stealth features, such as infrared suppressors on the exhausts.

"The single greatest advantage" of the CV-22, Jay said, is its range. "We could take a 10-man team 700 miles in, 700 miles out, [and] drop them off, ... and that's all in the hours of darkness; ... whereas before, if we did that with a helicopter, it would take at least three or four air refuelings, [and] probably a full day.... That's the quantum leap, here."

Combining the speed of a turboprop with the attributes of a helicopter also adds mission flexibility in other ways, Jay said.

"If we need to go somewhere really fast, we can do that. If the mission calls for ... going really low and slow, we can do that, too." While the CV-22 will have the inherent capability for "slung" loads like its Marine cousins, AFSOC doesn't plan to use it in that configuration.

Jay noted, moreover, that the CV-22 will give Air Force SOF crews a highly upgraded, sophisticated electronic warfare suite. "If we do go in harm's way, it gives us a much better potential of getting out safely," he said.

# Flying Armor

Officials also cite the aircraft's inherent battle-worthiness. To keep its exotic technology flying in the event of a system failure or hostile fire, Osprey's designers made its systems redundant, separated, and in some places, armored. One engine can power both rotors if necessary, thanks to cross-shafting between them. The composite materials can absorb the hit of a bullet and not crack. The seats and some parts of the cockpit are also armored.

The Air Force will put into the CV-22 a flight crew of three—pilot, copilot, and flight engineer. The service has not yet decided which of the three will be designated to use the Osprey's chin-mounted gun. "I think it may be that ... depending on where they are in the mission, it might be



The Osprey will go first to the Marines for ship-to-shore lift of troops and cargo, then to USAF for special operations, and finally to the Navy for Combat Search and Rescue, a mission USAF is also considering for the plane.

that any of the [three] could operate the gun," Jay said.

The computer displays will update threats in near real time, offering the crew a chance to see in a 3-D display where they can safely fly. Should any of the multifunction displays fail, others will take over its task, reducing the risk of "flying blind" from a display failure or lucky hit. There are "no knobs" on the computers, Jay noted.

The CV-22 won't be able to land like a conventional airplane, moving down the runway horizontally with engines tilted forward like propellers. The propellers are too big for this and would strike the ground.

Even so, each CV-22 will have a capability to make such a landing on a one-shot basis. The propellers are designed to break in a way that aids crew survivability, if such a landing were made in an emergency. The composite rotors, rather than breaking up into guillotine-like pieces of shrapnel, would simply shred into brittle filaments. The aircraft could, in an emergency, make an unpowered landing in helicopter mode; it has a limited ability to autorotate to a hard but survivable landing.

The Osprey can even fly backwards. The trick can be done by tilting the rotors past 90 degrees vertical. At this point, the power to fly backwards is more a quirk than a capability, but such maneuvers may someday yield a useful combat tactic for the special operators. Such characteristics will be explored during the Air Force's Initial Operational Test and Evaluation effort.

# On the CSAR?

The revolutionary Osprey is being considered for another important Air Force mission—Combat Search and Rescue. Today, the Air Force meets this requirement with a force of MH-60G helicopters. Officials note that the Air Force has not changed this situation and at present plans to continue using MH-60s for the task.

Even so, change may well come. Brig. Gen. Richard L. Comer, deputy assistant secretary of defense for policy and missions, ASD for Special Operations and Low Intensity Conflict, recently told a Washington audience that the CV-22 offers too many advantages in CSAR work for the Air Force not to buy it, eventually, for that purpose.

In CSAR, Comer said, "The critical element ... is time," since there may only be a few minutes in which to rescue a downed crewman who is either badly injured or facing imminent capture. The CV-22, he said, is a "deep battle machine." That fact dovetails with the Air Force, he said, because USAF is "culturally ... a deep battle force."

At present, Air Combat Command manages the CSAR mission, with its equipment falling under ACC purview. According to Comer, the CSAR and SOF communities "often don't communicate well when it comes to planning requirements and missions." He speculated that CSAR operators are afraid that they will be "swallowed" by AFSOC.

Comer voiced his approval of the CV-22 for CSAR because it offers the opportunity to "go in high," if such an approach would work better in certain missions. Also, he pointed out, the CV-22 can self-deploy to a far-forward base, whereas CSAR helicopters must be transported in a heavy airlifter like the C-17 or C-5, undergo reassembly at the destination, and then go through test flights before use.



Looking like a Rube Goldberg special, the MH-53J Pave Low III has been heavily modified with strap-on fuel tanks, terrain-following radar, night vision equipment, and countermeasures. The CV-22 carries this gear internally.



Flight testing is going well with the V-22. Built to last as many as 40 years, the V-22 will likely take on new missions, should it prove as versatile as expected. A civil tilt-rotor for intercity commutes is on the drawing board.

Comer cautioned, however, that the purchase of CV-22s for the CSAR mission is still not in the Air Force's plan. USAF also has not identified funds to apply to such a program.

Ever since the aircraft's engineering and manufacturing development program got under way, developers have carried out simulations to improve the cockpit layout and arrangement of gear inside the aircraft for maximum efficiency and common sense, Jay noted. "We've made lots of changes based on getting a real wide variety of crew members in [the simulator] from all different SOF backgrounds," he said. "This airplane [has] the capabilities of a helicopter and the capabilities of a C-130, and we have inputs from both of those career fields to really understand how to maximize that system."

Like a C-130, the V-22 has a rear ramp for loading vehicles and cargo. Like a helicopter, it has a rescue hoist, which is located inside the

CV-22 in Brief	
Operator	AFSOC
Function	Multimission airlift
Length	57.3 ft
Width (rotors turning)	84.6 ft
Weight (empty)	33,140 lb
Max takeoff weight (self-deployment)	60,500 lb
Ceiling	26,000 ft
Contractor	Bell/Boeing
SOF mission range	500 nm
Cruise speed	261 knots
Self-deployment range	2,487 nm
Shipboard compatibility	Yes
Air refueling capability	Yes
Programmed production number	50
First flight (V-22)	March 19, 1989
Planned delivery	2003
Initial operational capability	2004
Power plant	2 turbines
Thrust per engine	6,150 hp

AIR FORCE Magazine / December 1998

cabin to avoid drag and swings out in helicopter mode.

Jay added that "I think this [the extensive simulator work] is really revolutionary. It's a huge step for us in maximizing our cockpit management system." By that, he means that, when IOT&E gets under way with the real aircraft, endless notional rehearsals in the simulator will "put us way ahead of the game" and keep IOT&E more of a "validation" experience than a discovery period for making costly changes to the aircraft.

Air Force Chief of Staff Gen. Michael E. Ryan flew the V-22 in September and emerged pronouncing it "a very easy airplane to fly." Ryan said he had no trouble adjusting to what he expected to be the tricky part of the flight—making the transition from helicopter mode to airplane mode. The left hand control is a throttle in airplane mode and functions like a collective in helicopter mode; on the right hand, the "stick" between the pilot's legs functions as the cyclic in helicopter mode.

Ryan noted that a small thumbwheel on the left hand "thrust control" lever controls the angle of pitch of the engine nacelles and permits the aircraft to safely go into many attitudes that would be a precursor to a crash in any other airplane.

The first CV-22s will reach AFSOC in 2003. In that year, USAF expects to have four aircraft at Hurlburt Field, Fla. The services will send their V-22 pilots to MCAS New River, N.C., for what Jay called "basic, 100-level training" in the airplane. After that, CV-22 pilots will train at Kirtland AFB, N.M., in the special missions and capabilities of the SOF version, and finally from there go to operational units.

The Air Force should be able to declare initial operational capability in 2004, when it's expected that 10 aircraft will have been delivered. The full buy of 50 won't be completed until 2012. That's when the last MH-53Js will be phased out.

Jay said the Air Force is getting its money's worth from the Osprey multiservice program. "This has been a very cooperative effort across the services, for the most part. You always have challenges in a joint program. Sometimes you have to pull teeth and sometimes you get so much," but "I think right now we've got a very successful ... effort."

It was justifiably called "the airlift that saved Israel."



By Walter J. Boyne

AIR FORCE Magazine / December 1998



USAF's Operation Nickel Grass airlifted war materiel to Israel during the 1973 Mideast war. As part of the commemoration of the airlift's 25th anniversary, aviation artist Gil Cohen recently completed this painting, depicting a typical scene at the Lod/Ben-Gurion air complex near Tel Aviv, Israel. The painting hangs at the Air Mobility Command Museum at Dover AFB, Del.



New to USAF's fleet, the C-5 proved itself in Nickel Grass, hauling in oversize items like tractors, helicopters, and M-60 tanks (above). The first C-5 airlifter to land at Lod delivered 97 tons of 105 mm howitzer shells.

NE of the most critical but least celebrated airlifts in history unfolded over a desperate 32 days in the fall of 1973. An armada of Military Airlift Command aircraft carried thousands of tons of materiel over vast distances into the midst of the most ferocious fighting the Middle East had ever witnessed-the 1973 Arab-Israeli War. MAC airlifters-T-tailed C-141s and C-5As-went in harm's way, vulnerable to attack from fighters, as they carved a demanding track across the Mediterranean, and to missiles and sabotage, as they were off-loading in Israel.

Though not as famous as the 1948– 49 Berlin Airlift or as massive as the 1990–91 Desert Storm airlift, this 1973 operation was a watershed event. Code-named "Nickel Grass," it restored a balance of power and helped Israel survive a coordinated, life-threatening Soviet-backed assault from Egypt and Syria. It proved the Air Force concept of global mobility based on jet-powered transport aircraft. The airlift also transformed the image of the C-5 from that of expensive lemon to symbol of US might.

A quarter of a century ago, in summer and fall 1973, the Mideast seethed with tensions. Six years earlier, in June 1967, Israeli forces conquered vast swaths of land controlled by Egypt, Syria, and Jordan. Cairo and Damascus failed over the years to persuade or force Israel to relinquish its grip on the land and, by 1973, the stalemate had become intolerable. Egypt's Anwar Sadat and Syria's Hafez al-Assad meticulously planned their 1973 offensive, one they hoped would reverse Israeli gains of the earlier war and put an end to Arab humiliation. The war was set to begin on the holiest of Jewish religious days, Yom Kippur.

# Trapped by Complacency

The Arab states had trained well and Moscow had supplied equipment on a colossal scale, including 600 advanced surface-to-air missiles, 300 MiG-21 fighters, 1,200 tanks, and hundreds of thousands of tons of consumable war materiel. On paper, the Arabs held a huge advantage in troops, tanks, artillery, and aircraft. This was offset, in Israeli minds, by the Jewish state's superior technology, advanced mobilization capability, and interior lines of communication. Despite unmistakable signs of increasing Arab military capability, Israeli leaders remained unworried, even complacent, confident in Israel's ability to repel any attack.

The Israeli government became unequivocally convinced of impending war just hours before the Arab nations attacked at 2:05 p.m. local time, Oct. 6. Prime Minister Golda Meir, despite her immense popularity, refused to use those precious hours to carry out a pre-emptive attack; she was concerned that the US might withhold critical aid shipments if Washington perceived Israel to be the aggressor.

On the southern front, the onslaught began with a 2,000-cannon barrage across the Suez Canal, the 1967 cease-fire line. Egyptian assault forces swept across the waterway and plunged deep into Israeliheld territory. At the same time, crack Syrian units launched a potent offensive in the Golan Heights. The Arab forces fought with efficiency and cohesion, rolling over or past shocked Israeli defenders. Arab air forces attacked Israeli airfields, radar installations, and missile sites.

Day 4 of the war found Israel's once-confident military suffering from the effects of the bloodiest mauling of its short, remarkably successful existence. Egypt had taken the famous Bar Lev line, a series of about 30 sand, steel, and concrete bunkers strung across the Sinai to slow an attack until Israeli armor could be brought into play. Egyptian commandos ranged behind Israeli lines, causing havoc. In the north, things looked equally bad. The Syrian attack had not been halted until Oct. 10.

Grievously heavy on both sides were the losses in armored vehicles and combat aircraft. Israeli airpower was hard hit by a combination of mobile SA-6 and the man-portable SA-7 air-defense missiles expertly wielded by the Arabs. The attacking forces were also plentifully supplied with radar-controlled ZSU-23-4 anti-aircraft guns. Israeli estimates of consumption of ammunition and fuel were seen to be totally inadequate. However, it was the high casualty rate that stunned Israel, shocking not only Meir but also the legendary Gen. Moshe Dayan, minister of defense.

The shock was accompanied by sheer disbelief at America's failure to comprehend that the situation was critical. Voracious consumption of ammunition and huge losses in tanks and aircraft brought Israel to the brink of defeat, forcing the Israelis to think the formerly unthinkable as they pondered their options.

Half a world away, the United States was in a funk, unable or unwilling to act decisively. Washington was in the throes of not only post-Vietnam moralizing on Capitol Hill but also the agony of Watergate, both of which impaired the leadership of President Richard M. Nixon. Four days into the war, Washington was blindsided again by another political disaster—the forced resignation of Vice President Spiro T. Agnew.

Not surprisingly, the initial US reaction to the invasion was one of confusion and contradiction. Leaders tried to strike a balance of the traditional US support of Israel with the need to maintain a still-tenuous superpower détente with the Soviet Union and a desire to avoid a threatened Arab embargo of oil shipments to the West.

# Shifting Scenarios

The many shifts in US military planning to aid Israel are well-documented, notably in *Flight to Israel*, Kenneth L. Patchin's official MAC history of Operation Nickel Grass. Nixon, in response to a personal plea from Meir, had made the crucial decision Oct. 9 to re-supply Israel. However, four days would pass before the executive office could make a final decision on how the re-supply would be executed.

Initially, planners proposed that Israel be given the responsibility for carrying out the entire airlift. (Israel did use eight of its El Al commercial airliners to carry 5,500 tons of materiel from the US to Israel.) Israel attempted to elicit interest from US commercial carriers, but they refused to enlist in the effort, concerned as they were about the adverse effects Arab reaction would have upon their businesses. MAC's inquiries with commercial carriers received the same negative response. Then, it was suggested that MAC assist the Israeli flag carrier by flying the material to Lajes, the base on the Portuguese Azores islands in the Atlantic, where it could be picked up by Israeli transports.

The US dithered in this fashion for four days. Then, on Oct. 12, Nixon personally decided that MAC would handle the entire airlift. Tel Aviv's Lod/Ben-Gurion air complex would be the off-load point.

"Send everything that can fly," he ordered.

USAF had been preparing right along to take on the challenge. Gen. George S. Brown, USAF Chief of Staff, telephoned Gen. Paul K. Carlton, MAC commander, to begin loading MAC aircraft with materiel but to hold them within the US pending release of a formal order sending them onward. Carlton put his commanders on alert and contacted the heads of other involved commands, including Gen. Jack J. Catton of Air Force Logistics Command. AFLC accorded the same high priority to Nickel Grass, and the results showed immediately. More than 20 sites in the United States were designated to be cargo pick-up points where the US military would assemble materiel for shipment to Israel. Equipment, some directly from war-



The Air Force initially set the daily flow of airlifters at 12 C-141s and four C-5s, then raised it to 17 and six, respectively, until Oct. 30. The pace was rough on aircrews and support personnel alike.

AIR FORCE Magazine / December 1998

reserve stocks, began pouring into these sites.

Less than nine hours after Nixon's decision, MAC had C-141s and C-5s ready to depart. There would be some initial delays, and they would encounter some difficulties en route, but they would be the first of a flood of aircraft into Israel.

The complex nature of Nickel Grass required a flexible chain of command. Within MAC, 21st Air Force, commanded by Maj. Gen. Lester T. Kearney Jr., was designated as the controlling Air Force. The vice commander of 21st, Brig. Gen. Kelton M. Farris, was named MAC mission commander. The prime airlift director was Col. Edward J. Nash.

# We'll Hold Your Coat

The threat of an oil embargo frightened US allies. With a single exception, they all denied landing and overflight rights to the emergency MAC flights. The exception was Portugal, which, after hard bargaining, essentially agreed to look the other way as traffic mushroomed at Lajes Field. Daily departure flights grew from one to 40 over a few days. This was a crucial agreement for MAC, which could not have conducted the airlift the way it did without staging through Lajes.

When Nixon flashed the decision Oct. 12, top American officials instantly applied pressure for immediate results. MAC's complex machinery sprang into action, but it took some hours to establish a steady, regulated flow of aircraft and crews. Initial flights were delayed because of high winds at Lajes, generating White House fury that supplies had not magically reached Israel.

Adm. Thomas H. Moorer, Chairman of the Joint Chiefs of Staff, called Carlton about this, saying, "We'll have to get them moving, or we'll lose our jobs."

Carlton knew the airlift business. He knew that he had an adequate number of aircraft, crews, and required equipment. The fleet consisted of 268 C-141s and 77 C-5As, and Carlton knew that he could sustain a steady flow of three C-141s every two hours and four C-5s every four hours—indefinitely. He also knew that MAC could orchestrate the operation, establishing a rational flow of aircraft matching the cargo to be carried with off-loading equipment at the destination. In his plan, MAC would essentially become a conduit through which materiel would flow in a well-adjusted stream.

At first, however, he could not convey either his concept or his confidence to the White House, State Department, or Pentagon.

Carlton had already begun to expedite things, taking extraordinary actions in the interest of saving time. These steps included waiving crew rest requirements, weight limitations, daily utilization restrictions, and routine maintenance demands. He had to fight a continuing change of orders streaming out of the White House and State and Defense departments. There was continuing pressure to enlist the help of commercial airlines, despite their universal reluctance. At one point, late in the game, officials threatened to remove MAC entirely from the operation.

Even so, Carlton was confident he could establish a flow that not only would let MAC handle the initial requirement of 4,000 tons of materiel but also continue to handle all of MAC's other assignments. He asked for patience, stating that "once this flow starts, it [the materiel] is going to come like a bushel basket of oranges just being dumped."

The average distance from US departure points to Lajes was 3,297 miles. It was another 3,163 miles from Lajes to Lod/Ben-Gurion. The route varied from eastern departure points (McGuire AFB, N.J.; Dover AFB, Del.; and Charleston AFB, S.C.) to Lajes, but from Lajes onward it was precise. Aircraft flew to Gibraltar at the southern tip of Spain and then followed a narrow path over the Mediterranean to Tel Aviv.

The route was deliberately placed along the center of the Mediterranean Sea on the Flight Information Region boundary line dividing the airspace of the hostile African states to the south and that of the "friendly" European states to the north.

# Fighters All the Way

The threat of Arab interception was real, and the US Navy's Sixth Fleet acted as protector until the transports came within about 200 miles of Israel. There Israeli air force fighters took over. Although threats were made by radio, and several unidentified fighters were seen, no overt hostile action was taken.

Neither Lajes nor Lod possessed adequate aerial port facilities. Carlton called for establishment of Airlift Control Elements at both places, accurately estimating the number of personnel and the equipment that each would require. (More than 1,300 people would work at Lajes, seriously taxing all the facilities.) Other ALCEs were established at points within the US where aerial port facilities were not sufficient to handle the rush.

The initial missions to Israel were



Supplies airlifted into Lod kept aircraft like this Israeli air force A-4 flying. From Nickel Grass USAF learned the importance of an overseas staging base such as Lajes and the requirement for aerial refueling of airlifters.

delayed as a result of 50-knot crosswinds at Lajes. Scheduled to be the first aircraft at Lod was a C-5 carrying the ALCE team, headed by Col. Donald R. Strobaugh. However, it encountered engine trouble and had to return to Lajes, where Strobaugh and his team transferred to a C-141.

The first C-5 (Tail No. 00461) to land at Lod touched down at 22:01 Zulu. It carried 97 tons of 105 mm howitzer shells, and it arrived at a time when Israeli forces were down to their last supplies of ammunition. Another 829 tons would be delivered in the next 24 hours. Even as Israeli workers unloaded those first cargo airplanes, huge formations of Israeli and Egyptian armor, maneuvering just 100 miles to the southwest, were locked in a desperate tank battle that would prove to be the largest clash of armor since the World War II Battle of Kursk.

Carlton was only too aware of the C-5's vulnerability to ground attack. Whenever possible, the Air Force would have only a single C-5 on the ground at any one time.

The first C-141 (Tail No. 60177) to arrive at Lod landed at 23:16 Zulu. The aircraft carried more ammunition but, more importantly, it delivered Strobaugh and his ALCE crew. The group ultimately numbered 55, all of whom worked 12 hours a day, seven days a week. They were given three 40K loaders as well as locally improvised unloading gear.

The arriving MAC airplanes were greeted ecstatically by the Israelis. The crews received red-carpet treatment. Israel put in place a system to expedite cargo handling; materiel unloaded from the transports usually were at the front in Syria in about three hours and in the Sinai in less than 10 hours.

The original 4,000-ton airlift requirement grew daily. After the first day, USAF set the daily flow requirement at four C-5s and 12 C-141s. After Oct. 21, it raised the aircraft flow level to six C-5s and 17 C-141s and maintained it there until Oct. 30, when the demand began to drop.

The continuous flow of aircraft on the long flights was tough on the aircrews, but MAC was judicious in its positioning of relief crews for the C-141 and using augmented crews on the C-5. A special pool of navigators was created for the vital but tedious task of navigating the Mediterranean.

# To the Offensive

Because it eliminated the need to husband ammunition and other consumable items, the continuous flood of US war materiel enabled Israeli forces to go on the offensive in the latter stages of the war. In the north, Israel's ground forces recovered all territory that had been lost and began to march on Damascus. In the Sinai, tank forces led by Maj. Gen. Ariel Sharon smashed back across the Suez, encircled the Egyptian Third Army on the western side of the canal, and threatened Ismailia, Suez City, and even Cairo itself.

Egypt and Syria, which had previously rejected the idea of a negotiated settlement, now felt compelled on Oct. 22 to agree to the arrangement hammered out by Washington and Moscow with the goal of preventing the total destruction of the trapped Egyptian army. Israel was reluctant to comply immediately, wishing to gain as much as possible before a cease-fire.

The Soviet Union, faced with Israel's continuing offensive, raised the stakes. Moscow declared to the United States that, if the US could not bring Israel to heel, it would take unilateral action to dictate a settlement. On Oct. 24, the United States, in order to intensify the image of risk in Soviet minds and keep Soviet forces out of the crisis, responded by taking its armed forces to a worldwide DEFCON III alert, implying readiness for nuclear operations, if necessary.

Fortunately, after several abortive efforts, an effective cease-fire finally took hold Oct. 28.

Israel suffered 10,800 killed and wounded-a traumatic loss for a nation of some 3 million personsplus 100 aircraft and 800 tanks. The Arab nations suffered 17,000 killed or wounded and 8,000 prisoners, and lost 500 aircraft and 1,800 tanks.

The airlift officially ended Nov. 14. By then, the Air Force had delivered 22,395 tons of cargo-145 missions by C-5 Galaxy and 422 missions by C-141 Starlifter. The C-5s delivered about 48 percent of the tonnage but consumed 24 percent less fuel than the C-141s. Included in the gross cargo tonnage was a total of 2,264.5 tons of "outsize" materiel, equipment that could be delivered only by a C-5. Among these items were M-60 tanks, 155 mm howitzers, ground radar systems, mobile tractor units, CH-53 helicopters, and A-4E components.

The airlift had been a key to the victory. It had not only brought about the timely resupply of the flagging Israeli force but also provided a series of deadly new weapons put to good use in the latter part of the war. These included Maverick and TOW anti-tank weapons and extensive new electronic countermeasures equipment that warded off successful attacks on Israeli fighters. Reflecting on the operation's vital contribution to the war effort, Reader's Digest would call it "The Airlift That Saved Israel."

Both US transport types distinguished themselves by performing reliably and economically. The C-5A had an 81 percent reliability while the C-141 registered a 93 percent reliability. No accidents occurred. The abort rate of all planned flights came in under 2 percent.

The airlift taught the Air Force many lessons, large and small. One was that Lajes was a godsend-one that the US best not take for granted in a future emergency. The Air Force established an immediate requirement for aerial refueling to become standard practice in MAC so that its airlifters could operate without forward bases, if necessary. Another lesson was that commercial airlines, on their own, could not be expected to volunteer their services and aircraft. This meant that access to commercial lift in the future would have to be met by activating the Civil Reserve Air Fleet, as in fact it was during the Gulf War. Nickel Grass also led to the consolidation of all airlift aircraft under Military Airlift Command and its designation as a specified command Feb. 1, 1977.

Finally, the C-5 proved to be the finest military airlift aircraft in history, not the expensive military mistake as it had been portrayed in the media. Its ability to carry huge amounts of cargo economically, carry outsize pieces of equipment, and refuel in flight fully justified the expense of the program.

"For generations to come," said Golda Meir not long after the war's end, "all will be told of the miracle of the immense planes from the United States bringing in the material that meant life for our people."

'alter J. Boyne, former director of the National Air and Space Museum in hington, is a retired Air Force colonel and author. He has written more  $\gamma$  articles about aviation topics and 29 books, the latest of which is 9 Horizons: The Lockheed Story. His most recent article for Air rine, "MiG Sweep," appeared in the November 1998 issue. 00

agazine / December 1998



The largest tank battle since World War II took place during the 1973 Arab–Israeli War. Airlifters not only resupplied the Israelis with M-60s but also brought in new

anti-tank weapons and electronic countermeasures equipment.

# **Gallery of NATO Airpower**

# By Paul Jackson and Kenneth Munson

Together with the "Gallery of USAF Weapons" in the May 1998 issue of *Air Force* Magazine, this Gallery gives information on all first-line aircraft and missiles in service with NATO air forces. The French air force is also included, as France remains a member of NATO although it withdrew from NATO military command in 1966.

# **Bombers**

# Mirage 2000N and D

Brief: Two bomber versions of the Mirage 2000 are employed by France for "pre" strategic and tactical missions

Function: Strike/attack

Operator: France.

First Flight: Feb. 3, 1983. Delivered: February 1987-present.

IOC: July 1, 1988.

Production: more than 130 (continuing). Inventory: 125 (mid-1998).

Contractor: Dassault Aviation, France.

- Data for Mirage 2000N. Power Plant: one SNECMA M53-P2 afterburning turbofan; 21,385 lb thrust.
- Accommodation: pilot and WSO in tandem, on zero/ zero election seats

Dimensions: span 29 ft 11 in, length 47 ft 9 in, height 16 ft 11 in.

Weight: empty 16,755 lb, gross 37,480 lb.

Ceiling: 54,000 ft.

Performance: max speed at height Mach 2.2, at S/L Mach 1.2; range hi-lo-hi 748 miles.

Armament: ASMP nuclear missile (2000N only); up to 13,890 lb of external stores, incl bombs, rockets, and Magic self-defense AAMs, but specifically APACHE (and derivatives) standoff weapons dispenser, BGL 1000 LGB (with laser designator pod), and AS 30L ASM. No internal guns.

COMMENTARY

2000N. By comparison with the Mirage 2000C, the 2000N has a strengthened airframe for flight at a typical 690 mph at 300 ft above the terrain. Three squadrons are assigned to the Forces Aériennes Stratégiques. Primary weapon is the 150 or 300 kT Air-Sol Moyenne Portée (ASMP) medium-range air-tosurface nuclear missile. Equipment includes ESD Antilope 5 terrain-avoidance radar, two SAGEM inertial platforms, two improved TRT AHV-12 radio altim-eters, and Thomson-CSF color CRT head-down dis-plays in each cockpit, Self-defense aids comprise two Magic IR AAMs and an integrated countermeasures suite comprising a Serval RWR, Caméléon electronic jammers, and Spirale automatic chaff/flare dispensers. The last of 75 aircraft was delivered in 1993. All have additional conventional-attack capability, SAT Samir missile plume detectors were fitted in 1995.

2000D. Conventional-attack version, of which 86 have been funded and about 60 delivered to date. Minor differences from the 2000N include the addition of GPS, one more multifunction display (MFD) in the front cockpit and two more in the rear, ICMS fully integrated self-defense suite, and deletion of the ASMP interface; the radar is Antilope 5-3C with terrain-following capability.

Both versions can carry two 528-gallon drop tanks, but the 2000D offers a wider choice of weapons, includ-ing laser-guided AS 30L ASMs and BGL bombs, APACHE standoff weapon dispensers (from 1999), bombs, and rockets, as well as several types of sensor pod. The first squadron was declared operational at Nancy on March 31, 1994, and two more have followed.

# **Tornado IDS**

Brief: The Tornado fulfills two roles for NATO forces: interdiction/strike and air defense (described separately

Function: Interdiction/strike.

Operator: Germany, Italy, and UK, First Flight: Aug, 14, 1974,

Delivered: July 1979-98. IOC: June 1, 1982.

Production: 780.

Inventory: Germany 202, Italy 75, UK 178, Contractor: Panavia Aircraft, a UK/German/Italian consortium

Power Plant: two Turbo-Union RB199 Mk 103 after-burning turbofans; each 16,075 lb thrust.



