JUNE 1992/$3

AIR FORCE

PUBLISHED BY THE AIR FORCE ASSOCIATION MAGAZINE

The BUFF at War

USAF's Program for 1993

The Base Force Meets Option C

Lockheed delivers its 2,000th C-130 Hercules airlifter to the Kentucky Air National Guard.

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On May 15, 1992, the C-130 Hercules airlifter set yet another aviation milestone—2,000 deliveries in over thirty-five years of continuous production. No other aircraft in our Air Force's inventory approaches this distinction.

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AIWS fit check on F-15E

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JSOW Dynamic Submunition Dispense Test

Texas Instruments – leading the team for JSOW development and production.

TEXAS INSTRUMENTS

01-JSW-922

Once again, the Air Force sh

1918

The SPAD S.XIII was the U.S.A.'s fastest (139 mph) pursuit plane of World War I.

1924

The Curtiss PW-8 was the first aircraft fast enough to make it from coast to coast between dawn and dusk.

1926

Dubbed the "fastest pursuit in the world," the Curtiss P-6 Hawk was among the first to test turbo-chargers.

1939

Aptly nicknamed Lightning, the Lockheed P-38 was the first to cross the U.S. in just 7 hours.

1944

The Republic P-47 Thunderbolt was the first propeller-driven aircraft to exceed 500 mph in level flight.

1944

Originally built for the RAF, the North American P-51 Mustang could outrun all its contemporaries.

1949

The Republic XF-91 Thunderceptor used 4 rocket motors to pass the "century mark"—1000 mph.

1953

The North American F-86 Sabre captured three world speed records between 1948 and 1953.

1955

First U.S. supersonic fighter, the North American F-100 Super Sabre pushed the world record past 800 mph.

1958

Called the "missile with a man in it," Lockheed's F-104 set records for altitude (91,000') and speed (1403 mph).

1959

A new world record of 1525 mph was set in December by the Convair F-106 Delta Dart.

1961

Still in service after 30 years, McDonnell Douglass' F-4 Phantom II moved the world record to 1600 mph.

atters another speed record.

1935

Boeing's P-26 'Peashooter,' America's first all-metal monoplane, topped speeds of 230 mph.

1938

The Curtiss P-36 test-dove at 500+ mph, and later downed several attackers at Pearl Harbor.

1938

The turbo-charged Bell P-39, prototype of the Airacobra, achieved flying speeds of 400 mph.

1945

Never put into service, the Northrop XP-56 flew above 400 mph, powered by a 2000-hp radial engine.

1947

The Lockheed P-80 Shooting Star set a world speed record of 623 mph, and was a great success in Korea.

1948

Two Mustang fuselages sharing one wing, the North American F-82 was the first to fly Hawaii to NYC nonstop.

1956

At its debut, the Convair B-58 Hustler topped 1300 mph, unprecedented for a plane of its size.

1957

Heaviest of the "Century Series" fighters, the McDonnell F-101 Voodoo pushed the world record to 1207 mph.

1975

Lockheed's SR-71A Blackbird spy plane set 12 world records, routinely exceeding 2000 mph.

1975

The McDonnell Douglass F-15 Streak Eagle climbs to 98,424' in a record 207.8 seconds.

1992

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The Air Force has broken more speed records than you can shake a joystick at. But here's one that's long overdue:

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June 1992, Vol. 75, No. 6

AIR FORCE MAGAZINE

PUBLISHED BY THE AIR FORCE ASSOCIATION

About the cover: A fully loaded B-52 moves down the taxiway before a sortie against Iraqi targets. For a firsthand report on B-52s in the Persian Gulf War, see p. 44. USAF photo by TSgt. Rose S. Reynolds.

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Editorial

By John T. Correll, Editor in Chief

The Semifinal Verdict

"THE United States relies on the Air Force, and the Air Force has never been the decisive factor in the history of war." So said Saddam Hussein just after he invaded Kuwait and before the roof caved in.

"The decisive character of our victory in the Gulf War is attributable in large measure to the extraordinary effectiveness of airpower." So said US Secretary of Defense Dick Cheney, looking back on the results of Operation Desert Storm.

Both perspectives on airpower are included in the Pentagon's final report on the Gulf War, a whopping 1,262 pages long, delivered to Congress in April. The report was three months late, held up by fierce interservice wrangling.

The reason for the controversy is that accounts of the war—and this official report in particular—are not exercises in simple nostalgia. The findings are likely to figure for years to come in decisions about force structure, roles and missions, and budgets.

A leading point of contention, of course, was airpower, which showed to spectacular advantage in the Gulf. Behind careful and measured phrasing, the report confirms that, while airpower did not win the war alone, it was the dominant element in combat. It is at pains to say—correctly—that the circumstances of the Gulf War were highly favorable to an air offensive.

The Pentagon sees the war as a validation of US doctrine, high technology, and the caliber of the all-volunteer force. It also identifies shortcomings. Improvement is needed, for example, in the collection and use of intelligence for targeting, bomb-damage assessment, and tactical decisions.

Part of the reason underlying that particular deficiency is that standards have changed. It is no longer enough, the report says, for intelligence to report a target within a given complex of buildings. Targeteers want to know which part of what building. A precision guided weapon may be able to hit it on the nose.

Few readers will slog to the end of the report, which weighs almost seven pounds, but those who persist will gain a fresh understanding that the conduct of war involves much more than the shooting. Cargo delivered for Operations Desert Shield and Desert Storm, for instance, was greater than the amount moved across the English Channel to Normandy in support of the D-Day invasion during a comparable seven-month period.

The Pentagon's seven-pound report on the Gulf War is in, but the argument isn't over.

When the crisis broke in August 1990, the military communications infrastructure in the Gulf area was rudimentary. By November, there was more strategic connectivity (circuits, telephone trunks, radio links) than in Europe.

The Department of Defense may have turned in its final report on the war, but that does not mean it will be universally accepted as the final verdict on exactly what happened, how the events should be interpreted, or what conclusions can be drawn from the experience. Indeed, the revisionists have already begun.

Hot on the Pentagon's heels, the House Armed Services Committee published its own report. It agrees that airpower, technology, and the volunteer force were major reasons for the victory but also awards star billing to a fourth factor: the Goldwater-Nichols Act of 1986, which empowered the theater commander, established a single chain of command, and "assured that the services fought the same war."