Mirage 2000N, French air force



A-7 Corsair II, Greek air force (Paul Jackson)

Accommodation: crew of two in tandem, on zero/zero ejection seats

- Dimensions: span 45 ft 8 in spread, 28 ft 3 in swept. length 54 ft 10 in, height 19 ft 6 in.
- Weight: empty 31,065 lb, gross approx 61,620 lb. Ceiling: not available
- Performance: max speed at height Mach 2.2, with external stores 691 mph; T-O run less than 2,950 ft, landing run 1,215 ft, radius of action, hi-lo-hi 863 miles.
- Armament: two 27 mm IWKA-Mauser guns in fuselage; seven fuselage and wing hardpoints for 19,840 lb of external stores, incl AAMs, ASMs, and ARMs; cluster bombs, napalm; nuclear, smart, retarded, and con-ventional bombs; rocket packs; flare bombs; jamming/deception and chaff/flare ECM pods; and fuel tanks

# COMMENTARY

Key to the IDS Tornado's all-weather interdiction capability is a Texas Instruments multimode ground-mapping and terrain-following radar. This is backed in UK aircraft by a laser range finder and marked target seeker (LRMTS) in an undernose pod. Specialist weap-ons of RAF squadrons include ALARM anti-radar missiles and Paveway II/III LGBs guided by Thermal Imag-ing Airborne Laser Designator (TIALD) pods. The WE177 nuclear bomb was withdrawn in March 1998.

The Tornado IDS aircraft of the Italian and German air forces can carry B61 nuclear bombs, AGM-88 HARM anti-radar missiles, and MW-1 anti-airfield bomblet dispensers. Italy also has six equipped to carry Thomson-TRT CDLP laser designator pods for Paveway II LGBs and a squadron armed with Kormoran anti-ship missiles

GR. Mk 1B. RAF variant, in two squadrons (26 air-craft), capable of carrying up to four Sea Eagle antiship missiles. The weapon will be phased out early next century in favor of TIALD/Paveway III. Tornados of all three NATO operators are currently

receiving a Mid-Life Update. A joint German-Italian MLU has been formulated in two parts, the first involving addition of increased computer power, MIL-STD-1760 digital databus, and provision for the Rafael Litening designator pod and associated GBU-24. Part 2, in 1999-2001, will add FLIR and an associated MFD. Litef laser INS, GPS, new defensive aids computer, missile approach warning, and enhanced RWR. Having withdrawn from the APACHE program in 1996, Germany's replacement standoff weapons dispenser will be the DASA/Bofors KEPD 350 Taurus, Updated Italian Tornados will also have a microwave landing system

GR. Mk 4. The RAF MLU version includes an undernose FLIR, a digital map generator, new 25° raster HUD and pilot's color MFD, improved ECM, upgraded radar, fleet-wide TIALD compatibility, NVG compatible cockpit, and GPS. The prototype Mk 4 flew May 29, 1993, and the first of 142 conversions was redelivered Oct. 31, 1997. The last is due in October 2002, by which time the Tornado will be equipped with Storm Shadow standoff dispensers and Brimstone anti-armor weapons, although the MLU involves loss of one of the internal ouns.

# **Fighter and Attack Aircraft**

# A-7 Corsair II

Brief: The Corsair has been withdrawn from US Air Force and Navy service but continues to play a role in two other NATO air arms.

Function: CAS and Tactical Air Support of Maritime Operations.

Operator: Greece and Portugal.

First Flight: Sept. 27, 1965 (USN). Delivered: October 1966 (USN)-1983.

# IOC: December 1967 (USN).

Production: 1,610. Inventory: Greece 95, Portugal 15,

Contractor: Vought Corp., USA.

Data for A-7E. Power Plant: one Allison TF41-A-2 non-afterburning turbofan; 15,000 lb thrust.

Accommodation: pilot only, on rocket-powered Escapac election system

Dimensions: span 38 ft 9 in, length 46 ft 2 in, height 16 ft 1 in

Weight: empty 19,127 lb, gross 42,000 lb.

- Ceiling: 42,000 ft.
- Performance: max speed (clean) at S/L 691 mph, T-O run 5,600 ft, landing from 50 ft: 4,695 ft, combat radius (hi-lo-hi) 715 miles
- Armament: one 20 mm M61A1 cannon with 1,000 rds, two pylons under fuselage and three under each wing for up to 15,000 lb of Sidewinder AAMs, ATMs, ARMs, ASMs, bombs, rocket packs, and TV- or laser-guided weapons.

# COMMENTARY

A-7H. Sixty land-based A-7H Corsair IIs were deliv-ered to the Greek air force in 1975–77 for TASMO. They retain the folding wings and Allison TF41 turbofan of the US Navy's A-7E, on which they are based, but have no in-flight refueling capability. Stationed at Araxos, the A-7Hs have a NATO assignment which includes B61-5 nuclear bombs, Five TA-7H two-seat trainers were also delivered.

A-7E. Greece received a follow-on batch of 32 A-7Es and four TA-7C trainers to equip two squadrons previ-ously flying Starfighters. The batch was supplied from US Navy surplus, beginning March 1993. A-7P. The 43 A-7Ps delivered to the Portuguese air

force since 1981 are refurbished USN A-7As, with 13,400 Ib thrust TF30-P-408 engine, a mix of A-7D and A-7E standard avionics, AIM-9P Sidewinders for the secondary role of air defense, Tracor ALE-40 chaff/flare dispensers, Elisra SPS-1000 RWR, and a Westinghouse ALQ-131 (Block II) ECM pod. Six TA-7Ps were also supplied. One of the two original operating squadrons was disbanded in 1996; the other is to follow in 1999.

# AMX

Brief: The AMX multirole jet is a joint Brazilian/Itali/ venture optimized for the attack mission.

Function: CAS, battlefield interdiction, and reconnaissance Operator: Italy

First Flight: May 15, 1984 (prototype); May 11, 1988 (production).

Delivered: April 19, 1989 (Italy)-present. IOC: 1991 (Italy).

FOC: Aug. 5, 1994 (Italy). Production: more than 160 (continuing), Inventory: Italy 102 AMX and 26 AMX-T.

Contractor: AMX International (Alenia and Aermacchi of Italy, Embraer of Brazil). Power Plant: one Rolls-Royce Spey Mk 807 non-

afterburning turbofan; 11,030 lb thrust. Accommodation: pilot only, on zero/zero ejection seat. Dimensions: span 32 ft 9 in (over missiles), length

43 ft 5 in, height 14 ft 11 in. Weight: empty 14,837 lb, gross 23,700-28,660 lb.

Ceiling: 42,650 ft.

- Performance: max speed at 30,000 ft 583 mph, at S/L 639 mph; T-O run 2,070-3,220 ft, landing run 1,520 ft, combat radius with 6,000 lb of external stores 328
- miles lo-lo-lo, 576 miles hi-lo-hi, Armament: one 20 mm M61 multibarrel gun; twin centerline pylon and four under-wing pylons for bombs, cluster bombs, ASMs, and rocket pods; and two wingtip Sidewinder rails. Specific weapons incl the 1,000-lb GBU-16 LGB and Elbit Opher IR-guided bombs; designation provided by Thomson-TRT CLDP laser guid-ance pods. Max external stores load 8,377 lb. Internal bay for reconnaissance or ECM pallets.

# COMMENTARY

AMX. Italy's original requirement for 187 single-seat AMXs to re-equip eight squadrons was scaled down to 136, Six squadrons have been equipped, of which one disbanded in September 1997. Another unit has a partial reconnaissance commitment, using Oude Delft Orpheus camera pods inherited from withdrawn RF-104 Starfighters, These pods will be replaced by an internal sensor package in 2001.

AMX-T. The tandem-seat AMX-T advanced trainer (26 ordered) first flew March 14, 1990, and entered service Nov. 24, 1994, Each squadron has at least one for training, but the principal operator is 101 Squadron. AMX-T has been cleared to launch the Marte anti-ship missile

AMX-E. Projected conversion of AMX-T for escort jamming with external pods. Radar and enhanced navigation aids but no rear seat flying controls or internal gun. Armament to include AGM-88 HARM.

# Eurofighter

- Brief: The Eurofighter is to become the primary single-seat air superiority aircraft of four NATO air forces. Function: Air superiority, with a secondary ground-
- attack capability. Operator: Germany, Italy, Spain, and UK. First Flight: March 29, 1994.

Delivered: 2001 onwards. IOC: 2005.

Production: 620 planned, incl 160 two-seat.

Inventory: Germany 180, Italy 121 (plus nine options), Spain 87, and UK 232 (plus 65 options). Contractors: Eurofighter Jagdflugzeug, Germany: air-

- frame manufacture by Alenia, Italy; BAe, UK; CASA, Spain; and DASA, Germany. Assembly in all four countries
- Power Plant: two Eurojet EJ200 afterburning turbo-fans; each 20,250 lb thrust. A thrust vectoring version is under consideration.

Accommodation: pilot only, on zero/zero ejection seat; two seats in trainer version.

Dimensions: span over ECM pods 35 ft 11 in, length (incl two-seat) 52 ft 4 in, height 17 ft 4 in, Weight: empty 21,495 lb, gross 46,300 lb.

Ceiling: not available

- Performance (est.): max level speed at height Mach 2, T-O run (air combat mission) 985 ft, combat radius
- Armament: one 27 mm Mauser gun in fuselage; 13 external stations for up to 14,330 lb of AMRAAM, Aspide and short-range AAMs, three external fuel tanks, or air-to-surface weapons

# COMMENTARY

Following considerable delays caused by political posturing and rigorous cross-checking of the flight control system, a multinational contract for 620 Eurofighters and associated support was agreed to by four defense ministers Dec. 22, 1997, and formally signed Jan. 30, 1998. Production of the first batch of 148 (including 105 two-seat trainers) is now under way, comprising 37 for Germany, 29 for Italy, 20 for Spain, and 62 for the UK; the initial 48 aircraft in this batch will be to an interim standard which will be raised to full production configuration later.

All seven prototypes (including two tandem-seat) had flown by March 1997 and accumulated over 600 hours by the time of the 700th sortie in May 1998. Additionally, the first five production aircraft will be instrumented for weapon clearance trials. Although



Eurofighter 2000 prototype



F-4F Phantom II, German Luftwaffe (Gert Kromhout)



F-5B Freedom Fighter, Norwegian air force (Gert Kromhout)



F-16C Fighting Falcon, Greek air force

Eurofighter is dual-role, the final 40 German aircraft

will be optimized for ground attack. Eurofighter has a 53° swept tailless delta configura-tion, with canards, quadruplex digital fly-by-wire flight controls, and instability in pitch, combining to give high agility and STOL capability. Design life is 6,000 hours or 30 years. A degree of low observability is embodied, with fuselage, wings, fin, and rudder mainly of carbonfiber composites; but stores are carried externally. Op-erational equipment includes ECR 90 multimode pulse-Doppler radar, IRST, and an advanced integrated defensive aids subsystem with towed radar decoy.

# F-4 Phantom II

Brief: The F-4 Phantom II serves NATO air forces in air defense and attack roles.

Function: Air defense and attack

Operator: Germany, Greece, and Turkey. First Flight: May 27, 1958. Delivered: June 1961 (US Navy)-May 1987. IOC: October 1961 (US Navy).

Production: 5,195.

Inventory: Germany 145, Greece 90, and Turkey 205. Contractor: McDonnell Douglas, USA. Data for F-4E.

Power Plant: two General Electric J79-GE-17A after-burning turbojets; each 17,900 lb thrust.

Accommodation: crew of two, in tandem, on ejection seats.

Dimensions: span 38 ft 5 in, length 63 ft, height 16 ft

Weight: empty 31,850 lb, gross 41,487-61,795 lb. Ceiling: 58,750 ft.

- Performance: max speed (clean) at 36,000 ft Mach 2.16; T-O to 50 ft: 4,490 ft, landing run 3,680 ft, typical combat radius (hi-lo-hi) 495 miles.
- Armament: one 20 mm M61 multibarrel gun internally (640 rds); four Sparrows or AMRAAMs and four Sidewinders. Provision for 11 x 1,000-lb bombs, SNEB rockets, and 370- and (centerline only) 600-
- gallon external fuel tanks. COMMENTARY

F-4F. Beginning in 1992, 110 German F-4Fs received an upgrade to give them look-down/shoot-down capability against multiple targets. MBB (now DASA) was prime contractor for the program, known as Improved Combat Effectiveness (ICE), which replaced the existing Westinghouse APQ-120 radar with an alldigital multimode Hughes APG-65 embodying advanced ECCM. The cockpit has also been updated. New equip-ment includes a Litef digital fire-control computer, Honeywell laser INS, GEC–Marconi digital air data computer, improved IFF, and provision for four AMRAAMs. A further 40 F-4Fs, serving in the fighter-bomber role or as conversion trainers with the detachment inaugurated at Holloman AFB, N.M., in January 1997, have undergone a partial update.

F-4E. The other NATO Phantom operators have F-4Es, in both air defense and attack roles. The 56 originally received by Greece were augmented in 1991 by 28 from USAF. In 1997, DASA began upgrading 39 of these to a similar standard to the German ICE. Turkey gained 125 surplus aircraft to add to 72 delivered new. Of these, 54 are being upgraded by IAI of Israel almost to the standard of the IAI Kurnass, including Elta EL/ M-2032 radar, Kaiser/EL HUD and Elisra EW systems, plus the ability to carry Rafael Popeye and other precision guided missiles.

# F-5 Freedom Fighter

Brief: Single-seat F-5As and RF-5As, and two-seat F-5Bs, are now used mostly for advanced/lead-in training

Function: Ground attack, reconnaissance, and training.

Pigrator: Greece, Norway, Spain, and Turkey. First Flight: July 30, 1959. Delivered: April 1964 (USAF)-1975 (first-generation

only). IOC: October 1965 (USAF).

Production: 1,199 (first-generation only).

Inventory: Greece 25, Norway 15, Spain 29, and Turkev 48

Contractors: Northrop, USA; Canadair, Canada; CASA, Spain.

Data for F-5A.

Power Plant: two General Electric J85-GE-13 afterburning turbojets; each 4,080 lb thrust.

Accommodation: pilot only, on ejection seat; two pilots in F-5B.

Dimensions: span over tip tanks 25 ft 10 in, length 47 ft 2 in, height 13 ft 2 in. Weight: empty 7,860 lb, gross 20,040 lb.

# Ceiling: 50,500 ft.

Performance: max speed (clean) at 36,000 ft Mach 1.4, T-O run 2,650 ft, landing from 50 ft: 3,900 ft, max range 1,750 miles, range with max weapons 368 miles.

Armament: two 20 mm M39A2 guns in nose; Sidewinder on each wingtip; centerline pylon and two under each wing for about 4,400 lb of AAMs or ASMs, rocket packs, gun pods, bombs, or 275-gallon fuel tanks

# COMMENTARY

F-5A, RF-5A, and F-5B. Norway's No. 336 Sq operates as an advanced training unit for four squadrons of F-16s; its F-5As and F-5Bs have received improved avionics and self-protection systems for wartime air defense duties with AIM-9L Sidewinders or ECM support with SAMOVAR (SAM Obstruction in Velocity, Angle, and Range) jamming pods. Seven of the F-5As and eight Bs have been equipped by Sierra in the US with F-16 avionics, the first two returning to service in September 1993 and the last in July 1994, Their 1553B digital databus, air data computer, GEC-Marconi HUDWAC, Litton LN-93 ring-laser INS, multifunction throttle grip, and instrument panel are all similar or identical to F-16 equipment.

Greece and Turkey have absorbed many surplus F-5s from elsewhere, including NF-5s built by Canadair for Netherlands, Greek F-5s, including a few nominally reconnaissance-tasked RF-5As, will soon be replaced by F-16As, but Turkey is to update 48 NF-5s as lead-in trainers with avionics comparable to the Norwegian

retrofit but supplied by Israeli contractors. SF-5B and SRF-5A. CASA-built SF-5Bs (AE.9s) operated by the Spanish air force's weapons school completed a structural rebuild in the early 1990s for a further 4,000 hours of service. All 22 now have upgraded avionics, including RWR and IFF, and are designated SF-5B+. Seven unmodified single-seat SF-5As (A.9s) and SRF-5As (AR.9s) are also used.

# F-16 Fighting Falcon

Brief: The F-16 is a compact, versatile, and low-cost multirole fighter.

Function: Multirole fighter. Punction: Multirole fighter.
 Operator: Belgium, Denmark, Greece, Netherlands, Norway, Portugal, and Turkey.
 First Flight: Feb. 2, 1974.
 Delivered: August 1978 (USAF)-present.
 IOC: October 1980 (USAF).

Production: more than 3,800 (continuing). Inventory: Belgium 128, Denmark 65, Greece 75, Netherlands 135, Norway 58, Portugal 20, and Turkey 230

Contractor: Lockheed Martin USA

All data for Greek/Turkish F-16C except where indicated.

Power Plant: one General Flectric F110-GE-100 afterburning turbofan; 27,600 lb thrust.

Accommodation: pilot only, on zero/zero ejection seat. Dimensions: span over missiles 32 ft 10 in, length 49 ft 4 in, height 16 ft 9 in.

Weight: empty 19,020 lb, gross 42,300 lb. Celling: above 50,000 ft. Performance: max speed at 40,000 ft above Mach 2, radius of action more than 575 miles. Armament: one 20 mm M61A1 multibarrel gun in port

side wing/body fairing; Sidewinder AAM on each wingtip; centerline hardpoint and three under each wing for total 12,000 lb of stores, incl ASMs (Penguin Mk 3 on Norwegian aircraft), single or cluster bombs, rocket packs, ECM packs, and fuel tanks. Internal chaff/ flare dispensers. MLU aircraft have expanded weapons capability, incl AMRAAM, ASRAAM, GBU-24, and AGM-65G Maverick.

# COMMENTARY

F-16A/B. Aircraft built for four European air forces by SABCA in Belgium and Fokker in the Netherlands are similar to basic USAF F-16As and two-seat Bs, except for equipment changes. Belgian F-16s have Dassault Carapace passive ECM in an extended fin root fairing; those for Norway and the Netherlands have a brakechute in this location.

Belgium received 160 European-built F-16s, Den-mark 70, Netherlands 213, and Norway 74. All early models have a Pratt & Whitney F100-PW-200 after-burning turbojet, replaced by a 23,450-lb thrust F100-PW-220 in late-production aircraft. Portugal gained 20 aircraft from new US production in 1994, while Greece is hoping to acquire up to 40 surplus ex-European F-16A/Bs to augment its F-16C/Ds and replace A-7H Corsairs in the NATO-assigned nuclear strike role

F-16AM/BM. A total of 343 (Belgium 90, Denmark 61, Netherlands 136, and Norway 56) will receive the MLU authorized June 30, 1993, and due for completion by 2002 at depots in each country. The MLU brings the aircraft up to approximate F-16C Block 50 standard, with the ability to undertake all-weather BVR air defense and 24-hour precision attack. Features include a new modular mission computer, wide-angle HUD, new color MFDs, compatibility with NVGs, upgraded AN/ APG-66(V2A) radar, BAe Terprom navigation, GPS, improved data modern, and some optional items, such as helmet-mounted sights, Lockheed Martin Sharp-shooter targeting pods, microwave landing system, JTIDS, and new IFF. The first MLU aircraft flew April 28, 1995; production

examples were delivered from September 1997 onwards, and the version was formally accepted into service (with No. 322 Sq, Netherlands) June 13, 1998, MLU upgrades are being considered by Portugal, and an eventual total of 367 Euro-F-16s could be thus updated if all options are exercised.

F-16C/D. Turkey and Greece both opted for uprated F-16C/D versions, with a General Electric F110-GE-100 engine and APG-68 radar. The initial batch of 40 Greek aircraft, with Litton ASPIS self-protection systems, was delivered from November 1988; a further 40 followed in 1997–98. Eight US-built aircraft were supplied to Turkey in 1987; 232 more, fitted with Loral Rapport III internal self-protection systems, are being built in Turkey by Tusas Aerospace Industries to equip 10 squadrons, the first two of which formed at Akinci in 1989–90, LANTIRN navigation and targeting pods were first issued to Turkey in February 1994 and have also been provided to Greece.

# F/A-18 Hornet

Brief: Produced for carrier-based operation, the versatile Hornet performs key roles in two NATO air forces. Function: Air defense and attack. Operator: Canada and Spain. First Flight: Nov. 18, 1978, Delivered: May 1980 (US Navy)-present. IOC: November 1980.

Production: more than 1,500 (continuing).

- Inventory: Canada 120, Spain 90, Contractor: Boeing (McDonnell Douglas), USA. Data for CF-18A.
- Power Plant: two General Electric F404-GE-400 afterburning turbofans; each 16,000 lb thrust.

Accommodation: pilot only, on ejection seat. Dimensions: span over missiles 40 ft 5 in, length 56 ft, height 15 ft 4 in

Weight: empty 23,050 lb, gross (fighter escort mission) 33,585 lb.

Ceiling: combat ceiling approx 50,000 ft.

- Performance: max speed at height (clean) Mach 1.8, T-O run less than 1,400 ft, combat radius 660 miles. Armament: one 20 mm M61 multibarrel gun in nose;
- Sidewinder AAM on each wingtip; centerline pylon, two on engine trunks, and two under each wing for Sparrow AAMs, CRV-7 rocket packs, bombs, BL755 cluster bombs, ECM pods, etc. Max external stores load 17,000 lb.

COMMENTARY

CF-18A and CF-18B. Canada acquired 98 single-seat CF-18As and 40 two-seat CF-18Bs. By comparison with US Navy F/A-18s, these have a different ILS and an added spotlight on the port side of the fuselage for night identification of other aircraft in flight. Primary role is air defense of North America. All four opera-tional squadrons (the fifth is for pilot conversion) are tasked with overseas deployment on NATO or UN tasks but only after a 30-day workup. NORAD alert is maintained by semipermanent detachments at Goose Bay and Comox, while occasional exercises are flown from prepared forward operating locations at Rankin

Inlet, Yellowknife, Inuvik, and Iqaluit, Canada is planning a Hornet upgrade which will Include AN/APG-73 radar (replacing AN/APG-65), a new IFF interrogator/transponder, replaced mission computer and cockpit displays, JTIDS, GPS/INS, upgraded RWR, and a new stores management system. The last-mentioned will lead to procurement of NITE Hawk targeting pods, Paveway LGBs, AGM-65G Maverick ASMs, and a new short-range AAM, complete with helmet-mounted sight.

EF-18. Between 1986 and 1990, Spain received 72 EF-18s, designating the single-seaters C.15 and the two-seaters CE.15. From September 1992 to December 1994, these were upgraded to F/A-18A+/B+ standard, with new computers, software, wiring, and pylon modifications, thus approaching F/A-18C/D configuration. Optional equipment includes NITE Hawk targeting FLIR pods. Spain's wide-ranging Hornet weapons in-ventory includes GBU-10/16 LGBs, AGM-65G Maverick and AGM-84C/D Harpoon ASMs, AGM-88 HARMs, and AIM-9L/M Sidewinder, AIM-7F/M Sparrow, and AIM-120 AMRAAM AAMs. On Dec. 28, 1995, the first six of an eventual 24 ex-US Navy F/A-18As were received after upgrading to Plus standard.

# F-104S Starfighter

Brief: The world's last operational Starfighters are the third-generation F-104S versions used by Italy. Function: Air defense.

Operator: Italy

First Flight: December 1966 (US prototype), Dec. 30, 1968 (Italian production)

Delivered: June 9, 1969-79. IOC: 1970.

Production: 246.

Inventory: 120.

Contractor: Aeritalia, Italy, under license from Lockheed

Power Plant: one General Electric J79-GE-19 afterburning turbojet; 17,900 lb thrust.

Accommodation: pilot only, on ejection seat Dimensions: span without tiptanks 21 ft 11 in, length 54 ft 9 in, height 13 ft 6 in.

Weight: empty 14,903 lb, gross 21,693-30,997 lb. Ceiling: 58,000 ft.

Performance: max speed at 36,000 ft Mach 2.2, at

S/L Mach 1.2, T-O run 2,700 ft, landing run 2,500 ft, max combat radius 775 miles. Armament: AIM-9L Sidewinder on each wingtip; seven

pylons under fuselage and wings for bombs, rocket



F-104S Starfighter, Italian air force (Gert Kromhout)

packs, fuel tanks, and AAMs, incl two Aspides or Sparrow IIIs. Max external stores load 7,500 lb. COMMENTARY

Italian E-104s will remain until replaced by Eurofighters next century, for which reason 49 are receiving a second upgrade to maintain operational capability and compensate for delays in the Eurofighter program. Thus modified with new avionics (including HSI, AoA indicator, altimeter, GPS/INS, upgraded air data computer and instruments) and new oxygen, electrical, and hydraulic systems, the fighters are known as F-104S ASA-Ms, indicating *Modificato*. The first was redelivered Dec. 18, 1997, and Italy is now practicing mixed fighter force tactics with two Starfighters accompanying one Tornado F. Mk 3.

Between 1986 and 1993, 147 of the 205 that had been delivered to Italy received a major weapon system update to F-104S ASA (Aggiornamento Sistemi d'Arma) standard, including a FIAR R21G/M1 Setter look-down/ shoot-down radar. Alenia's Aspide medium-range AAM is standard, as an alternative to the very similar Spar-rows that accounted for the S designation. Aircraft which do not receive the -M upgrade will be withdrawn as they become due for a major overhaul. TF-104G. There are also 19 older TF-104G two-seat

trainers remaining in Italian service, of which 15 will be upgraded to TF-104G-M configuration.

# Harrier GR. Mk 7

Brief: The UK's GR. Mk 7 is generally similar to the USMC AV-8B, except for having an additional pair of wing pylons for AIM-9L Sidewinder AAMs.

Function: Battlefield interdiction. Operator: UK.

First Flight: April 30, 1985.

Delivered: May 1987 (Mk 5)-June 1992. IOC: Nov. 2, 1989. Production: 96.

Inventory: 80. Contractors: British Aerospace, UK, and McDonnell Douglas, USA.

Power Plant: one Rolls-Royce Pegasus Mk 105 vectored-thrust turbofan; 21,500 lb thrust. Accommodation: pilot only, on zero/zero ejection seat.

Dimensions: span 30 ft 4 in, length 47 ft 8 in, height 11 ft 8 in.

Weight: empty 15,705 lb; gross for VTO 19,300 lb, for STO 32,000 lb.

Ceiling: not available

- Performance: max speed at height Mach 0.97, at S/L 677 mph; STOL T-O run 1,720 ft; combat radius (hi-lo-hi) with five CBUs 650 miles.
- Armament: provision for two 25 mm gun pods under fuselage; four hardpoints under each wing, plus centerline position, for two or four Sidewinder AAMs. 12 BL755 or CBU-87 cluster bombs, or five 1,000-lb bombs, Alternatively, 500-lb bombs, Matra 155 or CRV-7 rocket pods, or 300-gallon tanks or centerline reconnaissance pod.

## COMMENTARY

The last 34 of 96 RAF Harrier IIs were built to Night Attack standard, with the designation GR. Mk 7. Their equipment includes GEC-Marconi FLIR, Smiths head-up and head-down displays, GEC-Marconi Zeus internal ECM, Plessey missile approach warning system radar in tailcone, and cockpits compatible with NVGs. Earlier aircraft (designated Mk 5 and 5A) have been upgraded.

Harrier II retains the basic fuselage of the first-generation aircraft but with a raised cockpit similar to that of the Royal Navy's Sea Harrier and with lift improvement devices under the fuselage. The wing has a supercritical section and is made largely of carbonfiber and other composites. Compared with the wing of the Harrier/AV-8A, it has greater span and area and 10° less sweep. Max external load is 10,800 lb at the max STOL weight. Equipment includes GEC-Marconi FIN 1075 INS and a Hughes Angle Rate Bombing Set with TV/laser target seeker/tracker, working in conjunction with a mission computer. Some Mk 7s have been further upgraded with FIN 1075G INS, which includes GPS. The first two aircraft with GEC-Marconi TIALD laser-designation pods achieved interim operational capability early in 1998.

GR. 7 deliveries to the first of two squadrons based in Germany began in September 1990, During the early/mid-1990s, Harriers were based in Turkey for reconnaissance patrols over northern Irag and in Italy for missions over the former Yugoslavia, where they saw their first combat in September 1995. RAF GR. Mk 7s can operate aboard Royal Navy aircraft carriers in a combined air group with Sea Harriers, using the ski jump for takeoff. The Harrier force will be concentrated in the UK from 1999.

Harrier T. Mk 10. Delivery of 13 Harrier T. Mk 10 two-seat equivalents of the Mk 7 was undertaken in 1995.

# Jaguar

Brief: The Anglo-French Jaguar was designed from the outset as a fighter-bomber. It is due to be re-

placed by Eurofighter or Rafale early next century. Function: Tactical support, ground attack, and recon-

naissance. Operator: France and UK. First Flight: Sept. 8, 1968. Delivered: April 1972-present. IOC: May 1973. Production: 588.

Inventory: France 65, UK 56. Contractor: SEPECAT consortium, France and UK.

Data for Jaquar A.

Power Plant: two Rolls-Royce Turbomeca Adour Mk 102 afterburning turbofans; each 7,305 lb thrust. Accommodation: pilot only, on zero/zero ejection seat. Dimensions: span 28 ft 6 in, length 55 ft 3 in, height 15 ft 10 in

Weight: empty 15,432 lb, gross 34,612 lb.

Ceiling: 45,000 ft.

- Performance: max speed at height Mach 1.3, at S/L Mach 1.1; T-O run 1,855-4,100 ft, landing run 1,545 ft, typical attack radius, hi-lo-hi 875 miles, lo-lo-lo 570 miles
- Armament: two 30 mm DEFA 553 guns in fuselage: centerline pylon and two under each wing for 10,000 lb of stores, incl AS 30L laser-guided ASMs, BGL 400 LGBs, 550 and 880 lb bombs, Belouga cluster bombs, BAP 100 area denial bomblets, BAT 120 anti-runway bomblets, F1 rocket pods; Magic 2 AAMs, Barracuda electronic emission detectors, Barem or CT 51J jamming pods, Phimat chaff/flare pods; 317-gallon tanks. COMMENTARY

Jaguar A and E. Single- and two-seat trainer versions, respectively, for France (160 and 40 delivered). The last 30 single-seaters built are equipped to carry Automatic Tracking Laser Illumination System (ATLIS) designator pods for AS 30L laser-guided ASMs and LGBs; these aircraft have otherwise remained in the configuration in which they were delivered. Withdrawal

will take place between 2002 and 2005. Jaguar GR. Mk 1 and T. Mk 2. UK equivalents of French A and E models for RAF (165 and 38 delivered). All 403 initially had Adour Mk 102 turbofans, but RAF Jaguars were retrofitted with 7,900 lb st Adour Mk 104s and also gained a Ferranti FIN 1064 INS in place of their original Navigation and Weapon-Aiming Subsystem (NAVWASS) equipment. Delays with the Eurofighter have given RAF Jaguars a new lease of life, resulting in the conversion of 11 aircraft in 1995-96 to carry a GEC-Marconi TIALD pod. These nine GR. Mk 1B and two T. Mk 2B aircraft also have FIN 1075G INS with GPS, a multipurpose digital moving map/TIALD color imagery display, and a new high-resolution, wide-field HUD. Armed with a 1,000-lb LGB, they began patrols over Bosnia May 27, 1995. Other aircraft in the fleet have been updated with

these modifications (except digital map) and a BAe Terprom ground proximity warning system as interim Jaguar '96s, having either reconnaissance (see below), TIALD, or plain bomber capability. Jaguar '97, now under way, incorporates all these options in each aircraft, adds an active matrix LCD, provision for ASRAAM (if approved), helmet-mounted sight and NVG-compat-(bible lighting, and will result in redesignation as GR. Mk 3 (single-seat) and T. Mk 4 (two-seat). Engines will be uprated to Mk 106 standard with 25 percent more thrust.

Jaguar GR. Mk 1A. One RAF squadron is partly assigned to tactical reconnaissance. Standard equip-ment since service entry in 1976 has been a 1,230-lb centerline pod containing five cameras and a Vinten 401 infrared linescan system. In 1990, a VICON 18 Srs 401 intrared intescan system, in 1990, a VICON 18 Srs 600 long-range oblique photography pod with 36-in focal length "wet film" camera was introduced as an alternative fit. In Jaguar '97, the aircraft gains the ability to upgrade to the Series 601 EO GP(1) electro-

optical pod with digital recording of imagery. French Jaguars may carry an RP 36P system, which is nothing more than a standard drop tank with three nose-mounted cameras. This complements the pan-oramic camera fitted in the nose of all French Jaguars.

MIG-29 (NATO Fulcrum) Brief: The MiG-29 fighter was acquired from the former East Germany after the reunification.

Function: Air defense. Operator: Germany. First Flight: Oct. 6, 1977.

Delivered: 1982-present. IOC: 1983.

Production: 1,200 (approx).

Inventory: Germany 23. Contractor: MAPO, Russia; Nizhny Novgorod for MiG-29UB

Data for Fulcrum-A. Power Plant: two Klimov/Sarkisov RD-33 turbofans; each 18,300 lb thrust with afterburning.

Accommodation: pilot only, on zero/zero ejection seat. Dimensions: span 37 ft 3 in, length 56 ft 10 in, height 15 ft 6 in.

Weight: empty 24,030 lb, gross 33,600-40,785 lb. Ceiling: 59,055 ft,



Jaguar A, French air force (Gert Kromhout)



Mirage F-1CE, Spanish air force (Gert Kromhout)

Performance: max speed at height Mach 2.3, at S/L Mach 1.225, T-O run with afterburning 820 ft, landing run with brake chute 1,970 ft, range 888 miles on internal fuel, 1,800 miles with three external tanks.

Armament: four medium-range radar/IR homing R-27R1 (AA-10 Alamo-A) or six close-range R-73E (AA-11 Archer) AAMs on three pylons under each wing. Able to carry bombs; 57 mm, 80 mm, and 240 mm rockets; and other stores in attack role. One 30 mm GSh-301 gun in port wing-root leading-edge extension, with 150 rds. COMMENTARY

Despite being nonstandard equipment, 20 (now 19) single-seat Fulcrum-As (MiG-29 9-12 versions) and four Fulcrum-B (MiG-29UB) two-seat trainers were retained by the German air force for air defense of the eastern part of the country. They now fly with JG 73 at Laage, partnered by a squadron of F-4 Phantoms.

Armament is unchanged, except for deletion of R-60 (AA-8 Aphid) AAMs. However, an upgrade begun in 1997 adds the ability to carry two 396-gallon drop tanks in addition to life-extension modifications. A Sextant-designed GPS-based navigation suite will be added shortly. Further information on the MiG-29 can be found in the "Gallery of Russian Aerospace Weapons" in the September 1998 issue of *Air Force* Magazine.

# Mirage F1

Brief: This second of Dassault's three Mirage genera-tions has been relegated to the middle rank of interceptors but continues as a useful attack aircraft.

Function: Air defense and attack

Operator: France, Greece, and Spain.

First Flight: Dec. 23, 1966. Delivered: 1973–91. IOC: December 1973.

Production: 711. Inventory: France 95, Greece 30, Spain 66. Contractor: Dassault Aviation, France.

- Data for F1-C. Power Plant: one SNECMA Atar 9K-50 afterburning turbojet; 15,873 lb thrust.
- Accommodation: pilot only, on ejection seat. Dimensions: span over missiles 30 ft 7 in, length 50 ft, height 14 ft 9 in.

Weight: empty 16,314 lb, gross 24,030-35,715 lb. Ceiling: 65,600 ft.

- Performance: max speed at height Mach 2.2, at S/L Mach 1.2, T-O run 1,970 ft, landing run 2,200 ft, combat air patrol endurance 2 hr 15 min, attack radius, depending on flight profile and weapon load, 265-863 miles.
- Armament: two 30 mm DEFA 553 guns in fuselage; one centerline, four under-wing, and two wingtip stations for practical external load of 8,820 lb; two Super 530 AAMs, a Magic or Sidewinder AAM on each wingtip, and chaff/flare dispensers for interception mission; or 14 x 550-lb bombs, 30 anti-runway bombs, 144 rockets, an ARMAT anti-radar missile, AM39 Exocet anti-ship missile, AS 30L ASM, or laser-guided weapons and ATLIS designator pod for ground-attack missions. COMMENTARY

F1-C and F1-B. Bought by France in May 1969, the baseline version is equipped with a HUD and Cyrano

IV-M multifunction radar, with a high degree of resistance to ECM. From a peak of 10 squadrons with 164 aircraft, F1-C strength has fallen to just one based in Djibouti, West Africa, for air defense/attack/reconnaissance duties, and an OCU that also has some of the original 20 two-seat F1-B trainers.

F1-CG. Greece received 40 Mirage F1-CGs from 1975 onwards; these are virtually identical to the French version.

F1-CE and F1-EE. Beginning in 1975, Spain re-ceived 45 F1-CEs (known as C.14As) and 22 multirole Mirage F1-EEs (C.14Bs), with INS, nav/attack com-puter, and HUD. To balance attrition, 14 single-seat and three trainer aircraft were received from Qatari and French surplus between 1994 and 1997, By 1999, all 29 C.14As, 17 C.14Bs, and four ex-French F1-Cs in current Spanish service will have been upgraded to extend their operational lives to 2010–12 by means of a new navigation and weapons system (radar altim-eter, GPS, new computer and stores management system), upgraded ECM, and secure communications. The ex-Kuwaiti aircraft are now designated C.14C and

(trainer) CE.14C; they retain their original avionics, F1-CT. Fifty-five French F1-C-200s (-200 indicating fixed in-flight refueling probe) replaced in the air defense role by Mirage 2000s were converted between January 1992 and March 1996 to F1-CT standard for attack duties in two squadrons. New equipment includes upgraded radar, HUD, and INS, plus laser range finder, Martin-Baker F10M ejection seat, Sherloc B2 RWR (to be replaced under a 1997 contract by Aigle/EWS-A), and ASMs, Armament comprises internal 30 mm gun plus two Magic 2 AAMs on wingtips, rockets, bombs, BAP 100 and BAT 120 bomblets, Belouga cluster bombs, and laser-guided bombs. Max external load is 8,820 lb.

Mirage 2000C, E, 5F, and B Brief: Selected Dec. 18, 1975, as the primary combat aircraft of the French air force, the Mirage 2000 was developed initially as an interceptor and air-superi-ority fighter. Strike-attack versions are described under the "Bombers" heading.

Function: Multirole fighter.

Operator: France and Greece.

First Flight: March 10, 1978.

Delivered: March 1983-present. IOC: July 1984.

Production: 413 (continuing).

Inventory: France 151, Greece 36. Contractor: Dassault Aviation, France.

Data for Mirage 2000-5F. Power Plant: one SNECMA M53-P2 afterburning turbofan; 21,385 lb thrust.

Accommodation: pilot only, on zero/zero ejection seat. Dimensions: span 29 ft 11 in, length 48 ft 1 in, height 17 ft 1 in.

Weight: empty 16,534 lb, gross 23,940-37,480 lb. Ceiling: 60,000 ft.

- Performance: max speed at height Mach 2.2, at S/L
- Mach 1.2, range for 5 mins' combat 898 miles. Armament: two 30 mm DEFA 554 guns (each 126 rds) in fuselage; five hardpoints under fuselage and two under each wing for max external stores load of 13,890 lb. Four MICA and two Magic AAMs for interceptor mission. Ground-attack weapons incl 18 550-lb retarded bombs or BAP 100 antirunway bombs, 16 Durandal penetration bombs, two 2,205-lb LGBs, six Belouga cluster bombs, two AS 30L ASMs, two ARMAT anti-radar missiles, four packs of 18 x 68 mm rockets, two packs of 100 mm rockets, or a twin 30 mm gun pod

COMMENTARY 2000C and Mirage 2000B. France's procurement plans were curtailed by defense economies at 124 airsuperiority Mirage 2000Cs and 30 Mirage 2000B two-seat trainers. Of those, the first 37 and 14, respectively, had RDM radar and M53-5 engines. The remainder were supplied with Dassault Electronique/Thomson-CSF RDI radar and the more powerful -P2 engine.

RDI has an operating range of 62 miles. Other equipment on the Mirage 2000C includes SAGEM Uliss 52E INS, Sextant head-up and head-down displays, a detachable in-flight refueling probe, chaff/flare dispenser, and Thomson-CSF Serval RWR, Control is fly-by-wire. Mirage 2000Cs patrolling former Yugoslavia were fit-ted in 1995 with a SAT Samir missile plume detector. The first of eight 2000Cs to be equipped with an Intertechnique "buddy" refueling system achieved IOC early in 1998.

early in 1998. 2000-5F. Funding was awarded in 1994 for the first of 37 late-production 2000Cs to be retrofitted to 2000-5 standard with Thomson-CSF RDY radar, modernized instrumentation, new HUD, more automated ICMS Mk 2 ECM/self-defense, plus ability to carry MICA AAMs. Provision is made for one 343-gallon plus two 528-allon drop.tanks. The first of two prototyces flew Eeb gallon drop-tanks. The first of two prototypes flew Feb. 26, 1996, and deliveries for trials began in December 1997. Redundant RDI radars will replace RDMs in early Mirage 2000Cs, the -5Fs going to two squadrons at Dijon, where IOC is due in February 1999.

63

AIR FORCE Magazine / December 1998

2000EG and 2000BG. Delivery to Greece of 36 multirole Mirage 2000EGs, plus four 2000BG two-seaters, took place in 1988–92. Assigned to defend Athens, these aircraft have enhanced ICMS Mk 1 ECM, including self-protection jammers and Matra Spirale automatic chaff/flare dispensers.

# Rafale

Brief: Early next century Rafales will equip the front line of both the French air force and naval aviation. Function: Multirole fighter. Operator: France.

First Flight: July 4, 1986. Delivered: 1999 onwards, IOC: June 2001 (planned). Production: 294 (planned). Inventory: not applicable Ceiling: 55,000 ft. Contractor: Dassault Aviation, France.

Data for Rafale C. Power Plant: two SNECMA M88-2 afterburning turbofans; each 16,400 lb thrust.

Accommodation: pilot only, on zero/zero ejection seat. Dimensions: span 35 ft 9 in, length 50 ft 2 in, height 17 ft 6 in.

Weight: empty approx 22,050 lb, gross 54,000 lb. Performance: max speed at height Mach 2, at S/L 746 mph, T-O run 1,315–1,970 ft, combat radius, attack 655 miles, air combat 1,093 miles. Armament: one 30 mm DEFA 791B gun in engine duct;

14 external stations for up to 20,950 lb of external fuel, MICA AAMs, APACHE standoff weapon dis-pensers, one ASMP nuclear weapon, laser-guided and conventional bombs, AS-30L ASMs and Exocet anti-ship missiles, COMMENTARY

Because of funding constraints and a change of government, Rafale procurement has been painfully slow, totaling to date only three aircraft for the air force and 10 **Rafale Ms** for the navy. The air force plans an eventual total of 234, of which 139 will be **Rafale B** two-seaters carrying a pilot and WSO. The navy has pro-duction priority, and the air force will not have its first **Partele** C exceptions constrained with 2005. Rafale C squadron operational until 2005. All versions have an RBE2 electronically scanned,

look-down/shoot-down radar able to track eight targets simultaneously, fly-by-wire controls, and Hands on Throttle and Stick (HOTAS) with a sidestick controller. Full-service standard (not available on early aircraft) will include automatic terrain-following, Spectra defensive subsystems, IRST, FLIR and laser range finder modules, voice-command controls, and a helmet-mounted sight.

# Tornado F. Mk 3

Brief: The fighter version of Tornado was developed from the strike variant for all-weather defense of the UK. Function: Air defense.

Operator: Italy and UK

First Flight: Oct. 27, 1979 (F. Mk 2). Delivered: March 1984-March 1993.

IOC: Jan. 1, 1987.

Production: 197. Inventory: Italy 24, UK 118.

Contractor: Panavia Aircraft, a UK/German/Italian consortium

- Power Plant: two Turbo-Union RB199 Mk 104 afterburning turbofans; each 16,520 lb thrust.
- Accommodation: crew of two in tandem, on zero/zero ejection seats.
- Dimensions: span 45 ft 8 in spread, 28 ft 3 in swept, length 61 ft 3 in, height 19 ft 6 in. Weight: empty 31,970 lb, gross 61,700 lb.
- Ceiling: 70,000 ft.
- Performance: max speed clean at height Mach 2.2, at low level 920 mph IAS, T-O run 2,500 ft, landing run with thrust reversal 1,215 ft, intercept radius more than 345 miles supersonic, 1,150 miles subsonic. Armament: one 27 mm IWKA-Mauser gun in fuselage,
- four Sky Flash AAMs under fuselage, four AIM-9L Sidewinders under wings.

# COMMENTARY

64

The airframe of the Tornado Air Defense Variant (ADV; RAF designation F. Mk 3) differs from that of the basic IDS in having an increased fuselage length, forward of the front cockpit, to house the longer radome of the GEC-Marconi Al.24 Foxhunter multimode pulse-Doppler radar, and a small stretch aft of the rear cockpit to allow four Sky Flash AAMs to be carried in tandem pairs under the fuselage. Together with an increase in wing-root chord, these changes reduce drag, especially at supersonic speed, and also allow a 10 percent increase in internal fuel capacity.

Of 173 production Tornado ADVs ordered for the RAF, including 52 with dual controls, the first 18 were built as F. Mk 2s with 16,920-lb thrust RB199 Mk 103 engines. These have been withdrawn from operational service and stored.

All subsequent ADVs are F. Mk 3s, with a retractable in-flight refueling probe, added head-down display for the pilot, a second INS, new IFF, and other changes. One of the two guns of the IDS is deleted, and RAF aircraft used only the two inboard under-wing pylons for a combination of tanks and missiles or chaff pods until the outboard pylons were activated in late 1995 to carry a GEC-Marconi Ariel towed radar decoy on air-

carry a GEC-Marconi Ariel towed radar decoy on air-craft patrolling former Yugoslavia. The first F. Mk 3 flew Nov. 20, 1985, and deliveries began in July 1986. Two squadrons are now receiving JTIDS data links, and some 100 RAF aircraft are being modified for compatibility with AMRAAM and ASRAAM, also gaining the definitive "Stage 2G" radar version

also gaining the definitive "Stage 2G" radar version Although optimized for long-range interception in the Greenland–Iceland–UK gap, the F, Mk 3 was the only politically acceptable aircraft when Italy required an interim interceptor because of delays in the Eurofighter program. Deliveries from RAF stocks began July 4, 1995, for a 10-year period of loan.

# Reconnaissance and Surveillance Aircraft

# C-212 Aviocar

Brief: Special mission versions of this utility transport are used by two NATO air forces. Function: Electronic intelligence/ECM and surveillance.

Operator: Portugal and Spain,

First Flight: Nov. 17, 1972-present. Delivered: Nov. 12, 1974 (TR.12A).

IOC: 1975. Production: 25

Inventory: Portugal eight, Spain 14.

Contractors: CASA, Spain. Data for EC-212/TM.12 generally as for C-212 trans-port except for slight difference in length due to modified nose

COMMENTARY

EC-212. The Portugese air force operates a single EC-212 Aviocar Srs 100A for electronic intelligence/ ECM duties. It carries equipment, including a blunt nose radome and fintip pod, for automatic signal interception, classification, and identification in dense signal environments, which allows a map to be drawn plotting the position and characteristics of hostile radars. Jamming emitters are also carried. Portugal also has other Srs

100A/Bs equipped for photo and magnetic survey. C-212 (TM.12). Three C-212s similar to the Portuguese EC-212 serve with the Spanish air force for ECM duties, under the designation TM.12. C-212 (TR.12). Spain also has five TR.12A Aviocars

fitted with Wild RC-10 cameras for survey work and recently acquired six TR.12Ds previously operated by the customs service for anti-smuggling surveillance.

# Canberra PR. Mk 9

Brief: Five Canberra PR. Mk 9s are the only dedicated strategic photoreconnaissance aircraft in the RAF. Function: Strategic photoreconnaissance. Operator: UK.

First Flight: July 8, 1955.

Delivered: July 1958-December 1960. IOC: January 1960.

Production: 23.

Inventory: five. Contractor: English Electric/Short Brothers, UK. Power Plant: two Rolls-Royce Avon 206 turbojets; each 11,250 lb thrust.

Accommodation: crew of two on ejection seats.

Dimensions: span 69 ft 5 in, length 66 ft 8 in, height 15 ft 7 in. Weight: gross 57,500 lb.

Ceiling: 50,000 ft.

Performance: max speed at height 560 mph, max range 4,000 miles.

# Armament: none,

# COMMENTARY

In the early 1990s, the RAF upgraded its five Canberra PR. Mk 9s for service until at least 2004, additions including a Zeiss RMK vertical camera (augmenting forward and oblique cameras, plus IR linescan) and GPS. The first with embedded GPS in a Litton LN-100G-INS was redelivered in November 1997. Can-berras have operated high-level reconnaissance missions over Bosnia in support of NATO policing operations. Some have the ability to carry a long-range oblique "wet film" optical camera in the belly; a replacement installation, known as Rodeo, with an electrooptical camera (from the reconnaissance Tornado RAPTOR pod) and high-resolution panoramic camera, is just coming into service.

# CL-600/601/604 Challenger

Brief: The Challenger is a business jet modified for special missions.

Function: Electronic warfare and training.

Operator: Canada, First Flight: Nov. 8, 1978 (CL-600),

Delivered: 1980-present.

IOC: 1989 (CE-144). Production: 16 (C-144 variants).

Inventory: 13.

Contractor: Canadair, Canada. Data for CL-600.

Power Plant: two AlliedSignal ALF 502L turbofans; each 7,500 lb thrust.

Accommodation: crew of four and up to 12 passengers in transport role.

Dimensions: span 61 ft 10 in, length 68 ft 5 in, height 20 ft 8 in.

Weight: empty approx 23,300 lb, gross 41,100 lb. Ceiling: 41,000 ft.

Performance: max cruising speed 529 mph, T-O dis-tance 6,500 ft, landing distance 4,450 ft, range 3,220 miles.

# Armament: none.

# COMMENTARY

CE-144A. Equipment of the first three interim CE-144A electronic warfare and training aircraft includes an ALR-76 ESM receiver, ULQ-21/23 radar jammers, a ZS 1910 communications jammer, and ALE-502 chaff dispenser. Two others are to receive a definitive EW fit authorized in April 1993.

CC-144A/B. Three CC-144B transport versions of the Challenger 601 accompany five earlier CC-144As in the communications role. Similar aircraft serve the air forces of Denmark (CL-604) and Germany (CL-601); these have more powerful CF34 engines.

# E-3A/D/F Sentry

Brief: Modified Boeing 707s fitted with a rotating radar dome defend the approaches to NATO territory. Function: AWACS (Airborne Warning and Control

System).

Operator: France, UK, and NATO pool. First Flight: Oct. 31, 1975.

Delivered: March 1977 (USAF)-August 1991.

IOC: 1977 (USAF).

Production: 68.

Inventory: France four, UK seven, and NATO pool 17. Contractor: Boeing, USA. Data for NATO E-3A.

Power Plant: four Pratt & Whitney TF33-PW-100/100A

turbofans; each 21,000 lb thrust. Accommodation: basic crew of 17, incl 13 AWACS specialists.

Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 41 ft 9 in.

Weight: gross 335,000 lb.

Ceiling: over 29,000 ft.

Performance: max speed 530 mph, max unrefueled endurance more than 11 hr.

# Armament: none COMMENTARY

E-3A. NATO's aircraft, which bear the insignia of Luxembourg, were equipped initially to the original standard of USAF E-3A Sentry Nos. 26-34. Much of the avionics was produced in Germany, and NATO funded a third HF radio, to cover the maritime environment; a new data analysis and programming group; under-wing hardpoints on which operational ECM pods could be attached; and a radio teletype to link the aircraft with NATO maritime forces and commands. The 18 aircraft were delivered between January 1982 and April 1985. Subsequent updating has included the addition of AN/AYR-1 ESM in cance-shaped pods on each side of the forward fuselage and other protrusions at nose and tail. The Block 1 upgrade launched in 1994 introduced JTIDS. Have Quick secure radios, and new color displays. Germany's DASA had modified all but the first aircraft by 1997. A follow-on Radar System Improvement Program (RSIP) to increase target detection capability was begun by DASA in November 1997 while a Mid-Term Modernization Program is being for-mulated for incorporation in 2004/05.

E-3D and E-3F. Seven E-3s were ordered for the RAF and four for the French air force, all with CFM56 turbofans. Deliveries began in 1990, the RAF aircraft being designated Sentry AEW. Mk 1. Both versions have an in-flight refueling probe and USAF-style re-ceptacle. RAF aircraft are fitted additionally with wingtip Loral 1017 Yellow Gate ESM pods, will be fitted with the JTIDS data link, and are receiving the RSIP\_E-3s of all NATO countries have been heavily involved in monitoring the former Yugoslavia,

Brief: This version of the multirole fighter is used by

AIR FORCE Magazine / December 1998

NATO forces for reconnaissance missions.

Operator: Belgium, Denmark, and Netherlands.

F-16A(R) Fighting Falcon

Function: Reconnaissance.

# First Flight: Jan. 27, 1983 (Netherlands).

Delivered: February 1983-July 1984 (Netherlands). IOC: Oct. 1, 1984. Production: 22 (plus conversions).

Inventory: Belgium 12, Denmark six, and Netherlands 21

Contractor: Lockheed Martin, USA.

Power Plant: one Pratt & Whitney F100-PW-220 afterburning turbofan; 23,770 lb thrust. Accommodation: pilot only, on zero/zero ejection seat.

Dimensions: span over missiles 32 ft 10 in, length 49 ft 4 in, height 16 ft 9 in. Weight: empty 18,238 lb, gross 42,300 lb. Ceiling: above 50,000 ft.

Performance: max speed at 40,000 ft above Mach 2, radius of action more than 575 miles.

Armament: Sidewinder AAM on each wingtip for selfdefense. Can revert to multirole fighter with up to 12,000 lb of stores.

COMMENTARY

Purpose-built F-16A(R)s were supplied to Nether-lands. They are fitted with a radar altimeter and carry on their centerline pylon an Oude Delft Orpheus pod. This contains a fan of three TA-8 cameras, plus one panoramic F.415 and infrared linescan.

In 1995, Netherlands loaned some Orpheus pods to Belgium, which modified three F-16s to carry them. Den-mark received six reconnaissance pods home-built by the air force in early 1994, using cameras from retired Saab Drakens, pending availability of a specially de-signed Modular Reconnaissance Pod (MRP) by Per Udsen Aircraft Industry, Six MRPs with an electro-optic framing camera and IR camera are on order for imminent delivery; four more long-range optical MRPs are due in 2000. Belgium ordered 12 MRPs in 1996, and these have just entered service on the first of 16 suitably modified aircraft. Netherlands plans to buy MRPs next year.

G222VS Brief: This modified transport aircraft is used on special duty missions by the Italian air force. Function: Elint.

Operator: Italy.

First Flight: March 9, 1978.

Delivered: 1978-81. IOC: July 1979.

Production: two

Inventory: two. Contractor: Alenia (formerly Aeritalia), Italy. Power Plant: two General Electric T64-GE-P4D turbo-

props; each 3,400 shp. Accommodation: Pilot, copilot, and up to 10 systems

operators. Other data generally as for transport. COMMENTARY

Externally distinguishable by a small thimble radome beneath the nose and a larger doughnut radome at the tip of the tail fin, this version has a modified cabin fitted with racks and consoles for detection, signal process ing, and data recording equipment, with an electrical system providing up to 40 kw of power for its operation.

Mirage F1-CR-200 Brief: Optimized for reconnaissance, this version of the Mirage has a secondary ground-attack role. Function: Tactical reconnaissance and ground attack, Operator: France.

First Flight: Nov. 20, 1987.

Delivered: not available IOC: July 9, 1983,

Production: 64.

Inventory: 52. Contractor: Dassault Aviation, France.

Data generally as for Mirage F1 fighter.

Armament: self-defense Magic AAM at each wingtip; bombs and rocket pods in secondary role.

COMMENTARY

The standard tactical reconnaissance aircraft of the French air force differs from the basic F1-C fighter in being fitted with Cyrano IVMR radar (with additional ground mapping, contour mapping, air-to-ground rang-ing, and blind let-down modes), a SAGEM Uliss 47 inertial platform, ESD 182 navigation computer, fixed in-flight refueling probe, and an SAT SCM2400 Super Cyclope infrared linescan reconnaissance system replacing the starboard gun. An under-nose bay houses either a 75 mm Thomson-TRT 40 panoramic camera or a 150 mm Thomson-TRT 33 vertical camera. FLIR is installed in the port gun bay,

F1-CR-200s can also carry a centerline podded sen-sor in the form of a Thomson Raphaël TH SLAR or an 880-lb Thomson-CSF Astac electronic reconnaissance system for detecting ground radars. Data from Raphaël can be downloaded in flight if within 400 miles of a SARA mobile ground station. In 1998, the F1-CR force received the first of five Thomson-CSF Presto pods with a 900 mm electro-optical (CCD) camera for stand off photography at ranges up to 30 miles. A Barax ECM pod can be carried under one wing, and a flare dis-penser fitted in place of the brake chute.



RF-4 Phantom II, Spanish air force (Gert Kromhout)

# Mirage IVP

Brief: This version of the first-generation Mirage is now used in its former secondary role of reconnais-

sance. Function: Strategic reconnaissance.

Operator: France

First Flight: June 17, 1959.

Delivered: February 1964-January 1968.

IOC: Oct. 1, 1964. Production: 62.

Inventory: five.

Contractor: Dassault Aviation, France. Power Plant: two SNECMA Atar 9K-14 afterburning

turbojets; each 14,840 lb thrust. Provision for 12 JATO rockets; total 11,000 lb thrust.

Accommodation: crew of two, in tandem, on ejection seats.

Dimensions: span 38 ft 11 in, length 76 ft 5 in, height 17 ft 9 in.

Weight (approx): empty 31,965 lb, gross 72,750 lb.

Ceiling: 54,000 ft. Performance: max speed Mach 2 at high altitude, 745 mph IAS at low altitude, radius of action 930 miles unrefueled. Armament: none.

# COMMENTARY

The Mirage IV bomber force stood down July 4, 1996, but one squadron continues in the strategic reconnaissance role with a CT 52 pod semirecessed on the centerline. Recent duties have included regular mis-sions over former Yugoslavia. For low-level photography, the Mirage IV has four

OMERA 35 cameras (three with 150 mm lenses for forward and oblique use and one 75 mm vertical). In the high-level role, the configuration is three 600 mm OMERA 36 cameras and one 152 mm Wild RC 8F, all vertical. An SAT Super Cyclope linescan is a third option, usually for low-level missions.