Recalling the "body count" imbroglio of the Vietnam War, the Defense Department does not speculate on Iraqi troop losses in the Gulf. The Committee, however, attempts an estimate, declaring it "militarily important for future contingencies."

On the basis of what captured officers said during interrogation, the Committee deduces that original estimates of Iraqi Army strength in the battle theater (567,000) may have been inflated by as much as a third. When the ground campaign began, perhaps 183,000 Iraqi troops remained to resist it. Desertions and casualties (estimated total, 179,000) accounted for the rest.

It is a reasonable guess that much of what the Committee says in its report was produced by its prolific chairman, Rep. Les Aspin (D-Wis.). In a personal statement appended to the publication, Mr. Aspin declares that the Pentagon is right in claiming that technology provided a decisive edge but wrong in appreciating the implications.

"The increased efficiency of shooter aircraft means we need fewer of them to hit the same number of targets," Mr. Aspin says. "High tech has altered the traditional balance between combat systems and support systems. More combat and less support no longer leads to the best results."

That conclusion aligns with one of Mr. Aspin's favorite themes, the "silver bullet" strategy, which would severely limit quantities of the most capable weapons and rely on less-advanced systems for the bulk of the force. He is currently applying the logic to the question of how many F-22 Stealth fighters the Air Force should get.

In his foreword to the Pentagon report, Secretary Cheney makes a point worth remembering: "Potential adversaries will study this war no less diligently than we."

Postmortems of Desert Storm should be taken as instructive rather than predictive. The war was not as easy to win as it may have looked, and it could be a different story next time if we cut our margin too thin. ■

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Letters

Lessons From the GLCMs

"Scud War, Round Two" *[April 1992, p. 48]* was excellent coverage of the campaign against theater ballistic missiles (TBMs) in Desert Storm and highlighted the continuing problem of locating and destroying mobile missile systems. Although many Air Force people were surprised by the difficulties in the anti-Scud effort, those who developed and operated the ground-launched cruise missile (GLCM) system knew that the problem was difficult.

In the late 1970s and 1980s, hardly a meeting of the GLCM Survivability Working Group went by without comments from the intelligence or tactical fighter representatives to the effect that ground mobile missiles would not last the first day of a war or that any ground system was a sitting duck for sophisticated sensors and attack systems. They consistently pushed for hardened fixed sites, a fallacy demonstrated in the first days of Desert Storm.

A major focus of the GLCM section of the Joint Cruise Missile Project and TAC's GLCM System Management Office was prelaunch survivability. A systematic effort was made to reduce an enemy's probability of detection, localization, identification, and kill against GLCMs. This was achieved through a combination of mobility, camouflage, signature reduction (Stealth?), and tactical vehicle spacing and armor.

I am convinced that Soviet war-gaming against GLCM surrogates demonstrated the prelaunch survivability of the system and led them to sign the INF Treaty as the only effective way to eliminate the threat. They gave up about nine warheads for each GLCM and Pershing we dismantled, a pretty good "kill ratio" for any system.

Although forces in Desert Storm employed sensors and attack aircraft at least two generations better than those that GLCM faced in the late 1970s, the mobile Scud units were a difficult problem even in desert terrain with little opportunity for concealment. The problem would be much worse in built-up or heavily wooded terrain. The Air Force should examine the lessons learned from the GLCM to help understand the theater ballistic missile problem.

Among the most potent threats to GLCM was a combination of *Spetsnaz* (Special Forces) reconnoitering an area on foot and calling in air strikes on units they located. This was also an effective tactic in Desert Storm. The Air Force should take this to heart and not focus exclusively on high-technology airborne solutions. The intelligence and attack communities have been seduced in the past by the advertising claims of the sensor manufacturers. We should not rely too much on technology for a problem that requires balance between human observers on the ground and long-range sensors.

With the focus on TBMs, we should not forget the cruise missile threat. Using commercially available Global Positioning System units, cruise missiles with better accuracy than Scuds can be deployed by many smaller countries. With a slow horizontal flight profile, cruise missiles are much better suited to releasing chemical weapons than Scuds are. With Scuds, early release results in harmless dispersion at high altitude and late release confines the agents to a small area immediately around the blast crater. TBMs can be detected during flight by space sensors and defended against by Patriots or similar missiles. The cruise missiles will be even easier to move and conceal than TBMs, and they offer few signatures for detection by space or remote aircraft sensors. Our Army has almost no air defense against small, low-altitude cruise missiles.

Lt. Col. Michael E. Rogers,
USAF (Ret.)
Tullahoma, Tenn.

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

Killing the TELs

I was quite interested to read Stewart M. Powell's "Scud War, Round Two"—the more so in that he artfully hedged any direct answer to the question of air strike effectiveness against Scud transporter-erector-launchers (TELs). His article supports the conclusion that the anti-TEL air campaign was a failure in respect to its primary mission of TEL destruction.

Despite the allies' unhindered access to the battlefield and with sufficient time having elapsed for target identification and damage assessment, the article fails to cite any TELs destroyed by the air campaign. Until such confirmations materialize, Secretary Cheney is quite correct in describing such kills as "nebulous," at best.

On a per-engagement basis, each Scud costs the US about $1.8 million in expended Patriot missiles—a poor cost-exchange ratio, considering that each Scud undoubtedly cost less than $1 million. However, if one conservatively evaluates the resources consumed in [the 2,493] anti-Scud sorties at $500,000 each, then the eighty-six Scuds fired resulted in approximately $14.5 million of Air Force resources consumed per Scud—a terrible cost-exchange ratio, especially in light of unconfirmed effectiveness.

The air campaign enjoyed the advantages of air supremacy, featureless terrain, clear weather, and enemy tactics (continuous barrage) most favorable to its objectives, yet it produced no clear success. Future scenarios will not be so benign, with surface-to-air and airborne opposition, concealing terrain, and poor weather.

Other aggressors may learn from Saddam's simple-minded tactics, electing to launch a preemptive, coordinated, mass barrage to saturate terminal defenses and achieve strategic objectives in a surprise attack. Any subsequent counterbattery air campaign may therefore be irrelevant to the outcome of the conflict.

Also, we can expect other, more mobile launch platforms: barges, ships, or even aircraft. (In 1955, the Air Force demonstrated launch of the GAM-63A Rascal missile from a DB-47. The Ras-

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The F-16.