Equipment includes Thomson–CSF Arcana pulse– Doppler radar, dual INS and, typically, a Thomson– CSF TMV 015 Barem self-protection jamming pod and a Bofors BOZ-103 chaff/flare pod on under-wing py-lons, plus two 436- or 660-gallon external fuel tanks. Thomson-CSF Serval RWRs are standard. Operational radius can be extended by in-flight refueling.

# Nimrod R. Mk 1

Brief: The Nimrod is known as a maritime reconnaissance aircraft, but three are assigned to other duties. Function: Elint.

Operator: UK. First Flight: Oct. 30, 1973.

Delivered: 1973-74. IOC: May 10, 1974. Production: three, plus one conversion.

Inventory: three.

Contractor: British Aerospace, UK.

Data as for Nimrod MR. Mk 2 except:

Accommodation: four flight crew and up to 24 systems operators.

# Armament: none.

COMMENTARY

This version can be identified by the short tailcone that replaces the MR. Mk 2's MAD boom and by modifications to the wing leading-edge pods. The three original aircraft were fitted with an in-flight refueling probe between 1982 and 1988, thus becoming Mk 1Ps. BOZ-107 chaff/flare dispenser pods, modified with AN/AAR-47 missile approach warning systems, were added un-der the wings in 1990. At the same time, an Ariel towed radar decoy was installed temporarily in the lower rear fuselage.

Early in 1995, one of the R. Mk 1Ps was recommissioned after being fitted with new E-Systems equip-ment under the Starwindow project. This includes two high-speed search receivers, 22 pooled digital inter-cept receivers, wideband digital D/F system, color active-matrix consoles, and distributed digital maps, databases, and analytical tools. Another two aircraft have been similarly upgraded, including a converted Nimrod MR, Mk 2 replacement for the third of the original aircraft that was lost after a safe ditching. Early

in 1998, proposals were invited for a further upgrade, code-named Extract, to automate some of the data collection processes.

# RF-4 Phantom II

Brief: Three NATO air forces in Europe continue to operate reconnaissance versions of the Phantom II. Function: Tactical reconnaissance.

Operator: Greece, Spain, and Turkey. First Flight: Aug. 8, 1963 (RF-4C). Delivered: 1964-75.

IOC: September 1964 (USAF).

Production: 667. Inventory: Greece 21, Spain 14, and Turkey 44. Contractor: McDonnell Douglas, USA. Data for RF-4C.

Power Plant: two General Electric J79-GE-15 afterburning turbojets; each 17,000 lb thrust.

Accommodation: crew of two, in tandem, on ejection seats.

Dimensions: span 38 ft 5 in, length 62 ft 11 in, height 16 ft 6 in.

Weight: empty 28,276 lb, gross 40,267-52,823 lb. Ceiling: 55,200 ft.

Performance: max speed at 40,000 ft Mach 2.10, at S/L 898 mph, T-O to 50 ft: 3,990 ft, landing run 3,100 ft, typical combat radius 755 miles, ferry range 1,632 miles

Armament: four self-defense Sidewinder AAMs.

COMMENTARY RF-4E. The Greek and Turkish air forces operate ex-German RF-4Es, as well as their original new-build aircraft. These versions have -17 engines and perfor-mance similar to the F-4E.

RF-4C. Ex-USAF RF-4Cs (CR.12s) serve in the Spanish air force, Their internal equipment comprises the usual one KS-91 and four KS-87 cameras, Following cancellation of the ATARS reconnaissance system intended for Spanish Hornets, the CR.12s have been upgraded with fixed in-flight refueling probes, APQ-172 terrain-following radar (replacing APQ-99), a new INS, 1553B digital databus and other improved avion-ics, plus chaff/flare dispensers and up to four selfdefense AIM-9L Sidewinder AAMs.

# Tornado ECR and GR. Mk 1A/4A

Brief: General and specific versions of the Tornado interdictor are used for reconnaissance with a variety of sensors.

Function: Tactical reconnaissance and defense sup-Operator: Germany, Italy, and UK. First Flight: Aug. 18, 1988. Delivered: 1990–91. IOC: May 1990.

Inventory: Germany 73, Italy 15, and UK 24. Contractors: Panavia Aircraft, a UK/German/Italian

Data for Tornado ECR. Power Plant: two Turbo-Union RB199 Mk 105 after-

Accommodation: crew of two in tandem, on zero/zero

Dimensions: span 45 ft 8 in spread, 28 ft 3 in swept,

Performance: generally as for Tornado IDS. Armament: two Sidewinder self-defense AAMs; two

AGM-88 HARM anti-radar missiles (ECR/IT-ECR).

a BAe sideways-looking IR system, Vinten Linescan 4000 IR surveillance system, and Computing Devices signal processing and video recording system, all lo-cated internally. Full attack capability is retained, ex-

cept for the absence of guns, Later this year, delivery will begin of eight RAPTORs (Reconnaissance Air-

borne Pods for TORnado) for long-range optical pho-

borne Pois for rownado) for long-range optical pho-tography. Germany and Italy jointly developed a reconnais-sance pod. Hung from the centerline pylon, the MBB pod contains two Zeiss cameras (610 mm Lorop and 57 mm low-level vertical), TV sensors, and a Texas Instruments RS-710 infrared linescan. Nine pods were assigned as interim equipment to 40 ex-German navy

Tornados transferred to the Luftwaffe in 1994, and others are used by one Italian IDS squadron. A new DASA pod, incorporating two Zeiss KS-153 optical

cameras (one Trilens 80 and one Pentalens 57) and a

Honeywell IR linescan, is now being delivered. Tornado ECR and IT-ECR. A specially developed

Tornado Electronic Combat and Reconnaissance(ECR)

version retains an air-to-surface combat role, except for removal of guns, It is fitted with a ground emitter

locator; FLIR; on-board systems for processing, stor-

ing, and transmitting reconnaissance data; and ad-vanced tactical displays for the pilot and WSO. It is normally configured to carry two HARMs, two Sidewind-

65

Tornado IDS/GR. Mk 1A. The RAF's GR. Mk 1A has

burning turbofans; each approx 16,235 lb thrust

Production: 35, plus conversions.

length 54 ft 10 in, height 19 ft 6 in. Weight: not available

consortium

ejection seats.

Ceiling: not available

COMMENTARY

ers, an active ECM pod, a chaff/flare dispenser pod, and two under-wing 396-gallon fuel tanks. ECR originally had IR linescan, but this was withdrawn in 1996 for installation in the above-mentioned DASA pod, Two Luftwaffe squadrons are equipped.

Italy is converting 15 of its existing Tornado IDSs to IT-ECR configuration, with equipment similar to that of Germany, except for addition of a Zeiss FLIR, advanced radar warning equipment, and retention of Mk 103 engines. The first was delivered to the Italian air force Feb. 27, 1998, although the operating squadron has been using 20 Tornado IDSs with an interim HARM capability since April 1994.

# Tankers

# C-135FR, KC-135R, and Boeing 707

- Brief: Several versions of the venerable C-135/Boeing 707 are used by six NATO air arms, mostly for aerial
- refueling. Function: Tanker, transport, and special duties. Operator: France, Germany, Italy, Spain, Turkey, and NATO
- First Flight: Aug. 4, 1982 (KC-135R), Delivered: July 1984-present.

# IOC: 1984.

Production: more than 360.

Inventory: France 14, Germany four, Italy four, Spain three, Turkey seven, and NATO pool three. Contractor: Boeing, USA.

Data for C-135FR.

Power Plant: four CFM56-2-B1 turbofans; each 22,000 lb thrust.

Accommodation: crew of four.

Dimensions: span 130 ft 10 in, length 136 ft 3 in, height 42 ft.

Weight: empty 123,460 lb, gross 321,875 lb.

Celling: 50,000 ft. Performance: max speed 560 mph.

# Armament: none.

COMMENTARY

C-135FR. Like USAF, France re-engined its 11 remaining C-135F tankers with CFM56 turbofans, the FR version returning to service in August 1985. C-135FRs had originally only a standard USAF-type flying boom, terminating in a drogue for compatibility with probe-equipped aircraft. In 1991, work began on fitting two FRL Mk 32 hose-drum units under the wings to free the boom for receptacle refueling of E-3F AWACS aircraft; Thomson-CSF Sherloc RWRs have also been fitted. Range of the C-135FRs is nearly 3,400 miles. In their

other role as transports, each can carry 75 fully equipped troops on sidewall seating, or 77,000 lb of freight over a range of 2,235 miles, or 44 stretchers and 54 other persons in a medevac mission.

KC-135R. France borrowed three USAF KC-135s to maintain capability during Mk 32 refits, but in June 1997 received the first of three bought outright. In 1995, Turkey received two USAF KC-135Rs on loan, pending 1997 delivery of the first of seven "new" con-

versions it has on order. **T.17 and TM.17.** Spain has three 707 VIP transports (T.17s); a further 707 (TM.17), fitted with Israeli Sigint equipment under Project Santiago, has a secondary tanker role

707-320C. Four 707s obtained for VIP and support flights with the German air force's special missions unit, at Köln/Bonn, have been partially replaced by Airbuses and will all have been retired by late 1999. Dornier of Germany headed a team that modified three 707-320Cs as trainer/cargo aircraft (TCA), with cockpit similar to that of the E-3A, for training NATO AWACS flight crews and to provide NATO with air transport capability. Italy has four 707 tanker/transports, two with seats for 110 passengers and two combis seating a maximum of 66. All four have three hoses and a fuel load of 24,100 gallons.

# KC-130H Hercules

Brief: Tanker versions of the Hercules transport are equipped for hose-and-drogue refueling of fighters.

Function: Tanker. Operator: Canada and Spain.

First Flight: 1973.

Delivered: December 1973-October 1982. IOC: 1974.

Production: 22.

Inventory: Canada five and Spain five. Contractors: Lockheed Martin, USA.

Power Plant: four Allison T56-A-15 turboprops; each

4,508 ehp. Accommodation: crew of four.

Dimensions: span 132 ft 7 in, length 97 ft 9 in, height 38 ft 3 in.

Weight: gross 175,000 lb. Ceiling: 26,500 ft.

66



KDC-10, Netherlands air force



C-130K Hercules C. Mk 1, RAF (Paul Jackson)

Performance: max cruising speed 362 mph, range 2.238 miles Armament: none

# COMMENTARY

KC-130H. Beginning in 1976, Spain received five new-build Hercules tankers to support its Phantom and Mirage (and now Hornet) forces.

CC-130H(T). In 1992–93, Northwest Industries modi-fied five Canadian forces CC-130Hs to tankers with two FRL Mk 32B pods beneath the wings and a 3,600gallon tank in the cargo hold. Normal clients are Canadian Hornets.

# KDC-10

Brief: The KDC-10 is a converted DC-10 airliner. Function: Tanker/transport.

Operator: Netherlands

First Flight: July 31, 1995. Delivered: Sept. 29, 1995.

IOC: 1995.

Production: two conversions.

Inventory: two.

Contractors: KLM Engineering, Netherlands (Mc-Donnell Douglas, USA). Power Plant: three General Electric CF6-50C turbo-

fans; each 52,500 lb thrust.

Accommodation: crew of three. Dimensions: span 165 ft 5 in, length 170 ft 6 in, height

58 ft 1 in.

Weight: gross 565,000 lb. Ceiling: 33,400 ft.

Performance: max speed at 30,000 ft 564 mph, range with max payload 4,124 miles.

# Armament: none. COMMENTARY

McDonnell Douglas (now Boeing) was awarded a contract in February 1993 to design and convert two tanker/transports from secondhand DC-10-30CFs, the modification work then being subcontracted to KLM. Features include a 43-ft "flying boom" and closed-circuit TV for the Remote Aerial Refueling Operator, who, unlike in USAF KC-10As, sits on the flight deck.

# Tristar

Brief: Six TriStar airliners were converted to tankers for the RAF (by which they are known as the Tristar), The service also has unconverted passenger trans-

ports.

Function: Tanker/transport.

Operator: UK. First Flight: July 9, 1985.

Delivered: October 1985 (K, Mk 1)-April 1993 (C, Mk

2A). IOC: Dec. 1, 1988.

Production: six conversions.

Inventory: nine.

Contractor: Marshall Aerospace, UK (Lockheed, USA). Data for K. Mk 1.

Power Plant: three Rolls-Royce RB211-254B4 turbo-fans; each 50,000 lb thrust.

Accommodation: three flight crew; up to 266 passengers (KC, Mk 1)

Dimensions: span 164 ft 6 in, length 164 ft 3 in, height 55 ft 4 in.

Weight: empty 242,684 lb (tanker), gross 540,000 lb. Ceiling: 43,500 ft.

Performance: max speed at 30,000 ft 545 mph, T-O distance 9,200 ft, landing distance 6,770 ft, range with max payload 4,310 miles.

# Armament: none. COMMENTARY

Six Lockheed L-1011-500 TriStar airliners purchased by the RAF from British Airways are operated as dual-role tanker/transports. Three ex-Pan Am aircraft are passenger transports.

K. Mk 1. Two modified by Marshall Aerospace at Cambridge to Tristar K. Mk 1 standard, with twin Flight Refueling Mk 17T hose drums (one a reserve) in the fuselage and seven tanks in the baggage compart-ments, raising total fuel capacity to 313,300 lb. Features include a refueling receiver probe over the flight deck, optional seating for 187 passengers, and closed-circuit TV to monitor refueling operations.

KC. Mk 1. Four aircraft converted to tanker/freighter, with a large cargo door, strengthened cabin floor, and cargo handling system. Fuel capacity is as for the K. Mk 1, but optional seating can accommodate 196 to 266 passengers. Refueling probes were re-moved in late 1991.

C. Mk 2/2A. Standard airliner with 267 seats and no fuel transfer capabilities. Two Mk 2s; the sole Mk 2A is the only RAF Tristar delivered with a milspec communications fit.

# VC10

Brief: All RAF VC10s are now dedicated or part-time tankers

Function: Tanker and tanker/transport.

Operator: UK.

First Flight: Nov. 26, 1965 (C. Mk 1). Delivered: July 1966-March 1996.

IOC: 1966 (transport), 1983 (tanker).

Production: 54.

Inventory: 25.

Contractor: British Aerospace, UK.

Power Plant: four Rolls-Royce Conway 301 turbofans; each 22,500 lb thrust.

Accommodation: crew of four, 150 passengers, 76 litter patients and six attendants, or 57,400 lb of freight (C. Mk 1(K)).

Dimensions: span 146 ft 2 in, length 166 ft 1 in (K, Mk 2), 179 ft 1 in (K, Mk 3), height 39 ft 6 in. Weight: gross 313,933 lb (K, Mk 2), 334,875 lb (K, Mk 3).

Weight: gross 313,933 to (K, Mk 2), 334,675 to (K, Mk 3).
Ceiling: 42,000 ft (C, Mk 1K).
Performance: max speed at 30,000 ft 580 mph, T-O distance 8,300 ft, landing distance 7,000 ft, range with 24,000 lb payload 5,370 miles (C. Mk 1K).

Armament: none COMMENTARY

C. Mk 1(K). Between 1992 and 1995 all 13 (now 12) surviving VC10 C. Mk 1 strategic transports were con-verted with tanker provisions, having two Flight Refueling Mk 32 wing pods but no additional fuel, thereby retaining full passenger/freight capability. K. Mk 2 and K. Mk 3. The RAF has five VC10 K. Mk 2s,

converted by British Aerospace from ex-BOAC Model 1101s, and four VC10 K. Mk 3s converted from East African Airways Super VC10 Model 1154s. Each has a Flight Refueling Mk 17B hose drum in the rear fuselage, a Mk 32 pod under each wing, a receiver probe on its nose, and closed-circuit TV to monitor refueling operations. Fuel tanks in the cabin give the K. Mk 2 a total capacity of 24,470 gallons and the K. Mk 3 a capacity of 26,455 gallons. First flight of the Mk 2 was June 22, 1982. Since April 1996, two have been based on the Falkland Islands, in the South Atlantic, to refuel the Tornado F. Mk 3 air defense flight

K. Mk 4. A further five ex-British Airways Super VC10s were converted to VC10 K. Mk 4 standard, first flown April 28, 1994. Although having a fuselage-mounted Mk 17B hose drum unit and a Mk 32 pod under each wing, they have no extra fuel tanks (or passenger/ freight provisions) in the fuselage.

Brief: Ex-airline Airbus aircraft are being used increas-ingly for long-range transport. The manufacturer also

offers (as yet unsuccessfully) a dedicated tanker.

Function: Strategic transport. Operator: Belgium, Canada, France, and Germany.

AIR FORCE Magazine / December 1998

Strategic

First Flight: April 3, 1982.

Delivered: March 1983-present.

Production: more than 260 (continuing).

A310

IOC: 1983.

Transports

Inventory: Belgium two, Canada five, France two, and Germany five.

Contractors: Airbus Industrie, France; airframe prime contractors Aerospatiale, France; Daimler-Benz Aero-space Airbus, Germany; British Aerospace Airbus, UK; CASA, Spain.

Power Plant: (Srs 304) two General Electric CF6-80C2A2 turbofans; each 53,500 lb thrust.

Accommodation: two crew on flight deck; palletized

seats for up to 270 passengers. Dimensions: span 144 ft 0 in, length 153 ft 1 in, height 51 ft 10 in.

Weight: empty 179,920 lb, gross 330,675-361,550 lb. Ceiling: not available

Performance: typical cruising speed Mach 0.8, refueling speed 253-368 mph,T-O distance 7,910-8,155 ft, landing distance 4,850 ft, normal range 5,523 miles, max range using transfer fuel 8,285 miles. Standard fuel 105,960 lb; up to 61,730 lb of transfer fuel in eight under-floor tanks.

## Armament: none. COMMENTARY

COMMENTARY A310-222. On Sept. 25, 1997, Belgium received the first of two ex–Singapore Airlines A310-222s, with P&W JT9D-7R4 engines of 48,000 lb thrust, for re-placement of Boeing 727s, The second arrived in May 1998

A310-304. Three Airbus A310-304s, with CF6-80C2A2 engines, were taken over by the German government in October 1990 and transferred to the air force. Following conversion to military transport requirements, they entered service at Köln-Bonn Airport Oct. 3, 1993, assuming many of the long-range transport tasks performed previously by four Boeing 707s and two Tu-154Ms. Two more have been added and two/four more are required. Two are in VIP fit; two will be converted to combi configuration in 1999 and then to tanker/ transports in 2003.

In 1993, two former airline A310-304s were acquired for France, replacing two of four DC-8s. Modifications include a cargo door, 28-seat cabin, and two additional fuel tanks, increasing max weight from 337,300 to

346,125 lb. Conversion to optional tanker is planned. CC-150. In Canada, five ex-airline A310-304s are operated under the designation CC-150 Polaris. Replacing a similar number of Boeing 707s, they flew their first service Jan. 22, 1993.

# Theater and **Special Use** Transports

# C-130 Hercules

Brief: A rugged aircraft capable of operating from rough dirt strips to provide theater airlift and drop-ping of troops and equipment. Refueling versions are described elsewhere.

Function: Theater airlift. Operator: All NATO air forces except Germany.

First Flight: Aug. 23, 1954. Delivered: April 1955-present. IOC: December 1956.

Production: more than 2,200 (continuing).

Inventory: Belgium 11, Canada 27, Denmark three, France 14, Greece 14, Italy 12, Netherlands two, Norway six, Portugal six, Spain seven, Turkey 14. and UK 55.

Contractor: Lockheed Martin, USA.

- Data for C-130H.
- Power Plant: four Allison T56-A-15 turboprops; each 4,508 ehp
- Accommodation: crew of five; up to 92 troops, 64 paratroops, 74 litter patients, or five 463L freight pallets.

Dimensions: span 132 ft 7 in, length 97 ft 9 in, height 38 ft 3 in.

Weight: empty 76,469 lb, gross 175,000 lb.

Ceiling: 26,500 ft.

Performance: max cruising speed 362 mph, T-O run 3,580 ft, landing run 1,700 ft, range with max payload 2,238 miles.

# Armament: none. COMMENTARY

C-130B. Ex-USAF aircraft were delivered in the early 1990s to Greece (five) and Turkey (seven) but have been little used.

C-130E (CC-130E). Canada received 24 C-130Es, with 4,050 ehp T56-A-7 engines, of which 18 remain, designated CC-130E. Seven C-130Es are in Turkish service. Canada is standardizing cockpit avionics on its five different subvariants of the Hercules. The first

AIR FORCE Magazine / December 1998

updated by CAE Aviation with a Collins digital glass cockpit flew Sept. 19, 1997, to launch the Avionics Update Program (AUP).

C-130H. This more powerful version was in produc-tion for 28 years and supplied to most of NATO. Bel-gium implemented an extensive avionics upgrade known as the Integrated Vehicle Mission Management Sys-tem, which includes a two-person glass flight deck, Denmark initiated an upgrade in 1997 with a Collins FMS-800 flight management system, including FMR-200X weather radar. An Italian avionics upgrade will be completed in 1999, while the first aircraft from a Spanish glass cockpit upgrade was redelivered Jan. 21, 1998. Several air forces have added RWRs and chaff/ flare dispensers, mainly as a consequence of participating in UN-sponsored policing/relief operations. The aircraft for Netherlands were delivered with a comprehensive missile/radar warning and jamming suite already installed. C-130H-30. Twelve C-130Hs were delivered to

France in 1987-91, including nine stretched C-130H-30s. Portugal's five C-130Hs are being stretched lo-cally by OGMA to match a single new C-130H-30. Spain has one (designated TL.10) and Canada received two in 1992–93. C-130K (C. Mk 1 and C. Mk 3). The RAF acquired

66 C-130Ks, basically Hs with UK equipment, as Hercules C. Mk 1s. Thirty were lengthened to C-130H-30 standard, as Hercules C. Mk 3s, able to carry seven cargo pallets instead of five, four Land Rovers and trailers, 128 troops, 92 paratroops, or 97 litter patients. Current programs are adding ALR-66 RWR and ALQ-157 IR jammers to half the fleet.

C-130J. In December 1994, the RAF became the first customer for the upgraded C-130J, placing an order for 25 of these Allison AE2100-powered aircraft, comprising 15 long-fuselage C. Mk 4s and 10 standard length C. Mk 5s. Italy has ordered 18, of which six will be converted to tankers. Following certification delays, deliveries to the RAF began in mid-1998. The C-130J has a two-crew flight deck, digital avion-

ics, six-blade advanced technology propellers, and improved reliability and maintainability.

# C.160

Brief: Universally known as "Transall" (from Trans-porter Allianz), the C.160 derives its designation from the 160 aircraft initially required by partner design nations.

Function: Transport,

- Operator: France, Germany, and Turkey. First Flight: Feb. 25, 1963. Delivered: November 1967–January 1986,

# IOC: April 1968

- Production: 204. Inventory: France 68, Germany 86, and Turkey 20. Contractor: Arbeitsgemeinschaft Transall (Aerospatiale
- and MBB); France and Germany. Power Plant: two Rolls-Royce Tyne RTy 20 Mk 22
- turboprops; each 6,100 ehp. Accommodation: crew of three; 93 troops, 61-88 paratroops, 62 stretchers and four attendants, tanks,

vehicles, or up to 35,275 lb of freight.





P.180 Avanti, Italian air force (Paul Jackson)

Dimensions: span 131 ft 3 in, length, excl probe, 106 ft 4 in, height 38 ft 3 in Weight: empty 63,935 lb, gross 112,435 lb.

Ceiling: 27,000 ft.

Performance: max speed at 16,000 ft 319 mph, T-O run 2,610 ft, landing run 1,180 ft, range with max payload 1,151 miles.

## Armament: none. COMMENTARY

C.160D/F. The French air force received 50 Fs, the German air force 90 Ds, and the Turkish air force 20 Ds. of the first-generation C.160, which ended production in 1972.

C.160NG. A second (Nouvelle Génération) series was authorized in 1977, with updated avionics and an optional center-section fuel tank. Of 29 of these C.160NGs built for the French air force, eight are standard transports, 10 are equipped as secondary probe-and-drogue in-flight refueling tankers, five others have provision for rapid conversion to tankers, and six are Astarté/Gabriel special mission aircraft (described elsewhere). C.160R/NGR. First-generation French aircraft be-

gan an avionics update in 1993, changing their designation to C.160R. This involves an Electronic Flight Instrumentation System (EFIS) optimized for NVGs, first pilot's HUD, ring-laser INS, and GPS. A similar upgrade has just started on second-generation French aircraft, and DASA is modifying German C.160Ds with a GEC air data computer, GPS, and Rockwell FMS-800 flight-management system. Eleven French Transalls have recently received a defensive aids suite including Elta MAWS, Thomson-CSF Sherloc RWR and Alkan-Matra Spirit chaff/flare dispensers.

# C-212 Aviocar

- Brief: Several versions of this rear-loading utility trans-port are employed on the Iberian Peninsula, Reconnaissance and surveillance models are described
- separately, Function: Tactical transport, patrol, training, and medevac, Operator: Portugal and Spain, First Flight: March 23, 1971.

Delivered: March 1974-present.

IOC: 1974.

Production: more than 435 (all versions; continuing). Inventory: Portugal 16 and Spain 70. Contractors: CASA, Spain.

Data for Srs 100.

Power Plant: two AlliedSignal TPE331-5-251C turboprops; each 715 shp. Accommodation: crew of two; 18 troops, 15 para-

troops and a jumpmaster; or 4,410 lb of freight, incl

light vehicles, loaded via the rear ramp, Dimensions: span 62 ft 4 in, length 49 ft 11 in, height 20 ft 8 in.

Weight: empty, equipped 8,609 lb, gross 13,889 lb. Ceiling: 28,025 ft.

Performance: max speed 230 mph, T-O run 1,150 ft, landing run 680 ft, range with max fuel 1,093 miles, Armament: none.

# COMMENTARY

T.12B/C. Aviocar transports and three remaining TE.12B crew trainers equip three cargo squadrons of the Spanish air force, the parachute school, and three training squadrons. All are Srs 100 variants, the T.12C configured for personnel transport.

D.3A. Two medevac conversions of T.12B can each carry up to 18 litter patients. C-212 Srs100. One Portuguese squadron and one flight in the Azores operate C-212 tactical transports. D.3B. Seven of this Srs 200 variant, with 900 shp

TPE331-10R-512C turboprops, are employed by Spain on SAR duties.

Srs 300. Two Srs 300s optimized for fisheries protection, and funded by the European Community, were delivered to Portugal in October 1994; they are equipped with SLAR in addition to the Swedish-designed Maritime Surveillance System (MSS) fitted to three existing ex-transport C-212s.

# CN-235 M

Brief: The CN-235 twin turboprop transport is pro-duced in parallel with the smaller C-212. The stretched C-295, unveiled in 1997, has yet to find a buyer,

Function: Transport, Operator: France, Spain, and Turkey, First Flight: Nov. 11, 1983,

Delivered: December 1986-present. IOC: March 1987.

Production: more than 150 (continuing).

- Inventory: France 10, Spain 20, and Turkey 52. Contractor: nominally by Airtech, a Spanish/Indone-sian consortium (CASA and IPTN), but all NATO aircraft are CASA-built.
- Power Plant: two General Electric CT7-9C turboprops; each 1,870 shp.

Accommodation: crew of three; up to 48 troops, 46 paratroops, 24 litters and four attendants, 13,227 lb

G222RM, Italian air force

of freight (loaded via rear ramp), or equipment for ASW/maritime patrol, EW, or photographic duties. Dimensions: span 84 ft 8 in, length 70 ft 3 in, height 26 ft 10 in.

Weight: empty 19,400 lb, gross 35,273 lb. Ceiling: 25,000 ft.

- Performance: max cruising speed at 18,000 ft 262 mph, T-O distance 4,235 ft, landing run (with propeller reversal) 1,305 ft, range with max payload 932 miles, with max fuel 2,704 miles.
- Armament: normally none, but six under-wing hardpoints are capable of carrying anti-ship missiles or other weapons

# COMMENTARY

Srs 100. Current military version. France is gradually acquiring 15, having formed its first squadron Aug. 1 1993, with six, another two going to replace Caravelle transports in Tahiti, Turkey has 52 to replace veteran C-47s, 50 being built locally by Tusas, 1992–98, follow-

T.19A. The first NATO military operator was the Spanish air force, which acquired two in December 1988 as personnel transports under the current designation T.19A

T.19B. Eighteen regular transports were delivered to two Spanish squadrons in 1991-93.

# F27 Maritime and Fokker 50/60

Brief: The Friendship civil and military transport was in production for 28 years before being re-engined and upgraded as the F50/F60.

Function: Transport and maritime surveillance.

Operator: Netherlands and Spain. First Flight: Nov. 24, 1955 (F27).

Delivered: November 1958-April 1997. IOC: 1958.

Production: 1,107.

Inventory: Netherlands eight and Spain three. Contractor: Fokker Aviation, Netherlands.

Data for F60.

- Power Plant: two Pratt & Whitney PW127B turboprops; each 2,750 shp. Accommodation: crew of two; 55 paratroops, 30 lit-
- ters, or 17,231 lb of freight.
- Dimensions: span 95 ft 2 in, length 88 ft 2 in, height 27 ft 4 in.

Weight: empty 29,383 lb, gross 50,596 lb.

- Celling: 25,000 ft. Performance: cruising speed 332 mph, T-O distance 3,460 ft, landing distance 3,670 ft, max range with 15,432 lb payload 1,208 miles.

# Armament: none.

COMMENTARY

F27 Maritime. The last F27s in NATO are maritime surveillance versions with Litton 360° search radar in a ventral radome. Powered by Rolls-Royce Dart turboprops, they have an endurance of 10-12 hours or a range of up to 3,107 miles. Spain's Canary Islands Air Command (MACAN) includes three F27 Maritimes (des-ignation **D.2**) for surveillance and SAR. A further two of Netherlands are assigned to non-NATO duties in the Netherlands Antilles.

F50. Two ex-airline F50s were delivered to the Netherlands in November 1996 after modification with the F60's flight deck and military avionics. Duties are mainly personnel transport.

F60UTA-N. This specifically military version of the F60 has a 64-in fuselage stretch, large cargo door on the forward starboard side, multipurpose rear door, reinforced floor, and integrated self-defense measures. Only four were built, all delivered to Netherlands, beginning April 1996.

# G222

- Brief: This general-purpose rear-loading transport has also served in USAF (as C-27A Spartan) and is now being promoted jointly with Lockheed Martin as the AE2100-engined C-27J.
- Function: Transport, fire fighting, oil slick dispersal, medevac, and calibration Operator: Italy.

First Flight: July 18, 1970.

Delivered: November 1976-present.

IOC: 1976.

Production: more than 110 (continuing).

Inventory: 42.

- Contractor: Alenia (Aeritalia), Italy. Power Plant: two General Electric T64-GE-P4D turboprops; each 3,400 shp.
- Accommodation: crew of three; 222TCM holds 46 troops, 40 paratroops, 36 stretchers and four atten-

dants, or 19,840 lb of freight, vehicles, and guns. Dimensions: span 94 ft 2 in, length 74 ft 6 in, height 34 ft 8 in.

Weight: empty 34,610 lb, gross 61,730 lb. Ceiling: 25,700 ft.

68

Performance: max speed at 15,000 ft 303 mph, T-O run 2,250 ft, landing run 2,860 ft, range with max payload 783 miles. Armament: none.

# COMMENTARY

G222. The G222 equips two of the three tactical transport squadrons of the Italian air force in its stan-dard general-purpose (222TCM) form. Six guick-change kits are held, for field conversion to aeromedical configuration. Also in service are five G222s ordered by the Italian Ministry for Civil Defense as a rapid intervention unit for fire fighting, oil slick dispersal, medevac, and airlift of supplies to earthquake and other disaster areas. The G222 fleet will be reduced to 26 in the next few years as C-130J Hercules are received. All those retained will have an avionics upgrade, beginning 1999 and including new radar, Have Quick secure radios, GPS, new INS, and better anti-icing and defensive aids

(MAWS, RWR, and chaff/flare dispensers). G222SAA. The air force fleet includes 10 G222SAA (Sistema Aeronautico Antincendio) fire-fighting aircraft, with an optional modular palletized pack carrying 1,585 gallons of water and retardant. These aircraft have been used extensively and successfully in many parts of Italy. G222RM. Four G222RMs (Radiomisure) are used for

in-flight calibration of ground radio nav/com facilities. Equipment includes a nose-mounted spotlight.

# Gulfstream III/IV and SMA-3

Brief: Derivatives of the Gulfstream executive trans-port are used for various special missions.

Function: Fishery protection, airdrop, medevac (incl airborne surgery), SAR, tactical air transport, and VIP transportation.

First Flight: Dec. 2, 1979 (III). Delivered: 1980-present.

IOC: 1980.

Production: more than 530 (continuing). Inventory: Denmark two, Italy two, Netherlands one,

and Turkey three.

Contractor: Gulfstream Aerospace, USA. Data for Gulfstream SMA-3.

Power Plant: two Rolls-Royce Spey Mk 511-8 turbofans; each 11,400 lb thrust. Accommodation: (maritime) crew of seven

Dimensions: span 77 ft 10 in, length 83 ft 1 in, height 24 ft 5 in.

- Weight: empty 36,173 lb, gross 69,700 lb.
- Ceiling: 45,000 ft.
- Performance: max cruising speed at 30,000 ft 577 mph, T-O distance 5,700 ft, landing run 3,400 ft, range with VFR reserves 4,537 miles.

# Armament: none

COMMENTARY

SMA-3. Two survivors of three SMA-3 special mission derivatives of the Gulfstream III, delivered to Denmark in 1982, have a cargo door on the starboard side, forward of the wing, Texas Instruments APS-127 sea surveillance radar, Litton 72R INS, and a detach-able centerline SLAR pod. Their primary task is fishery protection over huge areas of sea around Greenland and the Faeroe Islands. Withdrawal is due by 2002, the Canadair Challenger being the likely replacement.

Gulfstream III. The Italian and Turkish air forces each have standard Gulfstream IIIs for VIP transport.

Gulfstream IV. A secondhand Gulfstream IV was received by Netherlands in December 1995. This version has a structurally redesigned wing, more fuel capacity, and a 4-ft-6-in fuselage stretch.

## Falcon 20

Brief: Small numbers of Falcon twin-jet transports (known as Mystère in France) have been modified for special duties

Function: ECM training, calibration and systems training.

Operator: France, Norway, and Spain. First Flight: May 4, 1963.

Delivered: 1965-88.

IOC: 1965. Production: 515.

- Inventory: France 14, Norway three, and Spain five. Contractor: Avions Marcel Dassault-Breguet Aviation, France.
- Power Plant: two General Electric CF700-2D2 turbofans: each 4,500 lb thrust.
- Accommodation: flight crew of two; up to 10 other persons or 3,750 lb of equipment or cargo, according to role.
- Dimensions: span 53 ft 6 in, length 56 ft 3 in, height 17 ft 7 in. Weight: empty 16,600 lb, gross 28,660 lb. Ceiling: 42,000 ft.

Performance: max cruising speed 490 mph at 40,000 ft, range 2,180 miles. Armament: none.

# COMMENTARY

Norwegian Falcons are equipped for radar and communications intelligence and jamming duties, as well as transport. The French Mystères include five fitted with the combat radar and navigation systems of various Mirage types for training interceptor, strike, and reconnaissance pilots; two for navaids calibration; one target tug; and six transports.

T.11 and TM.11. Spain operates one ECM/Elint and two calibration versions both designated TM.11. Two more are T.11 transports.

# Falcon 50 and 900

Brief: Similar in configuration, these differently sized business jets are used by some NATO air forces for VIP/VVIP missions.

Function: Executive transport.

Operator: Belgium, France, Portugal, and Spain. First Flight: Nov. 7, 1976.

Delivered: July 1979-present.

# IOC: 1979.

Production: more than 460 (continuing). Inventory: Belgium one, France five, Portugal three, and Spain three.

Contractor: Dassault Aviation, France.

Data for Falcon 900B.

Armament: none.

COMMENTARY

P.180 Avanti

IOC: 1990

Inventory: six.

passengers.

12 ft 11 in.

Ceiling: 41,000 ft.

1,956 miles.

COMMENTARY

was announced.

**TBM 700** 

IOC: 1991.

lots.

14 ft 3 in.

Ceiling: 30,000 ft.

COMMENTARY

Inventory: 14.

Armament: none

Function: Executive transport.

turboprops; each 850 lb shp.

Delivered: September 1990-present.

Production: more than 30 (continuing).

Weight: empty 7,500 lb, gross 11,550 lb.

Operator: Italy. First Flight: Sept. 23, 1986.

Power Plant: three AlliedSignal TFE731-5BR-1C turbo-fans; each 4,750 lb thrust.

Accommodation: two flight crew and up to 19 passen-

gers. Dimensions: span 63 ft 3 in, length 66 ft 4 in, height 24 ft 9 in.

Performance: max speed at 27,000 ft 575 mph, T-O

distance 4,680 ft, landing distance 5,850 ft, range 4,603 miles.

France was an early purchaser of both these Falcon versions and currently employs its two 900s as presi-

dential transports. Spain uses both variants, and Por-tugal, the 50. Newest operator is Belgium, using a 900B (certified 1991 with 5.5% power increase and 115

miles of additional range) delivered in 1997. Italy plans to replace two Gulfstream IIIs with a pair of Falcon

Brief: Unconventional in appearance for an executive

transport, this twin-turboprop pusher has been or-dered by the Italian armed forces for VIP duties.

Contractor: Rinaldo Piaggio, Italy. Power Plant: two Pratt & Whitney Canada PT6A-66

Accommodation: one or two flight crew and up to nine

Dimensions: span 46 ft 1 in, length 47 ft 4 in, height

Performance: max speed at 28,300 ft 455 mph, T-O distance 2,850 ft, landing distance 2,860 ft, range

The first of an initial six Avantis was delivered to the

Italian air force in May 1993, the fleet now being divided between four regional communications flights.

In June 1997, when the first of three others was handed

over to the Army, a follow-on order of 12 for the air force

Brief: Developed in collaboration with Mooney of the

Power Plant: one Pratt & Whitney Canada PT6A-64 turboprop; 700 shp.

Accommodation: seven persons, incl one or two pi-

Dimensions: span 41 ft 7 in, length 34 ft 11 in, height

Performance: max speed at 26,000 ft 345 mph, T-O distance 2,135 ft, landing distance 1,640-2,135 ft,

Military deliveries of TBMs began in May 1992 as a

AIR FORCE Magazine / December 1998

tions squadrons of the French air force.

Operator: France. First Flight: July 14, 1988. Delivered: December 1990-present.

Contractor: Socata, France

range 1,150-1,783 miles. Armament: none.

Production: more than 140 (continuing).

Weight: empty 4,100 lb, gross 6,578 lb.

Function: Executive and light cargo transport.

USA, the TBM 700 is used by regional communica-

900EXs (5,000-lb-thrust TFE731-60 engines).

Weight: empty 22,610 lb, gross 45,500 lb. Ceiling: 51,000 ft.

replacement for the venerable Paris light jet. Current requirements call for an eventual total of 22.

# **Maritime Patrol** Aircraft

# Atlantic (Br 1150)

Brief: The Atlantic was conceived to meet a NATO specification but was bought by relatively few mem-ber nations. It is also used by the French and German navies-the former with an upgraded version. Function: Maritime patrol.

Operator: Italy. First Flight: Oct. 21, 1961.

Delivered: December 1965-July 1974.

IOC: 1966. Production: 87.

Inventory: 18.

- Contractor: SECBAT international consortium, under Dassault-Breguet (French) direction.
- Power Plant: two Rolls-Royce Tyne RTy 20 Mk 21 turboprops; each 6,100 ehp. Accommodation: crew of 12, comprising two pilots.
- ECM/MAD operator, radar/IFF operator, tactical co-ordinator, and two acoustic sensor operators. Provision for 12 relief crew. Dimensions: span 119 ft 1 in, length 104 ft 2 in, height
- 37 ft 2 in.

Weight: empty 55,115 lb, gross 98,105 lb.

- Celling: 32,800 ft. Performance: max speed at height 409 mph, T-O dis-
- tance 4,920 ft, range 5,590 miles, endurance 18 hr. Armament: internal weapons bay accommodates all standard NATO bombs, mines, 385-Ib depth charges, four homing or nine acoustic torpedoes, or two Exocet missiles. Under-wing pylons for two AS 30 or Martel missiles.

# COMMENTARY

Anti-submarine equipment, in addition to the retract-able radar, includes a Magnetic Anomaly Detector (MAD) tailsting and an Arar Electronic Surveillance Measures (ESM) pod at the tip of the tailfin. The entire upper and lower rear fuselage provides stowage for sonobuoys and marker flares. Italian Atlantics are operated on Mediterranean patrols by the air force, with Italian navy person-nel making up half of the crews. They underwent an upgrade known as ALCO (limited modification of operational equipment) under Dassault-Breguet manage-ment between 1987 and 1992. A GEC-Marconi Avionics AQS-902C sonobuoy processing system, ST-02 ESM, and Litton INS were installed, together with Thomson-CSF Iguane radar and other features of the French navy's much-improved Atlantique 2, Italy and the German navy are jointly examining possible successors for service entry in 2008, one contender being the proposed Atlantique 3.

# Nimrod MR. Mk 2 and MRA. Mk 4

Brief: As a consequence of diminished Russian submarine activity, the RAF reduced its Nimrod MR. Mk 2 maritime patrol force to 26 aircraft in 1992-93. A successor is now on order.

Function: Maritime patrol. Operator: UK.

- First Flight: May 23, 1967. Delivered: June 1968–April 1976. IOC: 1970.

Production: 46.

Inventory: 25. Contractor: British Aerospace, UK.

Power Plant: four Rolls-Royce RB168-20 Spey Mk 250 turbofans; each 12,140 lb thrust.

Accommodation: crew of 12.

- Dimensions: span 114 ft 10 in, length incl refueling probe 129 ft 1 in, height 29 ft 9 in.
- Weight (approx): empty 86,000 lb, normal gross 177,500 lb. Ceiling: 42,000 ft.
- Performance: max speed 575 mph, typical low-level patrol speed 230 mph, T-O run 4,800 ft, landing run 5,300 ft, typical endurance 12 hr (19 hr with one refueling)
- Armament: up to nine torpedoes, Harpoon missiles, mines, or bombs in weapons bay; two under-wing pylons for Sidewinder AAMs. COMMENTARY

MR. Mk 2. With an airframe based substantially on that of Britain's pioneer Comet 4C jet airliner of the 1950s, the current Nimrod is equipped with Racal-Thorn Searchwater long-range surface vessel detection radar, GEC-Marconi Avionics AQS 901 acoustics



AS 332 Super Puma, French air force (Paul Jackson)



AS 555AN Fennec, French air force (Press Office Sturzenegger via Paul Jackson)

processing system compatible with a wide range of passive and active sonobuoys, and Loral 1017 Yellow Gate EWSM in wingtip pods. During the Persian Gulf War, some Nimrods gained a FLIR turret, missile ap-proach warning, Bofors BOZ-103 chaff/flare pods, and a GEC-Marconi Ariel towed radar decoy.

Nimrod MR. 2s are often used as aerial command posts for complex or large-scale SAR operations.

MRA. Mk 4. It was announced in July 1996 that 21 Mk 2s will be completely rebuilt with new wings of increased area, four BMW Rolls-Royce BR 710 turbofans (each 14,900 lb thrust), upgraded (Mk 2000MR) Searchwater radar, and substantially updated pro-cessing and display avionics. IOC is due in 2003.

# Orion (P-3), Aurora (CP-140), and Arcturus (CP-140A)

- Brief: Variants and upgrades of the Orion are employed by five NATO air forces.
- Function: Maritime patrol. Operator: Canada, Greece, Norway, Portugal, and Spain

- First Flight: Aug. 19, 1958. Delivered: April 1961-September 1995.
- IOC: August 1962 (US Navy). Production: 756.
- Inventory: Canada 21, Greece six, Norway six, Portugal six, and Spain seven. Contractor: Lockheed Martin, USA

Data for P-3C.

- Power Plant: four Allison T56-A-14 turboprops; each 4,910 ehp.
- Accommodation: crew of 10.
- Dimensions: span 99 ft 8 in, length 116 ft 10 in, height
- 33 ft 9 in. Weight: empty 61,491 lb, normal gross 135,000 lb.
- Ceiling: 28,300 ft.
- Performance: max speed at 15,000 ft 473 mph, patrol speed at 1,500 ft 237 mph, T-O distance 6,000 ft, landing distance 3,200 ft, mission radius (3 hr on station) 1,550 miles.
- Armament: max expendable load of 20,000 lb, incl 500/ 1,000/2,000-lb mines. Mk 54 depth bombs, Mk 46/50 torpedoes, Harpoon ASMs, bombs, rockets, sonobuoys, marine markers, acoustic sensors, and parachute flares

# COMMENTARY

P-3A. The original P-3A Orion anti-submarine and maritime patrol aircraft has an airframe based on that of the Electra airliner, with 4,500 ehp Allison T56-A-10W turboprops, APS-80 radar, ASQ-10 MAD in a tailboom, and an ASR-3 sensor to sniff the exhaust of submerged diesel-powered submarines. Mines, nuclear or conventional depth bombs, and torpedoes are carried in a weapons bay forward of the wings. Ten under-wing pylons can carry more torpedoes, mines, or rockets, as well as a searchlight. Sonobuoys and acoustic devices are launched from beneath the cabin. Two of this variant remain in Spanish service.

P-3B. Six Greek and five Spanish air force P-3Bs (Spanish designation P.3) have the standard APS-80 radar, ASQ-10 MAD, and AQA-7 acoustic processing system, plus later addition of FLIR, Have Quick secure

radios, and provision for Harpoon ASMs. Greece is the more recent operator, receiving its first May 31, 1996,

after overhaul by Hellenic Aerospace. P-3C. Norway was issued in 1989 four Update III P-3Cs for what was once its primary task of detecting Russian submarines leaving Northern Fleet bases in the Murmansk area, from the base at Andoya in the far north of Norway. These aircraft have much-improved avionics, including an IBM Proteus acoustic processor to analyze signals picked up from the sea, a new sonobuoy receiver, a Texas Instruments AAS-36 undernose IR detection set, and Harpoon missile capability. P-3N. Two Norwegian P-3Bs are retained, minus

anti-submarine equipment, for exclusive economic zone (EEZ) surveillance and for training. P-3P. The Portuguese air force has six ex-Australian

P-39, The Foruguese air force has six ex-must latian P-38s, redesignated P-3P after major retrofit. A new APS-134 radar, dual AQA-7V9 sonar processor, infra-red detecting set (IRDS), Data Link 11, ALR-66(V)3 ESM, interactive displays for the tactical coordinator and pilot, and Harpoon capability make the P-3P com-parable to a P-3C Update 11.5.

CP-140/140A. The 18 CP-140 Auroras operated by Canadian forces since 1980 combine the P-3C air-frame with avionics and data-processing systems based on those of the US Navy's S-3A Viking, including APS-506 search radar, ASQ-501 MAD, and AYK-10 com-puter, all of which are now in need of upgrading or replacing. They were supplemented in 1991 by three P-3Cs for EEZ patrol under the designation CP-140A Arcturus. Unarmed and lacking ASW equipment, CP 140As have APS-507 radar. An upgrade now beginning includes Lockheed Martin

An upgrade now beginning includes Lockheed Martin AYK-23(V) computers and Flightline Electronics ARR-502A sonobuoy receivers (not for CP-140A). In pros-pect are new radios, GPS, and the SpotSAR modifica-tion of APS-506 radar to add overland surveillance capability with range Doppler profiling, strip map, and spotlight modes.

# **Helicopters**

# AH-64 Apache

- Brief: The Apache is the leading attack helicopter of the US Army and is also being supplied to the British and Greek armies. In the Netherlands it is flown by the air force.
- Function: Attack. Operator: Netherlands.
- First Flight: Sept. 30, 1975.
- Delivered: January 1984-present. IOC: July 1986 (US Army).
- Production: more than 1,140 (continuing).
- Inventory: 11.
- Contractor: Boeing, USA.

Data for AH-64D.

Power Plant: two General Electric T700-GE-701C turboshafts; each 1,890 shp. Accommodation: pilot (rear) and gunner in tandem.

Dimensions: rotor diameter 48 ft, fuselage length (tail rotor turning) 48 ft 2 in, height 14 ft 1 in. Weight: empty 11,800 lb, gross 17,650 lb. Ceiling: hovering ceiling IGE 13,500 ft. Performance (with 16 Hellfires): cruising speed 162 mph most coreo 352 miles

- mph, max range 253 miles.
- Armament: one 30 mm Bushmaster Chain Gun under nose, 16 Hellfire ASMs or up to 76 x 2.75-in rockets in pods of seven or 19. Planned additional stub-wing
- hardpoints for four Stinger or two Sidewinder AAMs.

AH-64A and AH-64D. A dozen US Army AH-64As were delivered on lease to Netherlands in November 1996 to allow operating experience to be gained prior to delivery of 30 new NAH-64Ds ordered in May 1995. The first of them flew May 13, 1998, but-initially, at least-Netherlands will not acquire the D version's compatible Longbow MMW radar.

# AS 332 Super Puma and AS 532 Cougar

Brief: The Cougar is an advanced version of the SA 330 Puma optimized for military operations. Those built before 1990 retain the original civil name of Super Puma.

- Function: Transport and SAR.
- Operator: France, Germany, Netherlands, Spain, and

First Flight: Sept, 13, 1978.

- Delivered: 1981-present.
- IOC: 1981.
- Production: more than 540 (continuing). Inventory: France 10, Germany three, Netherlands

17, and Spain 16. Contractor: Eurocopter (Aerospatiale, France, and DASA, Germany)

69

Data for AS 532U2.

Power Plant: two Turbomeca Makila 1A2 turboshafts; each 1,845 shp.

Accommodation: crew of two; up to 29 troops, or 12 litters and four seated persons, or internal or slung freight.

Dimensions: rotor diameter 53 ft 2 in, fuselage length 55 ft 1 in, height 16 ft 4 in.

Weight: empty 10,493 lb, gross with internal load 21,495-24,692 lb.

# Ceiling: 13,450 ft.

Performance: max cruising speed 170 mph, range with standard fuel 494 miles.

Armament: Resco only (see below). COMMENTARY

AS 332. The French air force uses three AS 332 Super Pumas (two 332Cs and a stretched 332L) for support duties at nuclear test sites in the Pacific and three more 332Ls for VIP transport. Another 332C was used as the prototype Resco. HD.21 and HT.21A. Spain acquired 12 (now 10) AS

332s (local designation HD. 21) for SAR missions from bases in Madrid, Seville, Gando in the Canaries, and Palma de Mallorca. Two HT.21s and four stretched HT.21As are VIP transports based at Madrid.

AS 532UL. Three were delivered in 1991-92 to the French intelligence bureau communications flight at Evreux

AS 532U2. Netherlands took delivery between 1996 and 1998 of 17 stretched, unarmed AS 532U2 Cougar Mk IIs for army support duties. These have hybrid Mk IIs for army support duties. These have hybrid glass/conventional cockpit displays and are being modified almost immediately with the addition of AlliedSignal weather radar. Germany took delivery of three U2s late in 1997 for VIP transport. AS 532A2 Cougar Resco. Combat SAR version for French air force. Cougar Mk II, with provision for light armament (two door-mounted 7.62 mm machine guns, and fixed 20 mm que or cocket ondes) and standard fit of

and fixed 20 mm gun or rocket pods) and standard fit of chin FLIR, weather radar, rescue hoist, searchlight, and chaff/flare dispensers. Four on order; deliveries to begin in December 1998, Range 930 miles; optional telescopic in-flight refueling probe.

AS 532AL. Two French-built SAR-configured Cou-gars will be delivered to the Turkish air force next year, to be followed by 18 assembled locally by TAI.

# AS 355 Ecureuil 2 and AS 555 Fennec

Brief: Essentially a civil helicopter, the AS 355/555 has been adapted for military use, occasionally with ar-

mament.

Function: Light utility. Operator: France and UK. First Flight: Sept. 28, 1979.

Delivered: March 1980-present.

IOC: October 1980. Production: more than 650 (continuing).

Inventory: France 49, UK two.

Contractor: Eurocopter (Aerospatiale, France, and DASA, Germany).

Data for AS 555AN Fennec.

- Power Plant: two Turborneca TM 319 Arrius 1A turbo-shafts; each 479 shp.
- Accommodation: pilot and up to five passengers.
- Dimensions: rotor diameter 35 ft 1 in, fuselage length 35 ft 10 in, height 10 ft 11 in. Weight: empty 3,046 lb, gross 5,732 lb with slung load.

Ceiling: 13,125 ft. Performance: max cruising speed 140 mph, range 448

miles

Armament: provision for carrying 20 mm gun and Mistral missiles.

COMMENTARY

The French air force received 52 of these twin-turbine light helicopters for surveillance of strategic military bases and other support duties. Some were used to develop combat SAR techniques (with NVG capability), while others undertake armed patrol of the Ariane rocket launch site in French Guyana.

AS 355F1. The first seven are AS 355F1s, with 420 shp Allison 250-C20F turboshafts, all now assigned to

Shp Allison 200-0201 through the series of the series of VIP transport. On April 1, 1996, the RAF received two leased AS 355F1 Twin Squirrels for VIP transport, replacing Gazelles. AS 555AN. The remainder of the French order, deliv-ered from January 1990, comprised this military-opti-mized version, which partly equips eight squadrons, come overseas. some overseas

# Bell 212 and 412

Brief: The Bell Model 212 is a twin-engine version of the Iroquois, utilizing a Canadian-built power plant, Function: Light transport and SAR.

Operator: Canada, Greece, Italy, Netherlands, Nor-way, and UK.

First Flight: April 1969 (212).

Delivered: September 1970-present. IOC: 1970 (USAF). Production: more than 1,450 (continuing).

70

Inventory: Canada 99, Greece four, Italy 35, Nether-lands three, Norway 19, UK nine.

Data for CH-146. Contractor: Bell Helicopter Textron, Canada. Power Plant: one Pratt & Whitney Canada PT6T-3D Turbo Twin-Pac; 1,910 shp.

Accommodation: pilot and up to 14 passengers Dimensions: rotor diameter 46 ft, fuselage length 42 ft

5 in, height 11 ft 5 in. Weight: empty 7,500 lb, gross 11,900 lb.

Ceiling: 10,200 ft.

Performance: max cruising speed 143 mph, range with max payload 463 miles.

# Armament: none. COMMENTARY

212. Canada has replaced all its early CH-135s by CH-146s, but Greece still operates the US-built version and Italy has 212AMs, produced under license by Agusta, for communications and SAR. 412CF (CH-146 Griffon). The 412 is most readily

identified by its four-blade main rotor. Over 3.5 years from October 1994, Canada received 100 CH-146s for army support, general transport, and SAR. All are built and certified to civil standards but have extensive military avionics, including provision for a comprehen-sive self-defense suite and 600-lb rescue hoist.

412SP Arapaho. Most of Norway's Arapahos were assembled locally from Bell kits to replace UH-1Bs used for transport and SAR at locations including inside the

Arctic Circle. Netherlands received three Agusta-Bell 412SPs, from February 1994, to supplant Alouette Ills. 412EP Griffin HT. Mk 1. The first of nine training helicopters entered RAF service in April 1997. They are operated under contract by a civilian consortium and are responsible for tri-service advanced helicopter training as well as the instruction of SAR candidates.

# **BO 105 CB**

Brief: Widely employed by civil and military operators, this utility helicopter has armed versions, although none serves with a NATO air force.

Function: Light transport, observation, and forward air control.

Operator: Netherlands,

First Flight: Feb. 16, 1967. Delivered: 1970-present.

IOC: 1970

Production: more than 1,445 (continuing).

Inventory: 27. Contractor: Eurocopter (Aerospatiale, France, and

DASA, Germany). Power Plant: two Allison 250-C20B turboshafts; each

420 shp.

Accommodation: five persons, incl one or two pilots; two litters in place of three rear occupants for medevac. Dimensions: rotor diameter 32 ft 3 in, fuselage length

28 ft 1 in, height 9 ft 10 in. Weight: empty 2,813 lb, gross 5,511 lb.

Ceiling: 17,000 ft.

Performance: max cruising speed 150 mph, range with max payload 408 miles.

# Armament: none.

COMMENTARY

Netherlands' army owns these helicopters, but they are flown and maintained by the air force. All are equipped for operation at night and in adverse weather, but five have been upgraded to CB-4 standard, beginning in 1996, with Kevlar cockpit armor and a chaff/ flare dispenser, for policing duties in Bosnia.

# CH-47 Chinook

Brief: Used extensively by the US Army, the twin-rotor Chinook serves with two NATO air forces, plus the Greek and Spanish armies.

Function: Medium utility transport. Operator: Netherlands and UK.

First Flight: Feb. 26, 1982 (CH-47D).

Delivered: March 1982 (US Army)-present. IOC: Feb. 28, 1984 (US Army).

Production: more than 1,120 (all versions; continuing).

Inventory: Netherlands six, UK 40.

Contractor: Boeing, USA. Data for Chinook HC. Mk 2. Power Plant: two AlliedSignal T55-L-712F turboshafts; each 3,750 shp.

Accommodation: crew of four; up to 55 troops, or 24 litter patients, or internal or external freight. Dimensions: rotor diameter (each) 60 ft, fuselage

length 51 ft, height 18 ft 11 in. Weight: empty 23,402 lb, gross 50,000 lb.

Ceiling: 10,150 ft.

Performance: max speed 185 mph, mission radius 115 miles with 13,907-lb payload.

Armament (optional): two machine guns in forward hatchway and port forward window. COMMENTARY

Both air forces operate Chinooks for the primary

benefit of their respective armies. CH-47D. Seven ex-Canadian CH-147s (CH-47Cs) were refurbished by Boeing to CH-47D standard, but with Honeywell ACMS glass cockpits, and delivered to Netherlands from December 1995 onwards. The first of a further six new-build CH-47Ds (not yet in the inventory) for the same operator was handed over May 21, 1998. Both versions will receive an RWR in 1999 and MAWS in 2000-03, if funds permit.

HC. Mk 2/2A. Conversion of 32 surviving RAF Chinooks to HC. Mk 2 standard, equivalent to the CH-47D, was completed by Boeing in 1995 and followed by delivery of three more new Mk 2s in 1996 and six Mk 2As from December 1997 onwards. RAF Chinooks are fitted with AAR-47 missile approach warners, ALQ-157 IR jammers, chaff/flare dispensers, and ARI.18228 RWR; some have satellite communications for Special Forces' operations. The last RAF Chinooks in Germany were withdrawn in June 1997

HC. Mk 3. Eight, equivalent to the MH-47E Special Forces' variant, will shortly be supplied to the RAF.