GENERAL DYNAMICS

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Letters

cal is equivalent in weight to a Scud.)

The Air Force must carefully reconsider its basic approach to the problem of TBMs before it commits scarce budgetary resources and manpower to *ad hoc* tactical solutions of undemonstrated effectiveness and doubtful future relevance.

Michael J. Dunn
Auburn, Wash.

Dedicated Intelligence Support

While reading "Plan of Attack" *[April 1992, p. 40],* I noticed that the "US satellite photo of downtown Baghdad" is actually unclassified French SPOT civil satellite imagery, put together by TAC's 480th RTG (now 480th AIG). Many sources of imagery were available to the Checkmate effort, but in some cases it was also helpful to work from an unclassified reference.

In addition to "intelligence people . . . invited in to help us identify targets," I, as Col. John Warden's intelligence counterpart briefer for the August 16 pitch to General Schwarzkopf, want to make mention of the dedicated work of the Air Force Intelligence Support Agency (AFISA) targeteers and analysts in that initial planning effort. Thirteen AFISA targeteers—officers and NCOs—were working in Checkmate, and numerous intelligence analysts were backing them up, supporting the planners and operators cited in the article. It was a team effort!

Col. James R. Blackburn, Jr., USAF
Director of Targets, AFISA
Fort Belvoir, Va.

Don't Forget the F-16

"A Strike by Stealth" *[March 1992, p. 38]* was well written, informative, and interesting. However, it was flawed by omission. Your map (p. 41) and the article mention attacks that first night by the F-117, B-52, F-15E, Tornado, F/A-18, A-6, F-111, MH-53, AH-64, and TLAM. They also mention support by the F-15, F-14, F-4G, EF-111, EA-6, E-3, E-2, RF-135, U-2/TR-1, KC-10, and KC-135. Nowhere do they mention the F-16.

Eight LANTIRN-equipped F-16Cs from the 421st TFS "Black Widows" were among the first wave. They successfully hit targets in southeast Iraq suspected of having chemical capability, a major concern in the opening days of the war.

I realize that the article focused on the role of the F-117. However, so many articles I have read ignore the contribution of the F-16—particularly those that fought at night—that I felt compelled to write. The F-16s were more numerous, flew more missions, and delivered more tonnage than any other weapon system. While we did not have camera footage of laser-guided bombs, we must have been successful, given the short ground war. I would just like to see an article that acknowledges that.

Maj. Donnie Moore, USAF
Yorktown, Va.

Unhappy Landings

"Getting Down" *[March 1992, p. 66]* needs a bit of clarification.

Let's look at the statement that U-2s float because pilots are accustomed to the relatively level landings of tricycle-gear airplanes. Really? Sweptwing jet airplanes must land with their noses cocked up at an imposing angle (except for the rare variable-incidence wing).

Conversely, contrary to what the article stated, a U-2 must be landed in a level attitude because of the bicycle landing gear. A Lockheed test pilot told me that Tony LeVier and other early U-2 pilots could not get the craft to land because of high idle thrust. Definitely not because the pilot "approached the runway in a horizontal attitude"—whatever that means.

The article also stated that "the most practical slowing device" for aircraft is the thrust reverser. In fact, spoilers and brakes, preferably antiskid brakes, are far more effective. Ground roll in the C-5 increases by an average of 1,000 feet without spoilers, but it adds only 300 feet without thrust reversers. Remarkably, the article mentions neither spoilers nor antiskid brakes.

Regrettably, each part of the article contains similar discrepancies. Pilots must have been astonished to read that "computerized avionics systems . . . control engine speed by increments of one knot." Engine speed, of course, is not controlled or measured in knots.

I could beat on this fuzzy writing a lot more, but the point is this: I know a lot about landing aircraft; I know very little about the high-tech stuff you publish and on which I rely for accurate information. Hope you are more on target with that coverage.

Bob Downs
Rough and Ready, Calif.

"Getting Down" was an interesting piece, but the author missed a couple of significant points. First, probably nothing says more about the improved landing characteristics of modern fighters than the fact that the T-38 Talon used in undergraduate pilot training is probably the "hottest" landing aircraft most young Air Force pilots will ever

fly. Of course, the T-38 emerged to prepare pilots for the challenges of an earlier generation of "Century Series" fighters, such as the F-100, F-104, and F-105.

In addition, I think the spectacular performance of the Air Force's newest airlifter, the C-17, deserved mention. Using a combination of externally blown flaps, sophisticated computers, and a head-up display for precise touchdown control, the C-17 has demonstrated landing ground rolls as short as 2,000 feet and flight speeds as low as eighty-three knots. The C-17 will also be very comfortably flown on five degree glideslopes vs. the three degree figure cited in the article for most transports.

The C-17 will give the Air Force a plane with approximately the C-141's external dimensions, the C-5's cargo cross section, and the C-130's ground maneuverability—just what we need to maintain America's global reach.

Col. Michael R. Gallagher, USAF
Scott AFB, Ill.

I wonder if Susan Katz Keating, author of "Getting Down," could share with us the identity of her source on landing technique for the P-51 Mustang?

Her prescribed procedure of "slowing to 130 miles per hour while applying enough forward power to keep the nose up" might have been interesting to observe. That bird did not stay stuck to the ground too well at normal landing weight at anything more than ninety-five mph without desperate efforts. The elevator trim was adequate throughout the speed envelope.

I suppose that a sudden application of power at the stall with a weak right leg could roll the bird to the left. It was a tricky bird in a gusty crosswind from the right—the right wing would rise in a gust, and application of power could aggravate the situation. On one occasion at Roswell, N. M., in late 1947, the pilot started lateral cartwheels from the left wingtip. At the end of the melee, the pilot arose from the separated upright seat to survey the scattered component parts. By some miracle, he was unscathed.

Maj. Charles W. Staley, USAF (Ret.)
Beloit, Wis.

Pride of the 451st

We who served in the 451st Bomb Group (H) in Italy are familiar with the photo on p. 71 of the February 1992 issue. We are accustomed to seeing it credited merely to Fifteenth Air Force *["The Mission," p. 70]*. This is possibly one of the most famous and most circulated photos of World War II air action.

For the record, and as a matter of group pride, the aforementioned photo was taken over Ploesti, Romania, on May 31, 1944, by the 451st Bomb Group's photographer Sgt. Robert Hoffman.

Frank J. Lather
Brownsville, Vt.

How Many Missions?

Bruce Callander states in "The Mission" that when he flew with Fifteenth Air Force during the summer of 1944, for his crew to rotate back to the States, they had to complete fifty missions, compared to Eighth Air Force's twenty-five missions.

I beg to differ.

I also flew during 1944, with the 390th Bomb Group, Eighth Air Force, and we were required to fly thirty missions to begin with before we could complete our tour of duty. However, as the war continued, our group completed thirty-five-plus missions before returning to the States.

Mr. Callander also mentioned Munich, Germany, as one of his group's targets. The 390th Bomb Group hit Munich on July 13–15, 1944. The mission was not exactly a walk in the park for us either.

Bill Rossell
Fort Lee, N. J.

Capitol Hill

By Brian Green, Congressional Editor

The Future of Force Modernization

The Air Force gives Congress its logic for fighter and bomber programs amid controversy about system developments.

CONCERNS about capabilities, affordability, quantity, requirements, and sequencing dominated recent House Armed Services Committee hearings on the future of Air Force combat aircraft modernization.

According to Chief of Staff Gen. Merrill A. McPeak, the highest priority in the Air Force plan for modernizing fighter aircraft goes to the F-22. Air superiority is the key to all military operations, General McPeak said, and the F-15 fleet to be replaced by the F-22 is the oldest component of these forces. "We want to fight in the other guys' airspace. . . . The F-15 can't get to the fight after the turn of the century," he said. The F-22 will achieve initial operational capability in 2002.

The Air Force plans to procure 648 F-22s to fill out 5.5 wings. General McPeak conceded that that number could not be pegged with precision to "the largest logical regional threat." He argued against reducing quantities of the F-22 or of the stealthy, all-weather, day/night A-X medium attack aircraft because these high-end aircraft are most important early in a conflict and are critical to quick and decisive military results. "Our allies bring [the] low end," said General McPeak. "We have to provide state-of-the-art capabilities for air superiority and interdiction."

In response to suggestions that the F-22 could serve as a "silver bullet" weapon system, the Chief of Staff argued that the production of only forty-eight aircraft a year (the current plan) over fifteen years came closer to the silver bullet mode than to the rapid, high-quantity procurements of the past. He also noted that a slow but efficient procurement program would effectively sustain the industrial base while lowering risk.

Controversy continues to dog the B-2 bomber. Gen. John Michael Loh, commander of the new Air Combat Command, told the committee that the B-2 would not meet its original stealth specifications "at every frequency, at every angle, and at every elevation," but argued that "it doesn't have to [in order] to be an operationally effective bomber." He contended that the original technical specifications were too stringent. The bomber will be as effective operationally as the Air Force planned, he said.

Gen. George Lee Butler, commander in chief of US Strategic Command, said that the B-1B bomber will have operational constraints similar to those of the B-52 in the conventional role. General Loh indicated, however, that with electronic countermeasures (ECM) improvements, the B-1 would be very effective. "We need to buy that core ECM system to give us the survivability and penetration capability equivalent to the B-2, for example. . . . You wouldn't necessarily fly [the B-1] alone until we had suppressed enemy defenses . . . but the combination of night; low-altitude entry and exit; medium altitude, very-high-speed attack; its ECM; and its supporting cast can make the B-1 very survivable," said General Loh.

The two generals agreed that procurement of the last five B-2s (for a total of twenty) is still critical. General Loh explained that a force of twenty B-2s allows formation of two eight-aircraft squadrons and that these would be more than twice as capable as a less flexible, less sustainable, eleven-aircraft squadron resulting from procurement of only fifteen B-2s. This additional capability could be bought for $2.8 billion, bringing the total program cost to $44.4 billion, he said.

Improving B-1B performance is another top priority. This includes bringing the B-1B's troubled countermeasures suite up to speed, moving to an organic maintenance capability for the B-1B, and upgrading the B-1B's conventional capability. General Butler is confident that a fix is on hand for the ECM suite that will meet the "original preferred characteristics." Conventional upgrades will include a data bus to communicate with smart munitions, use of the Global Positioning System to improve accuracy, computer upgrades, antijam communications, and the ability to carry the new Joint Direct Attack Munition. Projected cost: $2.2 billion.

The A-X is a high-priority program for both the Air Force and the Navy. The Navy's air-to-ground A-6 fleet is the oldest of any of the fighter-attack components and will average about forty years old by the time the A-X is deployed. Vice Chief of Naval Operations Adm. Jerome Johnson insisted, however, that acceleration of the A-X program is not feasible. The ten-and-a-half-year development program will draw on experience gained from other stealth aircraft and will share Air Force avionics technology. Accelerating the program would create too much technical risk, he said.

The Air Force, according to General McPeak, is working closely with the Navy on the A-X and will buy one A-X around 2001 so "that we can try some Air Force stuff." The Air Force plans on buying 411 A-Xs at $72 million each, at a rate of thirty-two a year, starting around 2012.

The Air Force Multirole Fighter (MRF) program will enter development about the same time as the Navy A-X. The long-term Air Force modernization budget provides $15 billion for development of a new aircraft. Affordability is a must, according to the Chief, since it must be procured in large numbers—"2,000 airplanes and perhaps more"—to replace the F-16.

The MRF will enter the force around 2012. The retirement rate of F-16s, however, could lead to an inventory gap starting late in the decade, according to the Chief. The long-term procurement plan also provides for acquisition of up to 500 F-16s—possibly an improved version—at $25 million apiece to cover this gap. Alternatively, he suggested, the Air Force could bring F-15s and A-10s out of storage to replace retiring F-16s. The gap would disappear if the force were reduced below 26.5 wings.