# CH-113 and CH-113A Labrador

First Flight: April 22, 1958. Delivered: 1964-72 (US production).

Brief: Aging Labradors form the mainstay of Canada's coastal and inland SAR units but will be replaced by EHI EH 101s.

Power Plant: two General Electric T58-GE-100 turbo-

Accommodation: crew of three; provision for up to 20

Dimensions: rotor diameter (each) 50 ft, fuselage length 44 ft 7 in, height 16 ft 10 in. Weight: empty 11,532 lb, gross 21,400 lb. Ceiling: 13,700 ft.

Performance: max speed 170 mph, range 690 miles.

There are six CH-113s (Vertol 107 II-9s) and seven

very similar CH-113As (107 II-28s) remaining from 1963-65 deliveries. Each helicopter has a 900-gallon

fuel capacity for relatively long-range missions, an

11,000-b cargo hook for external loads, a rear ramp, a watertight hull for landing on water, a high-powered searchlight, a rescue hoist, a scoop net for retrieving

survivors from the water, and Stokes litters. The sec-ond of two Labrador upgrade programs was completed in 1986, but although options on a third were rejected

in favor of replacement, original -8F engines are being modified to -100s (having increased commonality with

Brief: The Anglo-Italian EH 101 was developed initially

Contractor: EH Industries (Agusta, Italy, and GKN Westland, UK).

Power Plant: three Rolls-Royce Turbomeca RTM 322 turboshafts; each 2,312 shp.

Accommodation: crew of two, plus 30 fully equipped

Dimensions: rotor diameter 61 ft, fuselage length 64 ft

Performance: nominal cruising speed 173 mph, range

Merlin HC. Mk 3. On March 9, 1995, the RAF ordered 22 of a rear-ramped, utility version of the EH-101 to

22 of a rear-ramped, utility version of the EH-101 to boost its army support forces. These will be the first helicopters to enter service with an integrated defen-sive aids suite comprising, in this instance, GEC– Marconi Sky Guardian 2000 RWR, Tracor ALE-47 chaft/

flare dispensers, and Hughes Danbury laser warning. All will have provision for a fixed refueling probe and

chin FLIR turret. The first Mk 3 is due to fly later this

year; IOC will be in 2000. AW 320 Cormorant. In 1993, Canada canceled an

order for ASW and SAR versions of EH-101. However,

in January 1998, 15 of a low-cost adaptation, based on the civilian utility (rear-ramp) version and employing

off-the-shelf avionics wherever possible, were selected for the renewed SAR requirement under the designa-tion AW 320 Cormorant, Power plant is three General

Electric T700 turboshafts, each of 2,000 shp. Deliver-

AIR FORCE Magazine / December 1998

ies are due between 2000 and 2002.

(approx) 700 miles. Armament: optional door-mounted machine gun.

1 in, height (rotors turning) 21 ft 10 in.

Weight: empty 20,613 lb, gross 32,188 lb. Ceiling: 15,000 ft.

for naval applications, but recent orders have been for air force versions. A civil EH 101 is available.

civil CT58) under a four-year program.

EH 101 Merlin and Cormorant

Function: Medium utility and SAR.

Delivered: December 1995-present.

Operator: Canada and UK. First Flight: Oct. 9, 1987.

IOC: TBD. Production: orders for 98.

Inventory: not applicable

Data for HC. Mk 3.

troops.

COMMENTARY

Function: SAR. Operator: Canada.

Inventory: 13.

survivors.

Armament: none. COMMENTARY

IOC: June 1964 (USMC).

Production: more than 820.

shafts; each 1,350 shp.

Contractor: Boeing Vertol, USA.
#### HH-3F Pelican

Brief: The HH-3F Pelican is a license-built version of the Sikorsky S-61R multipurpose helicopter and a close relative of the Sea King. Function: SAR.

Operator: Italy.

First Flight: June 17, 1963 (S-61R). Delivered: December 1963-91.

IOC: 1964 (USAF).

Production: 203 (S-61R).

Inventory: 33.

- Contractor: Agusta, Italy. Power Plant: two General Electric T58-GE-100 turbo-shafts; each 1,500 shp.
- Accommodation: crew of two or three; six litters and 10 seated persons, or 26 troops, or 15 litters and two attendants, or equiv freight.

Dimensions: rotor diameter 62 ft, fuselage length 57 ft 3 in, height 18 ft 1 in.

Weight: empty 13,255 lb, gross 22,050 lb.

Ceiling: 11,100 ft.

Performance: max speed 162 mph, range 886 miles. Armament: ("Bravo") optional pintle-mounted 5.56 mm machine gun in cabin doorway.

COMMENTARY

Two batches of Pelicans have been supplied since August 1977. The last 15, termed the "Bravo" variant and optimized for combat SAR, were delivered with new radar, Loran, FLIR, RWR, NVG-compatible lighting, cockpit armor, chaff/flare dispensers, and a navigation computer.

#### NH 90

Brief: This pan-European helicopter is being devel-oped for multirole naval (NH 90 NFH) and tactical transport (NH 90 TTH) applications with rear-loading ramp

Function: Tactical transport helicopter.

Operator: France, Germany, and Italy (TTH and NFH); Netherlands (NFH only). First Flight: Dec. 18, 1995.

Delivered: from 2003 (German TTH).

IOC: TBD.

Production: requirements for 647 (498 TTH and 149 NFH).

Inventory: not applicable Contractor: NH Industries (Agusta, Italy; Eurocopter, Germany and France; Fokker, Netherlands), Data for NH 90 TTH.

Power Plant: two turboshafts, each 1,680 shp continuous: General Electric CT7 or RRTI RTM 322.

Accommodation: two or three crew, and either 20 troops or one 2.2-ton vehicle or 2.75 tons of

freight. Dimensions: rotor diameter 53 ft 6 in, fuselage length 52 ft 2 in, height 17 ft 10 in.

Weight: empty 11,905 lb, gross 20,062-22,046 lb. Ceiling: 13,940 ft.

Performance: max cruising speed at S/L 186 mph,

range (ferry) 748 miles. Armament: Provision in TTH for as yet unspecified area suppression and self-defense weapons.

COMMENTARY

The 85 TTHs to be acquired by the German air force will comprise 34 basic transports without EW, FLIR, or helmet-mounted sights; 15 with a full defensive aids subsystem; 20 without full EW; eight equipped for combat SAR; and eight in VIP configuration. Other TTHs will fulfil army aviation requirements of France (133), Germany (120), and Italy (160). Navy plans for France, Germany, Italy, and Netherlands are for inven-tories of 27, 38, 64, and 20, respectively, of the ASW/ ASVW NFH version, which also should be delivered (Netherlands) from 2003.

#### SA 316/319 Alouette III

Brief: The Alouette III, once used widely, is now in the twilight of its career with two of the last three NATO operators.

Function: Light transport, SAR, and training.

Operator: France, Netherlands, and Portugal.

- First Flight: Feb. 28, 1959. Delivered: July 1961-early 1983 (French production). IOC: 1961.

Production: 1,453 (French production only). Inventory: France 14, Netherlands 10, and Portugal

24

Contractor: Aerospatiale, France,

Data for SA 319B.

Power Plant: one Turbomeca Astazou XIV turboshaft; derated to 600 shp. Accommodation: pilot and six passengers or two

stretchers and two attendants.

Dimensions: rotor diameter 36 ft 2 in, fuselage length 32 ft 11 in, height 9 ft 10 in.

Weight: empty 2,527 lb, gross 4,960 lb. Ceiling: 10,500 ft.

Performance: max speed 136 mph, range with max payload 375 miles

Armament: none.

#### COMMENTARY

SA 316B and SA 319B. The Alouette III was produced first with an Artouste turboshaft, as the SA 316A/B, and then with an Astazou, as the SA 319B. Main uses are now light transport. SAR, and training. Netherlands will keep six in service until 2003/4

#### SA 330 Puma

Brief: Replaced in production by the Super Puma/ Cougar, the Anglo-French Puma anticipates many

more years of service with NATO air forces. Function: Light utility and SAR. Operator: France, Portugal, Spain, and UK. First Flight: April 15, 1965.

Delivered: September 1968-89.

IOC: 1969. Production: 828.

- Inventory: France 34, Portugal nine, Spain five, and **UK 41**
- Contractors: Westland Helicopters, UK, and Aerospatiale, France. Power Plant: two Turbomeca Turmo IIIC4 turboshafts;

each 1,435 shp.

Accommodation: crew of two; up to 16 troops, six stretchers and four seated persons, or internal or external freight.

Dimensions: rotor diameter 49 ft 3 in, fuselage length 46 ft 2 in, height 16 ft 10 in.

- Weight: empty 7,403 lb, gross 14,110 lb.
- Ceiling: 15,100 ft.

Performance: max speed 174 mph, range 390 miles. Armament: none fixed; optionally two 7.62 mm machine guns and other weapons.

COMMENTARY

SA 330Ba. The French air force version of the Puma, used for general support and SAR both at home and overseas. An interim combat SAR modification to some Pumas supporting operations in former Yugoslavia includes chaff/flare dispensers, armor, GPS, a 600-lb capacity hoist, nose radar, and a Chlio FLIR.

HC. Mk 1. RAF Puma HC. Mk 1 (SA 330E) assault helicopters have a cargo hook as standard equipment; a rescue hoist is optional. In late 1995, the last of 42 to receive the Puma Navigation Upgrade was returned to service. The PNU involved new VOR and Tacan, GPS, ILS, an electronic horizontal situation indicator, integrated defensive aids suite (RWR, missile approach, IR jammer, and chaff), compatibility with NVGs, and a covert lighting system for night formation flying.

SA 330S1. Surviving Pumas of the Portuguese air force are SA 330S1s, with the Super Puma's Makila 1A1 turboshafts; five are fitted with ORB-31 nose radar.

HD.19. In April 1995, five Spanish air force HT.19s were redesignated HD.19 to reflect their transfer from executive transport to SAR duties.

Sea King, S-61A, and CH-124 Brief: Original and license-built versions of Sikorsky's S-61/H-3 serve six NATO air forces in mainly humanitarian roles.

Function: Anti-submarine and SAR. Operator: Belgium, Canada, Denmark, Italy, Norway.

and UK.

First Flight: May 7, 1969 (UK license). Delivered: May 1969–May 1997.

IOC: 1969.

Production: 328 (UK).

Inventory: Belgium five, Canada 30, Denmark eight, Italy two, Norway 12, and UK 25. Data for Sea King HAR. Mk 3.

Contractor: GKN Westland Helicopters, UK.

Power Plant: two Rolls-Royce Gnome H 1400-1 turboshafts; each 1,660 shp.

Accommodation: crew of four; six litters, or two litters

and 11 seated persons, or 19 passengers. Dimensions: rotor diameter 62 ft, fuselage length 55 ft 10 in, height 15 ft 11 in.

Weight: empty 13,672 lb, gross 21,400 lb.

Ceiling: 14,000 ft.

Performance: max speed 131 mph, range 690 miles. Armament: none. COMMENTARY

HAR. Mk 3/3A. Equipment of the RAF's HAR. Mk 3A SAR version includes Thomson Thorn ARI 5955/2 radar, Racal RNAV2 computer, Cossor STR2000 GPS, and Type 91 Doppler. Cockpit lighting is compatible with NVGs.

Mk 43B. Norway is upgrading its older SAR Sea Kings to match three new-build Mk 43Bs, having 12 new or rebuilt Mk 43Bs with both nose-mounted (RDR 1300C) and spine-mounted (RDR 1500) radars, FLIR 2000F, and other improvements. Mk 48A. Belgian SAR helicopters were upgraded in

1995 with FLIR 2000F, replacement RDR 1500B ra-dars, Racal RNS252 INS, and Canadian Marconi CMA 3012 GPS. A new Smiths Newmark SN500 AFCS will be installed by 2000, and a sixth Sea King may be acquired for training. S-61A. Denmark has Sikorsky-built S-61As for SAR.

These were recently upgraded with FLIR, although the Sikorsky S-92 has been provisionally selected as a replacement.

CH-124A. Canadian forces deploy Sea Kings on board ships for ASW duties and for SAR, passenger transport, and carriage of slung loads. These began life as CH-124s, generally identical to the USN's SH-3A Sea Kings, with active sonar and General Electric T58-GE-8D turboshafts, but underwent the Sea King Im-

provement Program in 1975/76, becoming 124As. CH-124B. From 1991, six Canadian Sea Kings were converted to CH-124B standard, with a new tactical navigation system, acoustic processor, internal MAD, and passive Helicopter Towed Array System (HELTAS) sonar. Sea Kings are based on both Canadian coasts. The EH 101 is being promoted as a replacement, up to 32 of which would be required.

SH-3D/TS. Two VIP transport versions (also available for medevac) are used by the Italian air force; regular passengers include the Pope.

#### UH-1

Brief: The original single-engine Huey continues to play a useful role in NATO.

Inventory: Germany 105, Greece 20, Turkey 45. Contractor: Bell Helicopter, USA.

11 in, height 14 ft 6 in. Weight: empty 5,210 lb, gross 9,500 lb.

from Agusta license production in Italy

Function: Tactical transport and SAR.

Contractor: Westland Aircraft, UK. Data for HC. Mk 2.

port, liaison, and training.

of the Sikorsky S-58.

IOC: July 1961 (UK navy). Production: 378.

5 in, height 14 ft 5 in.

Ceiling: 12,000 ft.

Armament: none.

COMMENTARY

2001

the target.

Data for UH-1H. Power Plant: one AlliedSignal T53-L-13 turboshaft;

Accommodation: two crew and up to 14 other persons, or up to 3,880 lb of slung cargo. Dimensions: rotor diameter 48 ft, fuselage length 41 ft

Performance: max speed 127 mph, range 318 miles.

Variants of the single-engine Bell UH-1 Iroquois oper-ated by Turkey were built in the US, but some were

assembled locally; German aircraft were manufactured

under license by Dornier; those flown by Greece came

SAR. The D version has a 1,100-shp T55-L-11. UH-1H. Greece has Agusta-Bell 205As for light trans-

port and SAR. The Turkish UH-1Hs are used for sup-

Brief: The Wessex is a turbine-powered development

First Flight: May 17, 1957 (Mk 1); Jan. 18, 1962 (Mk 2). Delivered: 1958-69.

Power Plant: two coupled Rolls-Royce Gnome Mk

110/111 turboshafts; each 1,350 shp. Accommodation: crew of two or three; 16 troops,

Dimensions: rotor diameter 56 ft, fuselage length 48 ft

Performance: max speed 132 mph, range 478 miles.

Following withdrawal in April 1998 of two Mk 4 Wessex

used as royal transports, only the Mk 2 remains in RAF

service. HC. Mk 2. Of 72 Mk 2s bought for the RAF, 16 remain

in support of the Northern Ireland garrison and five in Cyprus, providing SAR and occasional UN support. Most are equipped with IR jammers, cockpit armor, and

a searchlight. Others, recently replaced in the SAR role

by Sea King Mk 3As, are in storage or have been sold. Final Wessex will serve until replaced by EH 101s in

Systèmè de Croisièrè à Longue Portée-Emploi Général-is a general-purpose cruise missile which

will be delivered to the French air force (Mirage 2000D)

and navy (Rafale M) from 2003, the latter service receiving 50 of the 500 ordered in January 1998. The

UK's Storm Shadow order was placed earlier, in Febru-

ary 1997, and deliveries of 900 will begin in 2001 for application to Harriers, Tornado GR. Mk 4s, and

Eurofighters. Both versions will approach at low level

before popping up to allow homing sensors to locate

71

seven litter patients, or 4,000 lb of freight.

Weight: empty 8,304 lb, gross 13,500 lb.

UH-1D. Germany's UH-1Ds are used for liaison and

Function: Light utility transport. Operator: Germany, Greece, and Turkey. First Flight: Oct. 22, 1956 (Bell 204/UH-1A).

Production: more than 10,000.

Delivered: 1959-83, IOC: June 1959,

1,400 shp.

Ceiling: 12,600 ft.

Armament: none.

COMMENTARY

Wessex

Operator: UK.

Inventory: 21



The Marine Corps and the Army believe future conflicts will take place in the streets, high-rises, and sewers of the urbanized Third World.

# War in the Urban Jungles

By James Kitfield

ARINE Corps Cpl. Lynne Blanke in 1998 learned firsthand the dangers inherent in urban military operations.

Earlier this year, the civil affairs specialist was working in Bosnia in the Croat-dominated town of Drvar. She returned from a patrol to her unit's downtown offices only to discover that an ill-tempered, unruly Croat mob had formed in the city center. The protestors were enraged by the repatriation of 150 Serb refugees.

Blanke and her colleagues, lacking prior intelligence warning or adequate backup, decided to evacuate. Before they could leave the building, rioters stormed it and set it on fire. Outside, the mob surrounded Blanke's Humvee, smashing its bulletproof window.

Blanke, thrown onto the defensive, reached for her side arm to fire a warning shot but held back. It turned out to be the right move: The protest petered out and an uneasy calm returned. Yet things might easily have gone the other way.

"That was hard to take," she said. "That incident proved to me that once you sense something isn't right on the street, it's probably already too late." She added grimly, "Things can go wrong really quickly here."

That is the fundamental lesson of urban warfare, and it is being learned today by more and more US servicemen and -women. US forces in the past decade have fought pitched battles in the mean streets of Panama City and Mogadishu, Somalia, and conducted perilous urban operations in cities ranging from Port-au-Prince, Haiti, to Tirana, Albania.

### **Bouts of MOUT**

In the murky world between peace and all-out war that has come to characterize much of the post-Cold War era, the breed of activity the Army calls Military Operations on Urbanized Terrain—or MOUT—is increasing. Each of the Army's major deployments of the 1990s—with the notable exception of the Gulf War—entailed urban operations. The same is true for Marines.

On any given day, US forces confront the myriad dangers of operations in Bosnian cities such as Sarajevo, Tuzla, Drvar, and Zvornik, where they average 100 patrols a month through the heart of angry, sullen, and potentially dangerous populations.

Tasks as mundane as moving people and supplies from base to base require detailed, painstaking planning, much as would be the case in combat. Four-vehicle convoys are mounted, missions are briefed, and force protection measures meticulously rehearsed.

For regular military forces, urban warfare is like a knife fight—chaotic, close range, and extremely bloody. The cities are brutal and dangerous, and US military doctrine advises the services to avoid urban conflicts whenever possible. Despite that, the Marine Corps and, to a lesser extent, the Army, take a different view. To find it, one need look no further than Gen. Charles C. Krulak, the commandant of the US Marine Corps.

"For our entire lifetime," said Krulak, "our whole doctrine has said, 'Do not go into the cities; avoid them at all costs,' and yet, that's where the center of gravity is going to be. Take everything you've watched on CNN since Desert Storm and try to remember anytime when you saw a conflict taking place that it wasn't in an urban slum or city. You can't."

According to Krulak, the US has to go into the urban warfare business for a simple reason. "If there is an enemy out there that wants to make a difference, he can only make a difference by getting us into a complex, chaotic, deadly environment that negates our technology, negates our strength, and capitalizes on their strengths. That place is called the cities."

Some analysts, while acknowledging that it might be prudent and necessary for US forces to hone their urban warfare skills, argue that nothing in the future would compel American forces to enter or to fight in cities; the US would go in only after having chosen to do so. In so doing, it would be choosing to discard its trump card—its highly trained, technologically superior conventional forces.

These experts caution against taking the view that urban combat is the unavoidable wave of the future, lest it become a self-fulfilling prophecy.

"I think there's some danger in confusing that which may become common with that which threatens our vital interests," said retired Air Force Maj. Gen. Charles D. Link, the officer who served as the Air Force's point man for both the National Defense Review and Commission on Roles and Missions studies.

### Seoul Cleansing

As an example, Link noted the kind of situation that could occur in a new Korean conflict. "Rather than sending thousands of young Americans to clear Seoul, city block by city block, ... I think you work the problem in other ways," said Link. "Maybe you encourage the South Koreans to take on that task, while US forces focus on attacking the enemy at his nerve centers."

Link said that "another alternative would be to use your dominance of air and space to isolate enemy forces in Seoul and attrit them very carefully."

Urban operations, of course, are not new for US military forces. In World War II, roughly 40 percent of the battles fought in Europe took place in urban areas. The Korean War also included significant urban combat, as did the Vietnam War during the 1968 Tet Offensive, when US forces fought street-to-street to dislodge Communist units from Hue.

If anything, however, those engagements provide a powerful cautionary tale about the dangers of urban warfare. More recent warnings abound. They can be seen in the disastrous experience of the Russians in the rebellious city of Grozny or in the British difficulties coping with sectarian strife of Belfast.

The view that urban operations constitute the future of war stems from at least three factors:

**Rampant Urbanization.** Demographic trends suggest that most of the world's population soon will live in the cities, many of them megacities. Given a seemingly inexorable movement of rural populations to cities—and of urban sprawl—an estimated 70 percent of the world's population is likely to reside in urban centers by 2015.

Retired Army Lt. Col. Ralph Peters, a key urban warfare proponent, sees an obvious message: "The future of warfare lies in the streets, sewers, high-rise buildings, industrial parks, and the sprawl of houses, shacks, and shelters that form the broken cities of our world."

US Military Supremacy. Some experts also believe that the US military's overwhelming conventional military superiority, as revealed in the Persian Gulf War, will drive future enemies to search for friendlier venues in which to challenge US power—with urban cityscapes being one that might negate superior American mobility, command and control, and standoff weapons.

The most harrowing example was seen in Somalia, where 18 American soldiers died in a close firefight in the labyrinthine alleys of Mogadishu. Two multimillion dollar helicopters were downed by ground fire.

The Humanitarian Imperative. As some analysts see it, Third World cities are collapsing under the weight of population and poverty, and such developments may trigger humanitarian crises characterized by famine and disease that could require military involvement. According to one recent federal study, "We must also expect to be involved in cities while conducting ... peacekeeping and peace enforcement operations."

These factors, taken together, have convinced some commentators that a large urban danger awaits. The final report of the National Defense Panel, which reviewed US military forces and strategy in late 1997, gave heavy emphasis to the challenges presented by global urbanization.

The Marine Corps has taken the most aggressive stance in tackling the issue of urban warfare. For the past two years the Marine Corps Warfighting Lab at Quantico, Va., has conducted a series of experiments dubbed Urban Warrior. The goal of the program, which will conduct final phase exercises early next year, is to find innovative concepts, tactics, and technologies that will aid Marines in future urban operations.

### "We Can Get Beat"

"Why are we spending two years on Urban Warrior?" asked Krulak. "Because that's where we can get beat. We don't know how to fight there."

Much of the focus of Urban Warrior has been directed at trying to better understand the urban environment and the unique challenges it presents to military commanders and forces.

In one exercise, Marine Corps participants received an in-depth tour of Chicago. Local police and fire officials acted as tour guides as they explored underground sewer networks and power grids. In another exercise, participants visited New York City and experimented with equipment that might allow them to travel from skyscraper to skyscraper without descending to street level, the traditional killing ground of urban warfare.

In Charleston, S.C., Marines worked with emergency response teams trained to cope with chemical and biological weapons. Their goal: to better understand how weapons of mass destruction can alter the dynamic in an urban warfare setting.

Urban Warrior also tapped the minds of some of the most experienced urban fighters. Retired Marine Lt. Gen. Ron Christmas, a company commander during the battle of Hue, discussed how the dispersed and chaotic nature of urban battles makes them "squad leader" wars. With communications technology being pushed down to the lowest levels, and massive firepower in the hands of junior officers, squad leaders in future urban battles will need to master skills required today of company commanders.

Marine Corps Maj. Gen. Emil R. Bedard, who served in Somalia, emphasized the importance of constant patrols to stabilize an area and calm local inhabitants; the need to protect convoys to ensure the safe movement of people and supplies in potentially hostile urban areas; and the use of strategically placed road blocks to gain control over sizable urban areas.

Urban Warrior participants concluded that, in at least one way, urban warfare has become more complex and deadly than ever.

"We realized that the strategies and tactics of urban warfare used in World War II and Korea, which was essentially to go in and destroy parts of the city and push an enemy out, are no longer relevant," said Timothy Jones, a spokesman for the Marine Corps Warfighting Lab at Quantico.

By that, he means that heightened US domestic political sensitivity to civilian casualties will make it impossible to use certain tried and true tactics—for example, clearing a room by first blindly lobbing in a grenade.

### **Three-Block War**

"Our experiences of the past decade have convinced us that we're probably not going to see that kind of warfare again," said Jones.

"In places such as Somalia, Haiti, and Bosnia," Jones continued, "we've had to essentially fight a three-block war in urban settings. On one block, we may be conducting humanitarian operations. On another we may be involved in a peacekeeping mission. In the third block, we may be fighting an all-out battle. So we have to develop the concepts, tactics, and Marines flexible enough to do all of those things."

The Army has also been studying the unique challenges of urban operations through a series of experiments on urban warfare funded as an Advanced Concept Technology Demonstration. Most of the work has been conducted at the Army's Dismounted Battle Space Battle Lab, at Ft. Benning, Ga.

While the study is still very much in flux, both the Marine Corps and Army have identified some common themes and challenges associated with urban operations.

They say that urban operations will put a premium on reliable and timely intelligence. Intelligence becomes even more important in light of the fact that US troops will operate on unfamiliar and unfriendly turf, where even a wrong turn on a city street can channel forces into a "kill sack."

Urban warfare exponents maintain that many of the intelligence systems used to great effect in the Persian Gulf War will have only limited utility in the city, meaning that greater emphasis will be placed on human intelligence. One Urban Warrior participant even suggested that squad leaders in urban combat carry around wads of cash in small denominations to readily buy information and assistance from local inhabitants.

"Military intelligence must be profoundly reordered to cope with the demands of urban combat," Peters argued in the article "Our Soldiers, Their Cities," first published in the US Army War College's Parameters. "From mapping to target acquisition, from collection to analysis, and from battle damage assessment to the prediction of the enemy's future intent, intelligence requirements in urban environments are far tougher to meet than they are on traditional battlefields. ... From language skills to a knowledge of urban planning, ... many of the abilities essential to combat in cities are given low, if any, priority in today's intelligence architecture."

Because urban operations largely would be the purview of dismounted infantry, they are also notoriously manpower- and casualty-intensive. Veterans of Operation Just Cause, the brief 1989 conflict in Panama, have noted that Panama City absorbed every soldier the United States could pour into it, and American forces still found it difficult to adequately sweep the city. During the operation, 23 US troops died and 320 were wounded against outgunned and disorganized opposition forces.

The fact that only four of the Army's 10 divisions are light infantry organizations has led some experts to suggest that the service would struggle to cope with the demands of a major urban operation in the future. The present division structure also may not provide enough specialized units whose skills are optimized in an urban setting, especially military police, civil affairs, and psychological operations units.

#### Shadow of Mogadishu

Given that they provide excellent cover for ambushes, city centers also present major challenges in terms of force mobility. US forces in Bosnia, for instance, are not allowed to leave base unless in four-vehicle convoys with a crew-manned .50-caliber machine gun. In Mogadishu, several Army Humvees had to be abandoned because they did not provide enough protection from ambushes. Former Defense Secretary Les Aspin was forced to resign when lawmakers learned he had denied the military's request for armored forces to operate in the city.

The firefight in which 18 American soldiers died also revealed that low-flying helicopters are especially vulnerable in urban environments. Individual soldiers who may have to rapidly ascend in skyscrapers or maneuver in sewer systems, meanwhile, cannot be overly burdened by heavy equipment or packs.

Urban centers would pose major challenges to command-and-control and communications systems. Units dispersed in such areas would be dispersed and operating largely independently, meaning communications systems would have to be distributed down to the individual soldier in some cases. Dense city structures would also significantly degrade radio reception.

"Communications is a major problem in urban environments. We know that transmissions in city centers dominated by steel and concrete structures will be very difficult with FM radio systems," said Jones. "We're looking hard at digital burst radios and possibly even cellular systems to possibly solve the problem."

The Marine Corps Warfighting Lab has also experimented with equipping squad leaders with handheld computers that might allow them to tap into the same data stream as a shipboard commander of an entire Marine Expeditionary Unit. "We're trying to figure out exactly what kinds of information a squad leader might need to know in an urban setting," said Jones.

While cityscapes negate many of the traditional technological advantages enjoyed by US forces, Marine Corps and Army experts are directing research efforts at specific technologies which might solve some of the thorniest challenges of urban operations.

The Army's Dismounted Battle Space Battle Lab, for instance, is looking into various types of body armor that could cut down on injuries and casualties in city settings. Items as simple as kevlar knee and elbow pads, and eye and ear protectors, for instance, can help soldiers avoid injuries from splintering wood and masonry and percussive sound in close-in firefights. Other researchers' are studying the use of camouflage uniforms specially designed for urban settings. Researchers are studying thermal imaging systems and advanced sensors that would offer greater situational awareness inside dark buildings and sewer systems. Daylight cameras and remotely operated weapons may, one day, allow soldiers to look around corners and engage targets without exposing themselves to hostile fire. At a minimum, personal weapons will have to become lighter and fire at a more rapid clip.