General McPeak argued that the Air Force plan could be accommodated in a declining budget. Rep. Les Aspin (D-Wis.), however, contended that future budgets may be too small to sustain the modernization. ■

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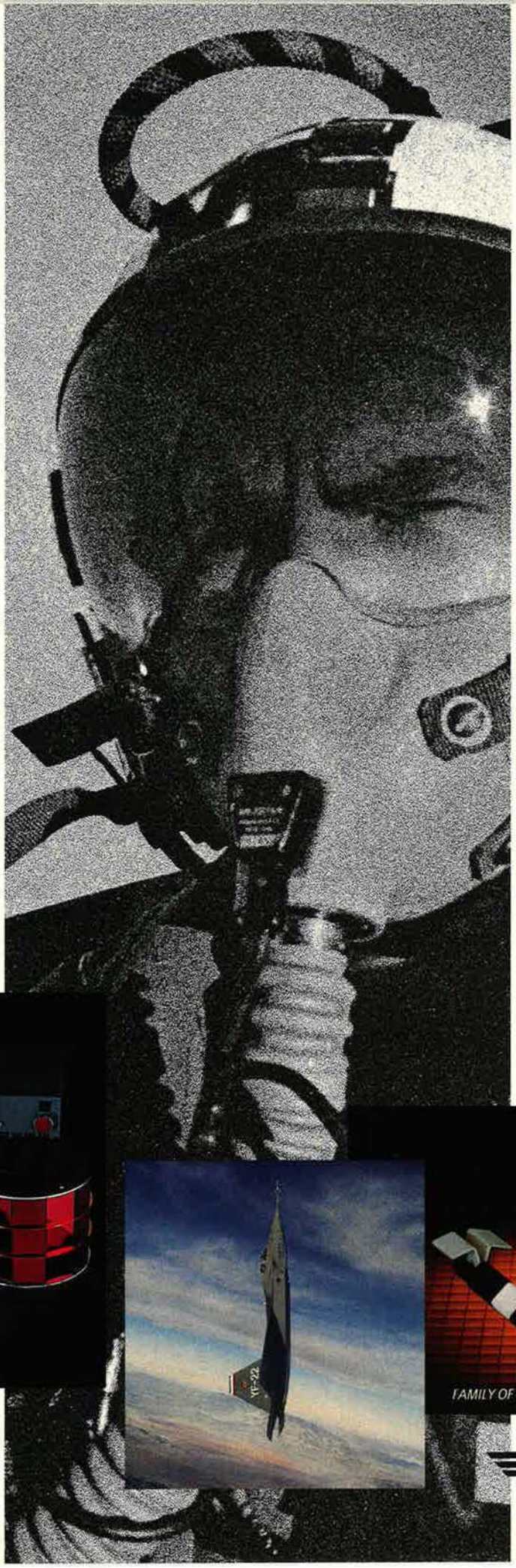

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The Chart Page

By Tamar A. Mehuron, Associate Editor

Aspin's Challenge

The Base Force is what the Pentagon considers the minimum force required to ensure US defense in the post–cold war world. The Base Force elements in this table were sized in 1990 to be able to respond to regional threats rather than to a global challenge from Soviet forces. Such regional threats are deemed to require fewer bombers, divisions, fighter wings, and warships.

Composition of the Base Force

	The Force in FY 1991	Base Force 1990
★ **Strategic**		
Bombers	B-52, B-1	B-52H, B-1, B-2
ICBMs	1,000	550
SSBNs	34	18
★ **Air Force**		
Active FWEs	22	15
Reserve FWEs	12	11
★ **Army**		
Active divisions	16	12
Reserve divisions	10	6
Cadre divisions	—	2
★ **Navy**		
Total ships	530	450
Aircraft carriers	15	12
Active air wings	13	11
Reserve air wings	2	2
★ **Marine Corps**		
Active MEFs	3	3
Reserve MEFs	1	1

FWE	Fighter wing equivalent
MEF	Marine expeditionary force

House Armed Services Committee Chairman Les Aspin (D-Wis.) has produced a competing plan, which he calls "Option C." It calls for deeper cuts, producing a US military smaller than the Base Force, and would rely much more on reserves and naval power projection.

The Option C Difference

	The Force, End FY 1991	Base Force 1997	Option C 1997
★ **Air Force**			
Active FWEs	22	15	10
Reserve FWEs	12	11	8
Active personnel	511,000	430,000	364,000
Reserve personnel	202,000	200,000	193,000
★ **Army**			
Active divisions	16	12	9
Reserve divisions	10	6	6
Cadre divisions	—	2	—
Active personnel	725,000	536,000	476,000
Reserve personnel	741,000	567,000	550,000
★ **Navy**			
Total ships	528	450	340
Carriers	15	13	12
Attack submarines	87	80	40
Assault ships	65	50	50
Active personnel	571,000	501,000	432,000
Reserve personnel	150,000	118,000	112,000
★ **Marine Corps**			
Active divisions	3	2.3	2
Reserve divisions	1	1	1
Active personnel	195,000	159,000	137,000
Reserve personnel	44,000	35,000	49,000
★ **Sealift**			
Fast sealift ships	8	8	24
Afloat prepositioning ships (new)	8	8	24

Washington Watch

By John T. Correll, Editor in Chief

The Base Force Meets Option C

Mr. Aspin says the Pentagon is wrong and that we can dispense with more troops, divisions, wings, and ships.

Rep. Les Aspin (D-Wis.), Chairman of the House Armed Services Committee, has done his own arithmetic—based on what he calls "the Desert Storm Equivalent"—to project a future US military lineup that differs significantly from the Pentagon's "Base Force" plan.

Secretary of Defense Dick Cheney, Chairman of the Joint Chiefs of Staff Gen. Colin Powell, and service leaders say Mr. Aspin's proposal is off track.

Army Chief of Staff Gen. Gordon R. Sullivan predicts that the force Mr. Aspin prescribes would suffer a high rate of casualties in combat and be less likely to achieve decisive victory on the battlefield.

The most picturesque criticism, however, came from Gen. Merrill A. McPeak, Air Force Chief of Staff, who said that Mr. Aspin got his numbers wrong and that his Desert Storm Equivalent would be more accurately termed "Desert Drizzle." The force structure options suggested by Mr. Aspin and his staff "are a recipe for military disaster," General McPeak said.

That illustrates the intensity of the battle under way in Washington power centers about the size and structure of US armed forces in the late 1990s. Participants include not only the Pentagon, the Administration, and Congress but also legions of private sector analysts and special interest groups.

All manner of proposals have been advanced, but serious attention concentrates on two of them—the Pentagon's Base Force projection and Mr. Aspin's "Option C," drawn up by the House Armed Services Committee staff.

Option C would cut the Pentagon's stripped-down Base Force by another three Army divisions, eight Air Force wings, and 120 Navy ships. It also prescribes a further reduction of 233,000 military personnel, ninety-three percent of it to come from the active-duty forces.