### Enter the Robots?

Robots could prove a critical tool in future urban battles, with soldiers using them to clear minefields, locate snipers, or detect chemical and biological weapons.

Some experts argue that the demands of urban warfare may well place a premium on airpower and close air support over traditional artillery and indirect fire. In the future a premium may be placed on precision guided munitions that are designed not to take out whole buildings but perhaps destroy only a single room. "Because of attack angles and the capabilities of precision munitions, airpower will prove much more valuable and will function as flying artillery," wrote Peters.

The demands of urban warfare will also likely revolutionize armored vehicles. The tanks and armored vehicles of the future, Peters argued, will have to boast different and more varied weapons, be faster in sprint mode and more maneuverable, and offer greater protection than today's models. "The primary job of armored vehicles in urban areas will be to protect maneuver, movement, and resupply," Peters wrote in Parameters. "Because urban environments promise endless ambushes, we need new forms of armored protectionnot just layers of steel or laminate or ceramics, or even reactive armor as it presently exists. Tomorrow's layers of armor will begin with spoofing techniques that complicate target detection on the part of enemy systems."

While advanced research efforts hold promise, however, Jones and other experts on urban combat caution against hopes that high-tech gadgetry would somehow solve the challenges or negate the unpleasantries of urban combat. "Hopefully technology will help enable us in urban settings, but I don't want to imply that it's going to be a panacea," said Jones. "No technology is going to substitute for leadership, training, and physical toughness."

To drive home that point, both the Army and Marine Corps have focused much of their efforts on improving training for urban operations. The Army has constructed numerous mock cities for this purpose. The service has MOUT training facilities at Fts. Hood, Campbell, Bragg, Lewis, Drum, Stewart, and Polk.

Before deploying to Bosnia, troops train in urban settings either at the 7th Army Combat Maneuver Training Center, Hohenfels, Germany, or at the service's premier MOUT facility at the Joint Readiness Training Center, Ft. Polk, La. The Army is also developing the Transportable Instrumentation System that will replicate the instrumentation technologies at the National Training Center, Ft. Irwin, Calif., allowing the service to adapt any urban terrain into a high-tech training area.

The Army, even though it is devoting more energy to the preparation for urban warfare, has resisted suggestions that it embrace urban warfare as the inevitable wave of the future. Army officials have gone on record against recommendations that it turn some of its divisions into specially trained and equipped "urban combat" units.

Even the Marine Corps shies from basic changes as a result of urban warfare. "Because we can easily envision missions that would require us to operate in an urban setting, we see this as something else we have to prepare and train our Marines to do," said Jones. "However, we don't see urban warfare as changing our fundamental nature. We still have to be able to conduct high-intensity warfare in open settings."

He added, "To the extent we can bypass urban centers and still achieve our objectives, it still makes a lot of sense."

James Kitfield is the defense correspondent for National Journal in Washington, D.C. His most recent article for Air Force Magazine, "Nuclear Adjustments," appeared in the August 1998 issue.

# If only life were so predictable.

You'll live a long and healthy life.

Don't see long-term care in your future? Chances are you probably will. Three out of five people over age 65 require some type of long-term care.<sup>1</sup>

Long-term care is expensive. Exactly how expensive?

- The average nursing home stay can cost over \$100,000.<sup>2</sup>
- Care at home could cost over \$50,000 for the same period of time.<sup>3</sup>

You may think you're covered for long-term care. But the truth is you're not. Health plans, Medicare and disability insurance provide little or no coverage for long-term care.

It's your good fortune that AFA's Long-Term Care Program will be available in early 1999.

You can purchase this valuable protection for much less than you could on your own because it's a group plan. It's an affordable way to prepare for the unexpected.

The plan is tax qualified. As such:

- Long-term care benefits may not be
- taxable for federal income tax purposes.
- Premiums may be tax deductible.

AFA's Long-Term Care Program, underwritten by Hartford Life Insurance Company, will be available to:

- AFA members and their spouses, adult children, parents and parents-in-law.
- All other current and former military personnel, and their spouses, adult children, parents and parents-in-law.

### Don't leave your future and that of your loved ones to chance.

The application period for AFA's Long-Term Care Program begins in early 1999. Watch your mail or call our toll-free line for enrollment material:

### 1-888-475-4713

Project Report for the Health Insurance Association of America, 1990
 Health Insurance Association of America, 1997
 3 Long Term Care Group, Inc., 1997
 \*This program is subject to state availability



Underwritten by Hartford Life Insurance Company

PA-8935-2a(4002)98

### **Industrial Associates**



Listed below are the Industrial Associates of the Air Force Association. Through this affiliation, these companies support the objectives of AFA as they relate to the responsible use of aerospace technology for the betterment of society and the maintenance of adequate aerospace power as a requisite of national security and international amity.

**3M/Federal Systems** Department AAI Corp. Aerojet Aerospace Corp. Aerospatiale, Inc. AIL Systems Inc., a subsidiary of Eaton Corp. Alliant Techsystems, Inc. AlliedSignal Aerospace Co. Analytic Services, Inc. (ANSER) Anheuser-Busch, Inc. ARINC Astronautics Corp. of America/Kearfott Guidance & Navigation AT&T Federal Systems Atlantic Research Corp. Autometric, Inc. Barber-Colman Aerospace & Power Controls Div. Battelle Memorial Institute **BDM** International, Inc. **Bell Helicopter Textron** Betac Corp. Blue Chip Computers Co. Boeing Co. Boeing Defense & Space Group Bombardier Inc., Canadair Booz-Allen & Hamilton Inc. Bose Corp. British Aerospace, Inc. **Brown & Root Services** Corp. BTG, Inc. Burdeshaw Associates, Ltd. C31 CACI, Inc.-Federal Canadian Marconi Co. Cessna Aircraft Co. C.F.C. Reclamation Charles Stark Draper Laboratory, Inc. Cobham plc Coltec Industries, Inc. Computer Sciences Corp. **Computing Devices** International **COMSAT** Aeronautical Services Contraves, Inc. Cubic Corp. Cypress International, Inc. Daimler-Benz Aerospace of North America Datatape, Inc. Derco Aerospace, Inc. **DFI** International **Dowty Aerospace DRS Military Systems** Dynamic Concepts, Inc. DynCorp Eastman Kodak Co., C&GS

ECC International Corp. EDO Corp., Government Systems Div. EDS EFW, Inc. EG&G Defense Systems Group E.I. du Pont de Nemours & Co. Electronic Warfare Associates ESCO Electronics Corp. Evans & Sutherland Exide Electronics Firearms Training Systems, Inc FLIR Systems, Inc. **GE Aircraft Engines** GEC Avionics, Inc. **GEC-Marconi Electronic** Systems Corp. GEICO **General Atomics** Gentry & Associates, Inc. Georgia Tech Research Institute Greenwich Air Services **GTE Government Systems** Corp. Gulf American Trading, Inc. Gulfstream Aerospace Corp. Harris Electronic Systems Sector Harris Government **Communications Systems** Div Harris Government Support Systems Div. Honeywell, Inc., Space and **Aviation Control** Howell Instruments, Inc. Hughes Space and Communications **IBP** Aerospace **IMI Services USA** IMO Industries, Inc. Information Technology Solutions Ingersoll-Rand Co. Innovative Technologies Corp. Intergraph Corp. Interstate Electronics Corp. **Israel Aircraft Industries** International, Inc. ITA Corp. **ITT** Defense Jane's Information Group JGW Intl. Johnson Controls World Services, Inc. Judd's, Inc. Kollsman Lear Astronics Corp.

Lear Siegler Services, Inc.

Leigh Aerospace Corp. Litton-Amecom Litton Applied Technology Litton Data Systems Litton Guidance & Control Systems Litton Industries Litton PRC Lockheed Martin Corp. Lockheed Martin Corp., Aeronautics Sector Lockheed Martin Corp., **Electronics Sector** Lockheed Martin Corp., Fairchild Systems Lockheed Martin Corp., Federal Systems Lockheed Martin Corp., Information & Services Sector Lockheed Martin Corp., Space & Strategic Missiles Sector Logicon, Inc. Logistics Management Institute Lucas Aerospace Inc. Lucent Technologies, Inc. Management Consulting & Research, Inc. Martin-Baker Aircraft Co. Ltd. MITRE Corp. Mnemonics, Inc. Motorola Inc., GSTG MTS-3, Inc. NavCom Defense Electronics, Inc. Nichols Research Corp. Nortel Networks Northrop Grumman Corp. Northrop Grumman Corp., B-2 Div. Northrop Grumman Corp., Electronic Sensors & Systems Div. Northrop Grumman Corp., Electronics & Systems Integration Div. Northrop Grumman Corp., Norden Systems Northrop Grumman Corp., Surveillance & Battle Management Systems-Melbourne Orbital Sciences Corp. **Ozark Aircraft Systems** Pemco Aeroplex, Inc. Per Udsen Co. PRB Associates, Inc. Precision Echo, Inc. Racal Communications, Inc. Rafael USA, Inc. RAND Corp Rational Software Corp.

Raytheon Aircraft Co. Raytheon Co. Raytheon E-Systems Raytheon FPA Business **Raytheon TI Systems** Raytheon Training RECON/OPTICAL, Inc. Reflectone, Inc. Robbins-Gioia, Inc. **Rockwell Collins Avionics &** Communications Div. Rolls-Royce Inc. Sabreliner Corp. Sargent Fletcher, a Cobham plc company SatoTravel Science Applications International Corp. SDS International, Inc. Sensis Corp. Sikorsky Aircraft Smiths Industries, Aerospace & Defence Systems Space Applications Corp. Spectrum Astro, Inc. SPRINT, Government Systems Div. Sun Microsystems Federal, Inc. Sundstrand Aerospace Sverdrup Technology, Inc. Symetrics Industries, Inc. Synergy, Inc. TEAC America, Inc. Technical Products Group, Inc. **Teledyne Brown Engineering** Teledyne, Inc. Teledyne Ryan Aeronautical Telephonics Corp. Telos Corp. Textron **Textron Defense Systems** Thiokol Corp. Tracor, Inc. Trident Data Systems **TRW Space & Electronics** Group **TRW Systems & Information** Technology Group Unisys Corp. Universal Propulsion Co., Inc. USAA UTC, Hamilton Standard UTC, Pratt & Whitney UTC, Pratt & Whitney/Space **Propulsion Operations** Veridian Virtual Prototypes, Inc. Wang Federal, Inc. Watkins-Johnson Co. Whittaker, Electronic Systems Williams International

### Books

### Compiled by Chanel Sartor, Editorial Associate

Ambrose, Stephen E. The Victors: Eisenhower and His Boys: The Men of World War II, Simon & Schuster, 1230 Avenue of the Americas, New York, NY 10020 (800-223-2348), 1998. Including photos, maps, sources, and index, 396 pages. \$28.00.

Astor, Gerald. The Right To Fight: A History of African Americans in the Military. Presidio Press, 505 B San Marin Dr., Ste. 300, Novato, CA 94945-1340 (415-898-1081). Including photos, bibliography, and index, 529 pages. \$29.95.

Burg, David F., and Edward L. Purcell. Almanac of World War I. The University Press of Kentucky, 663 S. Limestone St., Lexington, KY 40508-4008 (606-257-2951). 1998. Including bibliography and index, 320 pages. \$22.00.

Cambone, Stephen A. A New Structure for National Security Policy Planning. The CSIS Press, Center for Strategic and International Studies, 1800 K St. N.W., Washington, DC 20006 (202-887-0200). 1998. Including charts, notes, appendices, and index, 262 pages. \$23.95.

Chandler, Robert W., with John R. Backschies. The New Face of War: Weapons of Mass Destruction and the Revitalization of America's Transoceanic Military Strategy. AMCODA Press Publications Service, 1390 Chain Bridge Rd., Ste. 204, McLean, VA 22101 (888-262-6322). 1998. Including photos, maps, charts, bibliography, and index, 465 pages. \$33.00.

Ford, Daniel. Glen Edwards: The Diary of a Bomber Pilot. Smithsonian Institution Press, PO Box 960, Herndon, VA 20172-0960 (800-782-4612). 1998. Including photos, glossary, sources, and index, 195 pages. \$24.95.

Griffith, Thomas E. Jr. MacArthur's Airman: General George C. Kenney and the War in the Southwest Pacific. University Press of Kansas, 2501 W. 15th St., Lawrence, KS 66049-3904 (913-864-4155). 1998. Including maps, notes, bibliography, and index, 338 pages. \$39.95.

Haulman, Daniel L. The United States Air Force and Humanitarian Airlift Operations 1947–1994. US Government Printing Office, Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250-7954 (202-512-1800). 1998. Including photos, glossary, and notes, 535 pages. \$43.00.

llfrey, Jack, with Mark Copeland. Happy Jack's Go Buggy: A Fighter Pilot's Story. Schilfer Publishing Ltd., 4880 Lower Valley Rd., Atglen, PA 19310-9717 (610-593-1777). 1998. Including photos, appendix, bibliography, and index, 125 pages. \$35.00.

Kimball, Jeffrey. Nixon's Vietnam War. University Press of Kansas, 2501 W. 15th St., Lawrence, KS 66049-3904 (913-864-4155). 1998. Including photos, notes, bibliography, and index, 495 pages. \$39.95.

Kutta, Timothy J. U-Boat War. Squadron/Signal Publications, 1115 Crowley Dr., Carrollton, TX 75011-5010 (972-242-8663). 1998. Including photos, 64 pages. \$9.95.

Leonhard, Robert R. The Principles of War for the Information Age. Presidio Press, 505 B San Marin Dr., Ste. 300, Novato, CA 94945-1340 (415-898-1081). 1998. Including illustrations, appendix, bibliography, and index, 287 pages. \$29.95.

Mack, Pamela E., ed. From Engineering Science to Big Science: The NACA and NASA Collier Trophy Research Project Winners. Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250-7954 (202-512-1800). 1998. Including photos, graphs, charts, and index, 427 pages. \$35.00.

Maguire, Jon A., and the Men of the 27th ATG. Gooney Birds & Ferry Tales: The 27th Air Transport Group in World War II. Schiffer Publishing Ltd., 4880 Lower Valley Rd., Atglen, PA 19310-9717 (610-593-1777). 1998. Including photos, appendices, and glossary, 347 pages. \$59.95.

Marley, David F. War of the Americas: A Chronology of Armed Conflict in the New World, 1492 to the Present. ABC-CLIO, Inc., 130 Cremona Dr., PO Box 1911, Santa Barbara, CA 93116-1911 (800-422-2546). 1998. Including photos, maps, and index, 722 pages. \$99.00.

McLaren, David R. Lockheed T-33: A Photo Chronicle. Schiffer Publishing Ltd., 4880 Lower Valley Rd., Atglen, PA 19310-9717 (610-593-1777). 1998. Including photos and bibliography, 125 pages, \$24.95.

Nelson, Curtis L. Hunters in the Shallows: A History of the PT Boat. Brassey's, Inc., 22883 Quicksilver Dr., Ste. 100, Dulles, VA 20166 (703-260-0602). 1998. Including photos, maps, notes, bibliography, and index, 242 pages. \$28.95.

Newberry, Maj. Robert D., USAF. Space Doctrine for the Twenty-first Century. US Government Printing Office, Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250-7954 (202-512-1800). 1998. Including tables, appendices, notes, and bibliography, 68 pages. \$11.00.

Nijboer, Donald. Cockpit: An Illustrated History of World War Il Aircraft Interiors. Howell Press, Inc., 1713-2D Allied Ln., Charlottesville, VA 22903 (800-868-4512). 1998. Including photos, bibliography, and index, 176 pages. \$39.95.

Patton, W. Wayne. Aces. Squadron/Signal Publications, 1115 Crowley Dr., Carrollton, TX 75011-5010 (972-242-8663). 1998. Including photos and illustrations, 64 pages. \$14.95.

Rogers, Jeff, and Rick School. Valor at Polebrook: The Last Flight of Ten Horsepower. Order from: Rick School, PO Box 83, Kimberly, WI 54136. 1998. Including photos and bibliography, 134 pages. \$28.00.

Sawyer, Richard D. The Tao of Spycraft: Intelligence Theory and Practice in Traditional China. Westview Press, 5500 Central Ave., Boulder, CO 80301-2877 (303) 444-3541. 1998. Including notes and index, 617 pages. \$35.00.

Smith, Richard K. Seventy-Five Years of Inflight Refueling: Highlights, 1923–1998. US Government Printing Office, Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250-7954 (202-512-1800). 1998. Including photos, appendices, and notes, 86 pages. \$8.50.

Taylor, Theodore. The Flight of Jesse Leroy Brown. Avon Books, 1350 Avenue of the Americas, New York, NY 10019 (212-261-6900). 1998. Including photos and index, 300 pages. \$23.00.

Thixton, Marshall J., George E. Moffat, and John J. O'Neil. Bombs Away: By Pathfinders of the Eighth Air Force. FNP Military Division, 6527 Main St., Trumbull, CT 06611 (203-261-8587). 1998. Including photos, maps, bibliography, and index, 182 pages. \$25.00.

Tucker, Spencer C., ed. Encyclopedia of the Vietnam War: A Political, Social, and Military History, Vols. I-III. ABC-CLIO, Inc., 130 Cremona Dr., PO Box 1911, Santa Barbara, CA 93116-1911 (800-422-2546). 1998. Including photos, maps, bibliography, chronology, glossary, appendix, and index, 1,196 pages. \$275.00.

Whitcomb, Darrel D. The Rescue of Bat 21. Naval Institute Press, 2062 Generals Hwy., Annapolis, MD 21401 (800-233-8764). 1998. Including photos, notes, glossary, and index, 196 pages. \$27.95.

Whitney, Daniel D. Vee's For Victory: The Story of the Allison V-1710 Aircraft Engine 1928– 1948. Schiffer Publishing, Inc., 4880 Lower Valley Rd., Atglen, PA 19310-9717 (610-593-1777). 1998. Including photos, charts, appendices, bibliography, glossary, and index, 470 pages. \$59.95.

Winkowski, Frederic, and Frank D. Sullivan. 100 Planes 100 Years: The First Century of Aviation. Smithmark Publishers, 115 W. 18th St., New York, NY 10011 (212-519-1300). 1998. Including photos, 167 pages. \$19.98.

Woulfe, James B. Into the Crucible: Making Marines for the 21st Century. Presidio Press, 505 B San Marin Dr., Ste. 300, Novato, CA 94945-1340 (415-898-1081). 1998. Including photos and bibliography, 183 pages. \$24.95.

### **AFA/AEF National Report**

By Frances McKenney, Assistant Managing Editor, with Chanel Sartor, Editorial Associate

### Building Named for Former AFA Leader

A federal court building in Washington, D.C., was renamed at an Oct. 23 ceremony in honor of Howard T. Markey, a former Air Force Association national president and chairman of the board.

Markey was a nationally prominent jurist, the first chief judge of the US Court of Appeals for the Federal Circuit. He retired from the Air Force Reserve as a major general and had served on active duty in World War II and Korea.

Joining Markey and family members and friends, who traveled from Chicago, at the former National Courts Building were distinguished guests, including Supreme Court Justice Anthony M. Kennedy, who made the opening remarks, Rep. Henry J. Hyde (R-III.), delivering the main address, and Lt. Gen. Donald L. Peterson, USAF deputy chief of staff for personnel.

Thomas J. McKee, AFA national president, John R. Alison, national director emeritus, and John O. Gray, national director, were among the AFA leaders present for the unveiling of the name plaque.

Markey served as AFA national president from 1959 to 1960 and as chairman of the board from 1960 to 1961. He was also an AFA regional vice president and vice chairman of AFA's Executive Committee.

According to family member Peggy Markey, the retired judge said he was "honored and humbled" by the building dedication. "It was a great day," he said.

The Howard T. Markey National Courts Building is located at 717 Madison Place N.W. in Washington, D.C.

### Fighting for Soldiers' and Airmen's Home

The Military Coalition, of which AFA is an associate member, was among the veterans organizations voicing opposition to a congressional amend-



AFA National President Thomas McKee (left) greets Howard Markey in the courtroom that was jam-packed with well-wishers for a ceremony renaming a federal court building for Markey. He is a former AFA national president and board chairman.

ment that would force the US Soldiers' and Airmen's Home in Washington, D.C., to sell a tract of land to its neighbor, the Roman Catholic Archdiocese of Washington.

The legislation specifically addresses an unused 49-acre plot of land that the home had hoped might produce a continuing source of income to help offset an \$8 million-\$10 million yearly deficit. The USSAH was moving in that direction through a public-private venture with a national real estate development firm. Church officials opposed the business plan, based on concerns about the effect of commercial development near its properties in the area, including Catholic University.

The amendment forcing the sale to the church was added to the defense appropriations oill by Sen. Rick Santorum (R–Pa.). But as of mid-October, he agreed to a sixmonth moratorium on the plan because of opposition from fellow senators and veterans groups such as the Military Coaliticn. The Senate Armed Services Committee and House National Security Committee staffs will study the issue during the moratorium.

In operation since 1851, the USSAH has struggled because of a downsized military; it is supported in part by a monthly 50cent fee paid into a trust fund by active duty troops. The home has shut two of its four dormitories, cut the number of residents from 1,800 to 1,100, cut staff, and increased resident fees in an effort to remain solvent.

### An Overseas Connection

AFA is working with the Air Force Office of Legislative Liaison on a program to link members of Congress traveling overseas on fact-finding trips to AFA chapters in Europe and Asia.

The OLL coordinates significant numbers of such overseas trips for congressmen, arranging for refueling, rest, or overnight stops at Air Force bases in the area.

AFA recognizes this situation as an opportunity to educate congressional members about the special needs of USAF members stationed overseas and to help those overseas feel more connected to the political process back home.

The association envisions working with OLL and members of Congress to determine who is traveling overseas and when they might have blocks of free time. AFA will then use home of record information to match the congressmen with constituents stationed overseas. If there is no chapter in the area where the congressmen will visit, AFA plans to work to establish one. The overseas chapters will then bring together the congressmen and USAF members through events ranging from an informal coffee break to a full scale AFA chapter dinner meeting, where the congressmen would serve as guest speakers.

AFA, OLL, and Frank Swords, AFA special assistant Europe, plan to have this method for welcoming visiting congressmen to AFA chapters overseas in place for the start of the 106th Congress next month.

### **Required Reading**

Several members of the Air Force

Caucus sent a "Dear Colleague" letter to fellow congressmen, recommending that they read "The Access Issue" in the October 1998 issue of *Air Force* Magazine.

The article addresses the threat of a "lockout," in which the US military might be denied access to key overseas bases during a crisis. The *Air Force* Magazine special report pointed out that the lockout problem has not stopped a military operation to which the US was seriously committed.

"Those who use the access issue to promote carriers ... must recognize that carriers cannot sustain their own operations without maintaining access to land bases for replenishment," the letter stated. "It is time to stop the parochial rhetoric and to give this issue the serious consideration it deserves."

The letter was signed by Rep. Cliff Stearns (R–Fla.), caucus chairman, Rep. Sam Johnson (R–Texas), cochairman, and Reps. Van Hilleary (R–Tenn.), James A. Gibbons (R– Nev.), and John C. Cooksey (R–La.)

The Air Force Caucus was formed in August. Its other members are



Newly inducted into the Aviation Museum of Kentucky's Hall of Fame, Russell Dougherty, national director emeritus, poses with University of Kentucky AFROTC cadets (I–r) Timothy Purcell, Deborah Perry, Anna Hilb, and Jacob Lutterman, who is a member of the Lexington Chapter.

Reps. Joseph R. Pitts (R–Pa.), Jerry Kleczka (D–Wis.), Ron E. Paul (R– Texas), Lindsey Graham (R–S.C.), Nick Smith (R–Mich.), John Linder (R–Ga.), Paul E. Gillmor (R–Ohio), Roger Wicker (R–Miss.), Peter A. DeFazio (D–Ore.), and Heather Wilson (R–N.M.).

#### Dougherty in the Hall of Fame

Russell E. Dougherty, AFA national director emeritus and former executive director, was inducted into the Kentucky Aviation Hall of Fame at the Aviation Museum of Kentucky in Lexington.

More than 20 members of the Lexington (Ky.) Chapter turned out for the induction Oct. 2, which was the third annual enshrinement ceremony. It was organized largely by chapter members George Gumbert Jr. and Wendell Murphy.

Dougherty is a native of Glasgow, Ky., and a graduate of Western Kentucky University and the University of Louisville Law School. The retired general began his military career as an aviation cadet at the outbreak of World War II and went on to become Strategic Air Command commander in chief and chief of staff of NATO's Allied Command Europe.

A member of AFA for more than 40 years, Dougherty is also currently an AFA senior advisor. The **Gen. Russell E. Dougherty (Ky.) Chapter** is named in his honor.

Others inducted with Dougherty were astronaut Story Musgrave, a veteran of six space shuttle flights; Robert W. "Todd" Moore, a World War II pilot credited with 12 aerial victories; Henry Meigs II, a World War II P-38 pilot credited with six kills in the Pacific; and the "godfather of Kentucky aviation," LaRue Coy, who opened several airports in Kentucky and trained hundreds of pilots.

University of Kentucky AFROTC cadets, whose commander is Lexington Chapter President Col. James S. "Steve" Parker, performed as color guard for the event as well as distinguished guest escorts.

Also in October the Lexington Chapter hosted a dinner meeting, featur-



Col. Wyatt "Chris" Cook, Misawa (Japan) Chapter president, congratulates SrA. Lawrence W. Bredwell, 35th Fighter Wing, at an Airman Leadership School graduation. Bredwell earned an AFA Citation for his essay on enlisted heritage. He wrote about the pride he feels as a maintainer, responsible for pilots' lives.

ing John B. Conaway as guest speaker. A retired lieutenant general, Conaway is a native of Kentucky and former commander of the Kentucky Air National Guard. He is co-author of *Call Out the Guard! The Story of Lieutenant General John B. Conaway and the Modern Day National Guard.* According to Parker, Conaway had, as a lieutenant colonel, started the Gen. Russell E. Dougherty Chapter.

During the evening, Reginal K. Wise was named Chapter Member of the Year.

#### Nickel Grass Anniversary

At Dover AFB, Del., in October, the **Delaware Galaxy Chapter** and the Central Delaware Chamber of Commerce co-sponsored a commemoration of the 25th anniversary of Operation Nickel Grass, the USAF airlift to Israel during the Mideast war of 1973.

Dover's 3d Military Airlift Squadron crewed the first C-5 aircraft to arrive at the Lod/Ben-Gurion air complex, Israel, to begin the 32day airlift.

The two-day Nickel Grass 25 celebration began with a Governor's Reception, hosted by Lt. Gov. Ruth Ann Minner, held at the base's Air Mobility Command Museum. The reception featured a tribute to the US Navy's 6th Fleet, which had provided escort and air traffic control for Nickel Grass airlifters flying over the Mediterranean. Retired USAF Gen. David C. Jones, a former Chairman of the Joint Chiefs of Staff, was a special guest at the event, attended by more than 200.

Minner also unveiled an oil painting by world-renowned aviation artist Gil Cohen, portraying an M-60 tank being offloaded from a C-5 at Lod Airport during the airlift. Galaxy Chapter member Ronald H. Love, who was among those who spent two years organizing this event, said the chapter had arranged for Cohen to visit Lod Airport, as part of his research for this painting. The second day of commemorations included a Nickel Grass Roundtable. The panelists were Robert T. Cossaboom, command historian at AMC headquarters at Scott AFB, III.; retired Col. Emery J. Crane, a **Northeast Texas Chapter** member and director of operations at the 436th Airlift Wing at Dover during Nickel Grass; retired Col. Donald R. Strobaugh, Nickel Grass Airlift Control Element commander; and retired Maj. Gen. Itzhak Hoffi, commander of Israel's northern front during the 1973 Mideast war.

On the flight line, there was a recognition ceremony for Nickel Grass aircrews and support personnel, and a C-5 veteran of the airlift was rededicated *Nickel Grass*. As the renaming came to a close, a C-5 pulled up nearby, its cargo door opened, and an M-60 was unloaded—a reallife re-creation of the events of Nickel Grass, noted Love.

Later, Lt. Gen. Walter S. Hogle Jr., AMC vice commander, spoke about the future of air mobility.

The commemorative activities culminated with an evening banquet, in honor of AMC, Nickel Grass crews, Israel, and Portugal, which had allowed USAF to use Lajes Field in the Azores as an en route base during the airlift.

Bernard Kalb, a longtime newsman and CNN host, served as the banquet's keynote speaker. He covered the Middle East during that time and accompanied Henry Kissinger on his "shuttle diplomacy" trips that eventu-



Col. Felix Grieder, 436th Airlift Wing commander, speaks at a Nickel Grass 25th anniversary ceremony at Dover AFB, Del., where a C-5 was renamed Nickel Grass to commemorate the 1973 airlift to Israel. Grieder is a member of the Delaware Galaxy Chapter, which helped sponsor the anniversary.

### **This Is AFA**





PRESIDENT Thomas J. McKee Fairfax Station, Va.



BOARD CHAIRMAN Doyle E. Larson Burnsville, Minn.



SECRETARY William D. Croom Jr. Colorado Springs, Colo.



TREASURER Charles H. Church Jr. Lenexa, Kan.

### NATIONAL VICE PRESIDENTS

Information regarding AFA activity within a particular state may be obtained from the vice president of the region in which the state is located.