Pentagon leaders argue that it would be a mistake to abandon the Base Force structure, which is geared directly to the revised defense strategy adopted two years ago. The Base Force, they point out, reduces military strength by 779,000 from its peak in 1987 and would eliminate a fourth of the Army's active-duty divisions and almost a third of the Air Force's active-duty fighter wings that existed in 1991.

Mr. Aspin brackets his Option C with alternative force proposals—several of them considerably more extreme—made by others. Beyond the defense community, his position is widely perceived as moderate and middle-of-the-road. The House Budget Committee, for example, used Option C as the basis for its defense budget resolution in March.

The force structure options suggested by Mr. Aspin and his staff "are a recipe for military disaster," said General McPeak.

Behind the Arguments

The various challenges to the Base Force, including Mr. Aspin's Option C, derive mainly from three considerations.

Money. The federal deficit for 1992 is $425 billion. Congress is unwilling to curb entitlement programs, which have been the main growth factor in federal spending for the past twenty years. The Administration has agreed to cut the defense budget by thirty percent between 1990 and 1997, but Congress is demanding a larger "peace dividend."

Mr. Aspin estimates that his Option C would save an additional $48 billion over five years. He points out that others call for larger reductions, citing the example of Rep. Ronald V. Dellums (D-Calif.), who urges a $400 billion defense cut spread over four years.

Sen. Sam Nunn (D-Ga.), Chairman of the Senate Armed Services Committee, disagrees with Mr. Aspin about near-term reductions but says he believes the Base Force can be cut and that a further $30 billion to $35 billion can be saved over the next five years.

Force mix. The Guard-Reserve issue is a political nuke. So far, most of the defense reductions have been made in the active-duty force, with Congress blocking attempts by the Pentagon to make corresponding reductions in the National Guard and Reserve.

In March, Secretary Cheney sent Congress a list of 830 Guard and Reserve units he proposes to reduce or inactivate. Most of the reductions would be in the Army Reserve component, which is at present larger than the active-duty Army.

Most of the alternative force proposals, including Option C, strike hardest at the active-duty force. In a remarkable position paper published in February, the National Guard Association declared that "the existing Total Force Policy and the emerging Base Force policy are competing strategies."

Challenging the Pentagon head-on, the Guard Association says that the Army should have ten active-duty divisions and ten National Guard division equivalents, rather than twelve active-duty divisions, six reserve divisions, and two cadre divisions as projected for the Base Force.

The Guard Association says the Pentagon has slim chance of getting the budgets it has requested and could have more defense for its money with a richer mix of reserve components at "approximately twenty-five percent of the recurring costs of active forces at the same level of organization."

Asked about that by the Senate, General Powell said that such a percentage might apply to manpower-intensive forces but that more sophisticated reserve component units cost around eighty percent as much as active-duty forces. He said he did not need any more Guard divisions in the force structure.

Estimates of the requirement. Mr. Aspin's main claim is that his estimate of force requirements is better than the Pentagon's, which he derides as "defense by subtraction," calculated by obsolete "top-down" methodology, leading to "less of the same."

He presents his alternative in great detail, complete with charts, tables, footnotes, and the kind of catchy phrases that are something of an Aspin trademark.

His working paper postulates four options, but three of them are obvious throwaways. His keeper is Option C. "Compared to the Pentagon's proposed Base Force," Mr. Aspin says, "Force C would put proportionately more emphasis on naval power projection, Marine Corps expeditionary forces, and our National Guard and Reserve Forces."

The Base Force

The basic point of reference for all of the arguments and alternatives is the Base Force. Even Mr. Aspin, who makes much of having calculated Option C from the ground up, repeatedly uses the Base Force as his standard of comparison.

Two years ago, on the eve of the Persian Gulf War and before the collapse of the Soviet Union, the Pentagon switched to a new defense strategy, built around smaller forces, fewer deployments overseas, and the assumption that the primary threats would be regional rather than global.

It subsequently devised a Base Force structure to implement that strategy. The drawdown and realignment of US forces was accelerated, falling toward Base Force levels by the mid-1990s.

As a force-sizing tool, "not a blueprint for a new command structure," the Base Force is subdivided into four conceptual force packages (Strategic, Atlantic, Pacific, and Contingency forces) and four supporting capabilities (space, transportation, reconstitution, and research and development). Overall, the Base Force would be some twenty-five percent smaller than US forces of the 1980s.

Critics of the Base Force say it is obsolete because the underlying concepts were developed before the fall of the Soviet Union. General Powell rejected that charge under heavy grilling by the Senate Armed Services Committee in March.

Sen. Carl Levin (D-Mich.) was foremost among those doubting that the Department of Defense in 1990 was actually basing its plans on Soviet disintegration, which did not occur for another year.

General Powell offered to show the senators two-year-old charts that anticipated a fifty percent reduction in Soviet armed forces and a forty percent drop in the size of the Soviet military-industrial complex. He added that while the Soviet Union may have disappeared since then, the aggregate of forces in that part of the world has not yet dropped by the fifty percent in the planning base.

According to General Powell, cutting below the Base Force solely to reach a lower number "is where you run into disasterville."

(The public record supports General Powell's claim. The 1991 Joint Military Net Assessment, published five months before the Moscow coup that set up the demise of the Soviet Union, clearly stated that global war was no longer the planning focus of US strategy and that potential conflict in Europe had been downgraded to the status of a major regional contingency.)

General Powell cited the various requirements for US military capability. "When you add those—a Desert Storm Equivalent and forces deployed forward, in Korea and in Europe, and with some residual ability in the United States to still influence events—add it up and I get the Base Force," he told the Senate.

He acknowledged that some adjustments to the Base Force may be possible in time but says that premature alterations would be a critical mistake.

"My concern is that people are trying to shove us below the Base Force now, and the only reason for doing that is to increase the rate of drawdown to a lower number," he told the Senate. "That is where you run into disasterville."

Aspin's New Math

The person General Powell would most like to convince is Mr. Aspin, who is defending his position aggressively. To a considerable extent, Mr. Aspin bases his challenge on methodology, claiming that his differs from the Defense Department's in two important respects.

First, he says he used a "bottom-up" approach to identify "building blocks" of requirements from scratch. "Top-down force planning—what they are practicing in the Pentagon as they take successive cuts out of the budget—will leave us with a smaller version of the force we built for the cold war."

Second, Mr. Aspin says, Option C is "threat based," meaning it is tightly structured to meet clear and specific threats. "In this era of belt tightening, our citizens understandably may be reluctant to pay for defense unless there is a clear linkage between the forces and the threats those forces are designed to deal with," he says.

Mr. Aspin lists six situations "for which Americans might want military forces" in the 1990s: countering regional aggressors, combating the spread of nuclear and other mass terror weapons, fighting terrorism, restricting drug trafficking, keeping the peace, and assisting civilians.

From there on, Mr. Aspin's figuring is influenced strongly by the Persian Gulf War of 1991. For his "unit of account" in sizing threats, he adopts the "Iraq Equivalent" score developed by the Congressional Budget Office. Prewar Iraq, rated at 1.0, is the basis for the scale. North Korea, for example, rates 0.6 in land forces, 90.0 in seapower, and 2.6 in airpower.

The CBO scale considers nothing except force size and composition. In other words, it is a straight bean count, which Mr. Aspin acknowledges (although not exactly in those words).

Recognizing the need for qualitative measures, Mr. Aspin chooses the "Desert Storm Equivalent"—sized to deal with one Iraq Equivalent of threat—as the major building block for his Force C.

The basic Desert Storm Equivalent, "the force that mattered" in the Gulf War, "has six heavy divisions, an air-transportable, early-arriving light division, one Marine division on land and an excess of one brigade at sea, twenty-four Air Force fighter squadrons, seventy heavy bombers, and two early-arriving carrier battle groups, building up over time to four carrier battle groups including surface combatants," Mr. Aspin says.

Option C, according to Mr. Aspin, would provide for one Desert Storm equivalent, a Korea-sized contingency, a Panama-sized contingency, humanitarian missions, airlift, sealift, and a base for rotation of forces between the United States and overseas.

Weinbergerization and Drizzle

Mr. Aspin's numbers drew a candid

response from Air Force Chief McPeak, who said that "twenty-four squadrons is not the force we employed in the Gulf War. During Desert Storm, the US Air Force had thirty-three fighter squadrons of all types in theater. Our allies provided another eight FWE [fighter wing equivalents] or twenty-four squadrons to the effort, meaning that a 'Desert Storm Equivalent' is about fifty-seven total land-based fighter squadrons."

Noting the several force-structure alternatives devised by the House Armed Services Committee, General McPeak said, "My guess is that no one responsible for the outcome would ever sign up to those options as meeting the stated goals."

Referring to Mr. Aspin's declaration that "in the post–cold war era we will not plan on fighting long wars with high casualties," General McPeak said, "In my judgment, the options proposed would result in exactly that outcome; that is, sustained combat and higher casualties."

General McPeak's criticism figured prominently in an April 3 statement from Mr. Aspin accusing the Pentagon of "Weinbergerizing" the defense debate.

"Cap [former Secretary of Defense Caspar Weinberger] was quick to predict utter ruin if Congress deviated from his program," Mr. Aspin said. "That sort of thing cost Cap dearly. Eventually he 'Weinbergerized' himself out of the debate. His claims simply weren't credible."

He indicted both Secretary Cheney and General Powell for a revival of Weinbergerization, but bore down with special vigor on General McPeak.

"Another form of Weinbergerization," Mr. Aspin said, is "making claims on the public record that are known to be contradicted in classified information." In that context, he quoted General McPeak as saying that Option C's twenty-four squadron "Desert Storm Equivalent is not a Desert Storm Equivalent. I call it Desert Drizzle."

Mr. Aspin continued, "I can only conclude that General McPeak has not been reading the Pentagon's own classified scenarios for a renewed conflict in southwest Asia. If he had, I hope a respect for the facts would make him change his tune. I can't go into detail here, but the classified documents say McPeak is wrong and the Desert Storm Equivalent could do the job."

Leaks and Scenarios

The classified scenarios invoked by Mr. Aspin were apparently those from a planning paper leaked by a disgruntled Pentagon staffer to the New York *Times* and summarized in that newspaper February 17. The document was reported to list seven "illustrative" scenarios, including one in which Iraq invades Kuwait and Saudi Arabia and another in which Russia attacks Poland with help from Belarus (formerly Byelorussia).

Mr. Aspin sees the scenarios as vindication of his threat-based planning principle as well as confirming the assumptions of Option C.

"The Pentagon is using threat analysis internally to shape future budgets while claiming publicly that it will not work," he said. "We say it will. If the seven scenarios written as Fiscal Year 1994 budget guidance were part of the public debate, I suspect it would thoroughly validate the Desert Storm Equivalent, the basic building block in my force options."

When the Senate Armed Services Committee asked General Powell in March about the New York *Times* scenarios, he depicted them as a war-gaming exercise run to help structure the next year's defense planning guidance.

"The Base Force, I assure you, was not designed on the basis of some scenario that said we're going to have a major war up in the northeast corner of Europe," he added.

As for the Pentagon's approach to force planning, General Powell said, "I think we did do it from the bottom up, but I can't ignore the top down. I live in a top-down world. I'm not writing on a blank piece of paper."

For example, he said, "I see proposals that say 'take out another 200,000 reservists, 16,000 reservists, when I can't get the Congress to take out the reserve structure that we have been asking for for the last three and a half years."

The War-Planner's Art

Mr. Aspin paints a sharp line between his methods and those he attributes to the Pentagon. In fact, however, threat-based, bottom-up calculations are standard techniques for military planners.

They routinely use these methods—and in more detail than shows in Mr. Aspin's working papers—to run a wide variety of simulations, war games, and force-sizing exercises. Despite the appearance of mathematical precision, such calculations are no more than data-based estimates.

Actual combat seldom plays out the way it was modeled. The Gulf War, for example, took a third more fighter forces than calculated in the planning guidance for a "major regional contingency."

How well the Desert Storm Equivalent can predict requirements for a different conflict is questionable. The war was shaped by a number of factors: international support for the coalition, Saddam Hussein's tactical blundering, uncontested deployment of forces to the battle theater, the five-month interlude before combat, and more.

A change in situational variables for the next conflict could redefine the requirements rather severely.

As many in the defense community see it, Mr. Aspin has cut his estimates too fine and gives up a great many troops, divisions, ships, and air wings for a comparatively modest financial yield. His projected five-year savings, $48 billion, amount to a figure only 3.4 percent less than the Administration is requesting for the Base Force program.

For all of that, Mr. Aspin's force-structure options, coming from the chairman of the House Armed Services Committee, carry weight on Capitol Hill.