John E. Craig II 947 26th St. S Arlington, VA 22202 (202) 863-2306

Central East Region Delaware, District of Columbia, Maryland, Virginia, West Virginia



W. Ron Goerges 4201 W. Enon Rd. Fairborn, OH 45324 (937) 429-6070, ext. 102 Great Lakes Region Illinois, Indiana, Kentucky, Michigan, Ohio, Wisconsin



George E. Masters 1029 6th Ave., S.W. Minot, ND 58701-3606 (701) 723-6697

North Central Region Minnesota, North Dakota, South Dakota



Marleen E. Eddlemon 2309 Linda Ln. Jacksonville, AR 72076-2814 (501) 982-9777





Francis F. Carmichael Jr. 14 Carmichael Way West Wareham, MA 02576-1486 (508) 999-8642

New England Region Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont



Robert M. Williams 6014 Country Club Oaks Pl, Omaha, NE 68152 (402) 572-7655

Midwest Region Iowa, Kansas, Missouri, Nebraska



Barbara M. Brooks-Lacy 7315 N. Curtis Ave. Portland, OR 97217 (503) 283-4541

Northwest Region Alaska, Idaho, Montana, Oregon, Washington



(912) 929-3888 Southeast Region Florida, Georgia, North Carolina, Puerto Rico, South Carolina

Warner Robins, GA 31088-6064

Jack H. Steed 309 Lake Front Dr.

Thomas J. Kemp 3608 Kimberly Ln. Fort Worth, TX 76133-2147 (817) 695-7644

Southwest Region New Mexico, Oklahoma, Texas



Cheryl L. Waller 1481 Ivory Dr. Santa Maria, CA 93455 (805) 934-2673

Far West Region Arizona, California, Guam, Hawaii, Nevada

Raymond Hamman 9439 Outlook Ave. Philadelphia, PA 19114-2617 (215) 677-0957

Northeast Region New Jersey, New York, Pennsylvania



3210 S. Oneida Way Denver, CO 80224-2830 (303) 757-8565

**Rocky Mountain Region** Colorado, Utah, Wyoming

**Special Assistant Pacific** Vacant

### **Special Assistant Europe**

Frank M. Swords PSC 3, Box 1469 APO AE 09021-1466 011-49-6308-7237

### NATIONAL DIRECTORS

Edward C. Aldridge Los Angeles R. Donald Anderson Poquoson, Va. Henry W. Boardman Gulfport, Miss. Roy A. Boudreaux Montgomery, Ala. Dr. Dan Callahan Warner Robins, Ga. James E. Callahan East Amherst, N.Y. David J. Campanale Vienna, Va. Robert J. Cantu Universal City, Texas Gerald S. Chapman Oceanside, Calif. Michael J. Dugan New York Charles G. Durazo McLean, Va. Ronald R. Fogleman Durango, Colo. Samuel M. Gardner Garden City, Kan. Daniel C. Hendrickson Layton, Utah Sam Johnson Washington, D.C. Sharon M. Johnson Ravenna, Ohio William A. Lafferty Green Valley, Ariz. Stephen M. Mallon Hampton, Va James M. McCoy Bellevue, Neb. Ivan L. McKinney Bossier City, La. Raymond C. Otto Julie E. Petrina Perry Hall, Md. John J. Politi Sedalia, Mo. Jack C. Price Pleasant View, Utah Victor C. Seavers Eagan, Minn. Phillip J. Sleeman Tolland, Conn. James E. "Red" Smith Princeton, N.C. Lisa A. Smith Fresno, Calif. R.E. Smith West Point, Miss. William L. Sparks Daytona Beach, Fla Max Stitzer North Ogden, Utah Mary Anne Thompson Oakton, Va. Walter G. Vartan Chicago L.B. "Buck" Webber Fort Worth, Texas Joseph A. Zaranka Bloomfield, Conn.

ex officio John A. Shaud Executive Director Air Force Association Arlington, Va. Donald J. Harlin National Chaplain Albuquerque, N.M. Vacant Chairman, Junior Officer Advisory Council Heidi Kaiser National Commander Arnold Air Society Prescott, Ariz. Paula Campa Chairman, Enlisted Council Maxwell AFB, Ala

directors emeritus John R. Alison Washington, D.C Joseph E. Assaf Mashpee, Mass. Richard H. Becker Oak Brook, III. David L. Blankenship Tulsa, Okla, John G. Brosky Pittsburgh Dan F. Callahan Nashville, Tenn. Robert L. Carr Pittsburgh George H. Chabbott Dover, Del. O.R. Crawford Austin, Texas R.L. Devoucoux Portsmouth, N.H. Jon A. Donnelly Richmond, Va. Russell E. Dougherty Arlington, Va. George M. Douglas Colorado Springs, Colo Joseph R. Falcone Ellington, Conn. E.F. "Sandy" Faust San Antonio Joe Foss Scottsdale, Ariz. John O. Gray Washington, D.C. Jack B. Gross Harrisburg, Pa. Martin H. Harris Montverde, Fla. Gerald V. Hasler Albany, N.Y. Monroe W. Hatch Jr. Clifton, Va. H.B. Henderson Ramona, Calif. John P. Henebry Deerfield, III. Robert S. Johnson Lake Wylie, S.C. David C. Jones Arlington, Va. Arthur F. Kelly Los Angeles Victor R. Kregel Colorado Springs, Colo. Jan M. Laitos Rapid City, S.D. Frank M. Lugo Mobile, Ala, Nathan H. Mazer Roy, Utah William V. McBride San Antonio Edward J. Monaghan Anchorage, Alaska J.B. Montgomery Piedmont, Calif. Bryan L. Murphy Jr. Fort Worth, Texas J. Gilbert Nettleton Jr. Los Angeles Ellis T. Nottingham McLean, Va. William C. Rapp Williamsville, N.Y. Julian B. Rosenthal Durham, N.C. Peter J. Schenk Pinehurst, N.C. Walter E. Scott Dixon, Calif. Mary Ann Seibel Clayton, Mo. Joe L. Shosid Fort Worth, Texas William W. Spruance Wilmington, Del.

Thos. F. Stack San Mateo, Calif Harold C. Stuart Tulsa, Okla. James M. Trail Oro Valley, Ariz A.A. West Hayes, Va. Sherman W. Wilkins Issaquah, Wash.



AIR FORCE Magazine / December 1998

### **AFA/AEF** National Report



Several of the newly elected national vice presidents met in Minneapolis in October. Gathered around the table (I–r) are Robert Williams, AFA National President Thomas McKee, AFA Chairman of the Board Doyle Larson, Barbara Brooks–Lacy, AEF President Jack Price, Jack Steed, Marleen Eddlemon, AFA Executive Director John Shaud, Cheryl Waller, and Thomas Kemp.

ally led to a peace treaty between Israel and Egypt following the Mideast war. Kalb co-authored *Kissinger*, a book that includes observations of the war and events leading up to Operation Nickel Grass.

Among the more than 300 guests at the banquet were Sens. Joseph R. Biden Jr. (D-Del.) and William V. Roth Jr. (R-Del.); Lt. Gen. Maxwell C. Bailey, 21st Air Force commander at McGuire AFB, N.J.; and Maj. Gen. William Welser III, Air Mobility Warfare Center, also at McGuire.

Guests at the AFA table included AFA National President Thomas J. McKee and Stephanie M. Wright, Delaware state president.

Another significant AFA contribution to the celebration: Galaxy Chapter's Kenneth K. Robertson Jr., the Nickel Grass 25 Committee chairman. spent a year researching the airlift and produced a 70-page history of it.

### Convention in the "Diamond State"

Delaware State AFA hosted its state convention in September at the Air Mobility Command Museum at Dover AFB, Del.

Col. Peter K. Sullivan, commander, 512th Airlift Wing (AFRC Assoc.), spoke about the mission of the wing and its host at Dover, the 436th Airlift Wing.

As part of the convention, state off cers were elected. Stephanie M. Wricht was elected president; Ronald H. Love, vice president; Stephen W. Welde, 2d vice president; Mary E. Frey, secretary; and Teresa A. Connor, treasurer. All are from the Delaware Galaxy Chapter.

Awards went to Connor, Frey, Love, Welde, and fellow chapter member Margaret A. Whitman and to Howard G. Sholl Jr. and Norman Runge, both of the **Diamond State Chapter**.

The State of Delaware AFA Premiere Salute Award went to Delaware Galaxy Chapter's Jack G. Anderson for outstanding leadership during his tenure as state president.

### Promoting the Partners

In August, the Fairbanks Midnight Sun (Alaska) Chapter and the Greater Fairbanks Chamber of Commerce cohosted a membership luncheon to highlight the chapter's Community Partner program and to recognize Brig. Gen. Tommy F. Crawford, commander, 354th Fighter Wing, Eielson AFB, Alaska. He is also a chapter member.

Crawford discussed the mission and achievements of Eielson AFB units, including the 168th Air Fueling Wing (ANG), the only Arctic region refueling unit in Pacific Air Forces. Crawford also discussed Eielson's role in Cope Thunder, two-week air combat exercises hosted by the base, and construction on Eielson—of interest to the 100 or so audience members because many were business leaders welcoming the boost to the local construction industry.

Afterwards Community Partner chairman James A. Messer discussed the purpose and advantages of being a Community Partner. Membership forms and materials were placed on each table.

#### Steak on the Barbecue

What better way to attract a crowd than a good old-fashioned barbecue? The **Dale O. Smith (Nev.) Chap**ter sponsored a steak barbecue fund-



Jerry Waterman (Fla.) Chapter President George Norwood (center) presents an \$850 check to SMSgt. Becky Ritz, 6th Civil Engineering Squadron first sergeant. The donation to the MacDill AFB, Fla., Education Council helps active duty personnel with college expenses. With them (I–r) are Lt. Col. Joni Miranda, 6th Air Refueling Wing special assistant, Brig. Gen. James Soligan, 6th ARW commander, and at far right Lt. Col. Lance Young, chapter treasurer.

raiser in September at the Nevada Air National Guard's All Ranks Club at Reno/Tahoe IAP.

Some 40 people attended the event including seven past presidents: Don Schwartz, Victor R. Hollandsworth, Clarence E. Becker, Anthony Martinez, Carl G. Peterschmidt, Paul B. Kincaide, and Kathleen Clemence.

The guest speaker at the barbecue was chapter member Maj. Leslie M. Gonzales, commander, 152d Intelligence Squadron (ANG). He spoke about the squadron's new missions and high-tech equipment that provide a variety of imagery intelligence products to military leaders in near real time, anywhere in the world.

The barbecue was one of four fundraising efforts the chapter holds each year. All proceeds go to the chapter's scholarship fund for ANG dependents and for sending Civil Air Patrol cadets to summer camp. Fund-raising efforts have generated more than \$2,000 over this past year.

### Helping a Reunion

When the 505th Bomb Group held its reunion in Baton Rouge, La., in September, the **Maj. Gen. Oris B.** Johnson (La.) Chapter lent a helping hand. More than 100 people attended the event, hosted by chapter member and 505th veteran Harry Sumrall.

The chapter provided commemorative cups as souvenirs for all who attended, and then–State President Michael F. Cammarosano, with the help of supporters and friends, rounded up vans to transport 70 attendees who wanted to dine out one evening. The chapter also provided supplies for the hospitality suite.

ROTC cadets from the Louisiana State University AFROTC Det. 310 in Baton Rouge, helped run the hospitality suite. They also provided the color guard and rifle squad for the reunion's memorial ceremony held at the USS Kidd and Nautical Center.

Throughout the reunion, display tables bearing banners, copies of *Air Force* Magazine, and membership applications were available, said Cammarosano.

### Warbirds Visit New York

It was two days of high flying fun at Republic Airport in Farmingdale, N.Y., in September when the **Nassau Mitchel (N.Y.) Chapter** co-sponsored a visit of two fully restored B-17 and B-24 warbirds, owned by the Collings Foundation of Stow, Mass. The bombers on display attracted thousands and proved to be an excellent way to spread the word about AFA, its Community Partners, and Aerospace Education Foundation programs.

Chapter President Fred DiFabio and Gerald Hunter, vice president of veterans affairs, set up a display that featured chapter history, Air Force uniforms, photos, and other USAF memorabilia.

They also handed out copies of *Air Force* Magazine, the chapter's newsletter, and AFA applications, while Hunter provided important veterans information.

The Collings Foundation's B-17G was produced late during World War II, so it never saw combat. It did fly as part of the Military Air Transport Service before it spent 20 years as a fire bomber. It was named after a 91st Bomb Group, Eighth Air Force, B-17 that flew 140 missions without a crew fatality before being scrapped.

The foundation's B-24 is a Pacific theater veteran. It is named after a 461st Bomb Group, Fifteenth Air Force, Liberator that shot down 14 enemy fighters and was eventually lost over Yugoslavia (her crew survived).

### Give the Gift of Video! AFA Members Receive a \$3 Discount!

The newly released video, People, Power, and Mission commemorates the fiftieth anniversary of the United States Air

Force. Its stirring, visually rich history is presented in compelling style, featuring rarely seen footage.

Featured are interviews with General Brent Scowcroft, Gabby Gabreski (the world's greatest living ace), General Bernard Schriever, and dozens of others who have made the USAF the best in the world.

The Air Force Association has joined the Emmy Awardwinning production team of Russ Hodge, Tim White, and a production staff with more than a half-dozen Emmys to produce this must-have video. Order your copy today!

Non-members: \$19.95 (plus \$4 shipping & handling) \$23.95 AFA members: \$16.95 (plus \$4 shipping & handling) \$20.95

SEND CHECK OR MONEY ORDER TO: Three Roads Communications Post Office Box 3682 • Frederick, Maryland 21705-3682



### **AFA/AEF** National Report

### More Chapter News

The PE-TO-SE-GA (Mich.) Chapter held its fourth-quarter membership luncheon in September to discuss the future plans of the chapter. At the top of the meeting's agenda was member recruitment. The small chapter of 82 has been holding steady to its membership numbers. Also at the luncheon, members re-elected its chapter leaders for another term. Jonathan Dayton, a retired USAF lieutenant colonel and Vietnam veteran, is again chapter president. He's a resident of Traverse City and has been a realtor for 14 years. David W. Hauser, a retired USAF lieutenant colonel and a former B-52 pilot, was re-elected as vice president. He is a realtor in the same office as Dayton. Robert H. Witkop was re-elected as treasurer. Thomas E. Largent was re-elected secretary. Both Witkop and Largent are private pilots and aviation buffs.

### Have AFA/AEF News?

Contributions to "AFA/AEF National Report" should be sent to *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 2209-1198. Phone: (703) 247-5828. Fax: (703) 247-5828. E-mail: fmckenney@afa.org.

### **Unit Reunions**

49th FG Assn. April 22–25, 1999, at the former Castle AFB, CA. Contact: Earl R. McIver, 1561 Austin St., Atwater, CA 95301 (209-358-6758).

57th BW Assn of WWII (all B-25 units in the Mediterranean Theater). Aug. 31–Sept. 5, 1999, at Cavanaugh's Inn at the Park, Spokane, WA. Contact: Bob Evans, 1950 Cunningham Rd., Indianapolis, IN 46224-5341 (317-247-7507).

446th BG, Eighth AF (WWII). May 19–23, 1999, at the Viscount Suite Hotel in Tucson, AZ. Contact: Marv Anderson, 8411 E. Albion PI., Tucson, AZ 85715 (520-296-4829).

**483d BG (H)** (WWII) and **566th Air Engineers.** Oct. 4–10, 1999, in Oklahoma City. **Contact:** Harold Leveridge, 4729 NW 70th St., Oklahoma City, OK 73132-6839 (405-721-4913).

555th, 563d, 564th, 566th, and 573d Signal Air

Warning Battalions. Sept. 16–18, 1999, in Atlanta. Contact: Walter Bryson, 524 Knox Bridge Crossing Rd., Lavonia, GA 30553 (706-356-8886).

556th Recon Sq March 26–27, 1999, in Las Vegas. Contact: Donald J. Chase (402-493-5612) or Don Hein (949-454-8986).

820th BS, 41st BG, Seventh AF (WWII). May 13– 16, 1999, at the Colorado Springs Marriott in Colorado Springs, CO, Contact: William W, Childs, 3637 Patsy Ann Dr., Richmond, VA 23234-2951 (804-275-6012).

4080th Strategic Recon Wg. May 27–29, 1999, at the Civic Center in Del Rio, TX. Contact: 4080th SRW Reunion Committe '99, PO Box 1526, Del Rio, TX 78841 (830-775-5346).

AFTAC/WF0-1155TH, TOD. April 8-11, 1999, in Sacramento, CA. Contact: Rich Charles, PO Box 888, North Highlands, CA (916-332-5877).

Seeking members of AFROTC Dets. 420 and 930, University of Minnesota Duluth, to plan a reunion in October 1999. Contact: Helen Sandwick, AFROTC Det. 420, University of MN Duluth, 10 University Dr., Duluth, MN 55812-2496 (218-726-8159) (air@d.umn.edu).

Mail unit reunion notices well in advance of the event to "Unit Reunions," *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

### **Bulletin Board**

Seeking information on the pilot of a **P-47** shot down Dec. 18 or 19, 1944, after strafing the Grossachsenheim, Germany, airfield. Also seeking information on B-17 pilot **Timothy A. Ahern**, who was MIA in late 1944. **Contact:** G.C. Burns, Box 2308, Framingham, MA 01703.

Seeking contact with **Bill Spellman** of Boston, who was in the Air Force and stationed near Liverpool, UK, around 1948–50 and who knew June Jones. **Contact:** Patricia Melander, 40 Third Ave., Manor Park, London, UK, E12 6DU (0181-553-1305).

Seeking information on Edmund Whately, of Mississippi, who was a crew chief with the 33d TCS, flying C-47s out of Townsville, Australia, and Port Moresby and Hollandia, New Guinea. He became a C-47 crew chief in the Berlin Airlift and was killed in an airplane crash, fall 1948. Contact: Bob Monson, 1310 Daveric Dr., Pasadena, CA 91107-1644.

Seeking anyone who knows or knew Anthony Rizzo, an artist who was a patient at the base hospital at Grenier Field, NH, in 1945 and had possibly just returned from overseas duty. Contact: Bill Rains, 207 N. Best St., Goldsboro, NC 27530 (phone or fax: 919-735-1638).

Seeking an original or copy of the **314th College Training Detachment** cadet newspaper, Ellensburg, WA, published December 1943 and containing the name John Darr. **Contact:** John W. Darr, 6811 Moreland Ave., Cheyenne, WY 82009 (307-635-2924) (JWDarr@prodigy.net).

Seeking information on the history of and where to buy armed forces insignia, divisional shoulder **patches**, USAF shoulder insignia, and Marine Corps, Navy, defense, and service command patches. **Contact:** Rocco Cavalieri, 1804 S. Dover St., Philadelphia, PA 19145.

Seeking contact with **George Batchelor**, born about 1919, who was stationed around Manchester and Cheshire, UK, in 1943. His last known address was Hyattsville, MD, and he also lived in North or South Carolina and Virginia. **Contact:** S. Hepplestone, 16A North Memorial Homes, Stoughton Rd., Oadby, Leicestershire, UK, LE2 4FL.

Seeking USAF Vietnam veterans, officers and enlisted, who served with any **Caribou units**, 1966–72, at Cam Ranh, Phu Cat, or Vung Tau, South Vietnam. **Contact:** Nick Eavanish, 210 48th St., Gulfport, MS 39507-4317 (601-863-8668) or Bill Avon, 729 Kaderly Ave., Strasburg, OH 44680-9785 (330-878-7451).

Seeking contact with anyone who served with USAF missions to **Peru, Nicaragua, or Haiti** during the 1950s. **Contact:** Dan Hagedorn, 13125 Pennerview Ln., Fairfax, VA 22033 (703-222-5390) (nasarc04@sivm.si.edu).

Seeking contact with or information on Capt.

Lawrence T. Dissette, 358th FS, 355th FG, Eighth AF, whose P-57 crashed April 16, 1945, near Straubing, Germany. Also seeking information on 1st Lt. Thurman C. Long, 1st Lt. Francis N. McCollom, and 2d Lt. Joseph E. Yuryan. Contact: Josephine H. Schulte, Eagle's Nest Apt. 933, 5211 Fredericksburg Rd., San Antonio, TX 78229 (210-524-9853).

Seeking information on or contact with Sgt. William Gibson, whose last known address was in Albuquerque, NM, and Thomas L. French, a native of the Oklahoma panhandle, or anyone who served in the 20th MMS at Barksdale AFB, LA, during the early 1960s. Contact: John E. Howell Jr., 1875 Grubb Rd., Lenoir City, TN 37771-7128 (423-986-8898) (johnfiero@aol.com).

Seeking information on and military or civil aviation photos of **Kai Tak IAP**, Hong Kong, China, from the 1920s to the present. **Contact:** Joe Chan, PSC 464, Box 30, FPO AP 96522-0002.

Seeking contact with Ailey, Clyde English, Tom Flavin, Walter Keinath, William A. Pennington, Storey, and Pern A. Todd, who knew Edward H. Grossheim Jr. and were stationed in Horham, UK, during WWII. Contact: Maria E. Grossheim– Schultz (jschultz@parkave.net).

For a collection, seeking **Military Payment Certificates** used overseas from 1946 to 1975 in Vietnam. **Contact:** Nick Schrier, Box 60104, Sacramento, CA 95860 (916-486-8720). Seeking anyone who knew MSgt. Roy B. Brooks, 71st BS, 38th BG, who was stationed at Patterson Field, OH; Langley Field, VA; Jackson AAF, MS; Australia; New Guinea: and was in the southwest Pacific January 1942–April 1944. He was promoted to chief warrant officer. Contact: Donn Brooks, Box 147, Kyle, TX 78640 (dbrooks@haysco.net).

Seeking information on, memorabilia, or contact with members of the **Elmendorf AFB (Alaska) Catholic Men's Choir,** 1950–55. **Contact:** William F, Costa Jr., PO Box 796174, Dallas, TX 75379-6174 (972-417-3840) (wcosta19@sprynet.com).

Seeking to share information with Vietnam War veterans with prostate cancer who have filed or plan to file for Veterans Affairs compensation. Contact: M.C. Garrison, 805 Copperas Dr., Caldwell, TX 77836 (409-567-3976) (ADUA70A@Prodigy.com).

Seeking contact with members of Aviation Cadet Pilot Training Classes 44-A, B, C, and D, particularly from eastern and southern training commands. Contact: A.E. Purinton, 717 Red Oak Ln., Arlington, TX 76012-4859 (pinkyfly@airmail.net).

To collaborote on memoirs, seeking contact with **retired general officers** who live in the northern Virginia area and who were with Air Defense Command, Air Force Systems Command, or Strategic Air Command in 1956, 1960, or 1963–67. **Contact:** W. Witt, 5823 N. Washington Blvd., Apt. 80, Arlington, VA 22205-2934.

Seeking Don A. Borden, Arthur Burstein, and Jack A. Johnson Jr., 52d BG, Eighth AF, crew members during 1944–45. Contact: Howard Towns, 1138 Circle Dr., Lake Wales, FL 33853.

Seeking metal models of aircraft for collection and display. Contact: Ira Kuperstein, 22 Brush Hill Terr., Kinnelen, NJ 07405 (973-283-2420).

Seeking contact with members of **Pilot Class of 41-I**, Ellington AFB, TX, Dec. 12, 1941, who knew Lt. Charles L. Maggart, 9th Pursuit Sq., 49th Gp, Morrison Field, FL. He was killed in action Dec. 5, 1941, while a member of the 38th BG. **Contact:** Philip E. Maggart, 516 Spencer Ave., Marion, IN 46952 (765-664-8552).

Seeking contact with Joseph (Fry) Frye of Atlanta, GA, who was in the Air Force and stationed at Huntingdon, UK, between 1955–58 and who knew Pansy Ruby Berkeley of west London. Contact: Michael A. Berkeley, 80 Forest Hill Rd., East Dulwich, London, UK, SE22 0RS.

Seeking information on or contact with anyone who knew **Carl Chapman**, 23d Photo Recon Sq, Alghero, Sardinia, 1944, who received the Distinguished Flying Cross for his participation in an April 1944 mission over Germany. **Contact:** Frank G. Dorber, Wyvern, Morannedd, Criccieth, Gwynedd, Wales, UK, LL52 OPP.

If you need information on an individual, unit, or aircraft, or want to collect, donate, or trade USAFrelated items, write to "Bulletin Board," *Air Force* Magazine, 1501 Lee Highway, Arlington, VA 2209-1198. Items submitted by AFA members have first priority; others will run on a space-available basis. If an item has not run within six months, the sender should resubmit an updated version. Letters must be signed. Items or services for sale, or otherwise intended to bring in money, and photographs will not be used or returned.





http://www.pc-express.com Call 24 Hours a Day - 7 Days a Week



1-800-471-5614

### **Pieces of History**

Photography by Paul Kennedy

### The Heart of the Night



The Nighthawk's roots gc back to 1974, when the Defense Advanced Research Projects Agency asked five military aircraft manufacturers to develop a stealth fighter. The first F-117A flew in June 1981, but the Nighthawk's existence wasn't officially revealed until 1988. The next year during Operation Just Cause in Panama, the stealth fighter went into combat for the first time. In the Persian Gulf War, F-117s flew more than 1,200 sorties, with no losses or battle damage. This is the cockpit of the second F-117A built, with modifications to test various systems. Some of the more sensitive instruments have been removed—thus the gaps in the dashboard. This aircraft spent most of its career at Edwards AFB, Calif., before being retired in 1991 to the USAF Museum at Wright–Patterson AFB, Ohio. Its markings are as it appeared during tests conducted for Air Force Systems Command between 1981 and 1991.

## WORN BY COMBAT PILOTS

### CHASE-DURER WATCHES ON DISPLAY AT: <u>CALIFORNIA</u> Alhambra SWISS WATCH JEWELERS & OPTICAL (318) 576-8926

Granada Hills BOYADJIAN JEWELERS (818) 83]-0753 La Jolla C 1 CHARLES (619) 454-Tarzana DARVA JEWELERS (818) 881-4653 Yorba Linda HAYMAN JEWELERS 714-996-9033 COLORADO Denver RIGHT TIME (303) 691-2521 CONNECTICUT Stamford (203) 327-0024 FLORIDA Cocoa Beach BEACH JEWELER (407) 783-3756 Orlando BRITTANY / HILTON WALT DISNEY (407) 827-6106 Palm Harbor SUTTON FLACE JEWELERS (813) 771-C205 St Petersburg GOLDEN SAILS JEWELERS (813) 381-1414 Tampa ALDO BRIONI JEWELERS, INC. (813) 253-2288 KING JEWELERS (813) 287-2599 Vero Beach DUBOSE AND SONS JEWELERS (561) 770-9160 IDAHO Pocatello (208) 232-2354 ILLINOIS Lake Forest CLOCKWORKS (847) 234-7272 NEVADA Las Vegas BERGER & SONS FINE JEWELRS (702)

737-7118 GOLD CASTLE - LUXOR HOTEL (702)

739-0033 NEW YORK Great Neck JEWELS BY VIGGI, LTD (800) 844-4413 Rome ENGELBERT'S JLRS INC (315) 337-3100 OKLAHOMA Enid Eell Jewelers (580) 234-8434 PENNSYLVANIA Butler GOLDEN DREAMS JEWELERS (724) 282-2653 Kennett Square BOVE JEWELERS (610) 244-4525 Philadelphia J&D JEWELERS (215) 592-8956 RHODE ISLAND No Kingstown EROWNE & CO (401) 295-2420 VIRGINIA Mc Lean DIAMOND CREATIONS (703) 883-1818 WASHINGTON Seattie FOX'S GEM SHOP (300) 733-2528 WISCONSIN Wisc Rapids DIAMOND JEWELERS (715) 423-8333 ... AND AT SELECTED FINE JEWELERS NATIONWIDE

Credit Card Orders Call 1-800-544-4365 Ask For Operator 745

### PILOT

### DESIGNED FOR MILITARY PILOTS

- Revolving E6B Computer Bezel
- Water Resistant to 330 ft
- 6 Hr Elapsed Time & Lap Time
- FRECISION SEIKO YM55
  Quartz Chrono Movement

\$350 Value Only \$179 + \$6 s&h

### BLACK STEEL UNDERWATER DEMOLITION CHRONOGRAPH

60 65

 Super SPO/Tritium Hands with 20 Year Continuous

- PRECISION SWISS 22 Jewel ETA Quartz Movement
- Solid Black Steel Case & Band
- Double Lock Security Clasp
- Screw-in Crown & Back
- W/R to 330 ft
- Calendar Date Wincow
- Elapsed Time & Lap Time
- Hardened Mineral Lens
- 1/10th Sec TimingRevolving Countdown Bezel

Revolving Countdown Beze
 S500 Value Now Only \$249

+ \$6 s&h

Designed for covert attack operations.

U.S. SPECIAL FORCES

All CHASE-DURER Watches Feature: 30 DAY MONEY BACK GUARANTEE LIMITED 5 YEAR INT'L WARRANTY • SAME DAY SHIPPING Or send check or money order to: CHASE-DURER, Ltd • 270 No Canon Drive • Dept 1402-745 • Beverly Hills, CA 90210

Phone: 310-550-7280 • Fax: 310-550-0830 • www.Chase-Durer.com