Sometime in the next few months, Senator Nunn, the most credible voice in Congress in defense matters, will almost certainly elaborate on his views.

The debate about the size and shape of US armed services in the future is far from over, but it is a good bet that the outcome will be somewhere in the area triangulated by the positions of Representative Aspin, Senator Nunn, and the Base Force. ■

Aerospace World

By Frank Oliveri, Associate Editor

The Air Force chose the team of Slingsby Aviation Ltd. of Great Britain and Northrop Worldwide Aircraft Services, Inc., in late April to build the new Enhanced Flight Screener. The aircraft, a variant of the Slingsby Firefly, will be used to screen prospective pilots for specialized undergraduate pilot training.

Air Reserve, Guard Escape Cuts

Secretary of Defense Dick Cheney delivered to Congress a list of 830 National Guard and Reserve units to be cut or closed down during the next two years. However, the move left the Air Force Reserve and Air National Guard virtually untouched.

The Pentagon plan would end the service of roughly 140,000 Guardsmen and Reservists. Some 33,000 would be dropped from the rolls in Fiscal 1992. Another 107,000 would go in Fiscal 1993. Plans call for closing down units in fifty states, the District of Columbia, and Puerto Rico.

The plan contemplates no reduction in the ANG in either year. In fact, Gen. Colin Powell, Chairman of the Joint Chiefs of Staff, reported that there would be modest growth for the ANG during this period. AFRES would lose only 742 persons—191 in Michigan this year and 551 in California next year. The reason given for the Pentagon's forbearance is that ANG and AFRES missions are worldwide, not tied to any specific theater of operations.

The overwhelming share of reductions will be taken out of the Army's backup units, the National Guard and Army Reserve. These organizations lose 125,500 spaces. The Navy Reserve is to shrink by 10,600, the Marine Corps Reserve by 2,700.

Nearly eighty percent of the targeted reserve units have primary missions calling for them to support active-duty units that have been eliminated or soon will be as a result of the dissolution of the Warsaw Pact threat in Europe.

In its March 26 message to Congress, the Pentagon claimed that the reductions will cut personnel, operations, and equipment costs by $2.1 billion in Fiscal 1993. The estimated savings by the end of Fiscal 1997: $20 billion.

A-X Agreement

The Navy and Air Force agreed that USAF participation in early development and source selection of the Navy's A-X Advanced Strike Aircraft is critical to the development of an affordable interdiction aircraft for both services.

The accord is spelled out in a formal A-X memorandum of understanding hammered out by service leaders and then made public in March. The MOU emphasizes that the Air Force must be involved in every phase of the program to ensure the production of a common aircraft that meets the needs of each service and to prevent costly changes in requirements.

The Navy has a critical need to replace the A-6 carrier-based attack aircraft, while the Air Force will need first to replace F-111s and later F-15Es. Both services, notes the MOU, "also are faced with affordability problems."

According to the MOU, the Air Force will install a deputy program manager and liaison officer, plus others, at the Navy A-X program office. The Navy will pay for the development of common and Navy-specific portions of the A-X. The Air Force will pay for technologies unique to the USAF variant.

The memorandum calls for the Chief of Naval Operations and the Air Force Chief of Staff to co-chair quarterly A-X meetings to ensure that A-X requirements are evolving properly.

Separation Program Shortfall

Some 23,259 members of the Air Force applied to receive payment under the Voluntary Separation Incentive (VSI) program or the Special Separation Benefit (SSB) program, according to the Air Force. Only 19,419 were approved.

The Air Force thus did not meet its goal of 31,500 voluntary separations—24,000 enlisted and 7,500 officers—by the April 15 deadline. It now faces the need for involuntary cuts.

Some applications were not approved because the Air Force established quotas in all career fields and some fields were oversubscribed. Many applicants have been put on a waiting list.

The VSI and SSB programs were created to entice active-duty personnel to leave the service before the end of their current tours of duty. The methods were intended to help the Air Force avoid involuntary manpower cuts.

The VSI provides the separating member annual payments equal to 2.5 percent of his or her annual basic pay, multiplied by the member's years

of service. The payments will be made in equal installments for a period equal to twice the number of years of service of the member.

Under the SSB plan, DoD would provide the separating member a lump sum payment equal to fifteen percent of annual pay multiplied by the number of service years.

The Air Force reported that, by the April 15 deadline for application, 20,193 enlistees had applied for one of the offers, with most opting for the SSB. Officers applying for the incentive programs totaled 3,066, with a slight majority seeking the VSI payment.

Each application had to be formally approved by Air Force leaders.

YF-22 Crashes

The Air Force's single flyable YF-22 fighter prototype crashed and burned on April 24, touching off an investigation into the cause of the accident. USAF officials said at the time that the service hoped to complete the probe and make results known in June.

The aircraft, the forerunner of the next-generation F-22 fighter, crashed during a test flight at Edwards AFB, Calif. The plane was built by a team of Lockheed, Boeing, and General Dynamics. This YF-22 prototype—one of two—had Pratt & Whitney engines fitted with thrust-vectoring nozzles.

Gen. Merrill A. McPeak, the Air Force Chief of Staff, told House Armed Services Committee members that the fighter program would be "essentially unaffected" by the mishap. He said that, though USAF did not have all the flight data it wanted, the prototype flying program had been scheduled to end in May anyway.

The Chief said that, in flying the plane that day, the Air Force was "out to collect supersonic data points." The YF-22 had just refueled when a telemetry problem caused officials to scrub the test.

Because of increased weight of the fuel load, Lockheed test pilot Tom Morgenfeld carried out low-approach runs to burn off fuel before landing. On one such run, Mr. Morgenfeld put down the landing gear, approached the runway, and then pulled up the gear. He then lit the afterburner to make another run.

At that point, said General McPeak, the YF-22's thrust-vectoring nozzles began "oscillation in the lateral axis." The aircraft began "porpoising" (*i.e.*, pitching rapidly up and down). The General noted that, "during one oscillation, the aircraft made contact with the ground and skidded for several thousand feet." It caught fire, but the pilot escaped with minor injuries.

The prototype suffered heavy damage. General McPeak told the House Armed Services subcommittees on R&D and procurement that the Air Force would make no attempt to repair the prototype. Nor, said General McPeak, would the service attempt to prepare the second YF-22 prototype for flight. The second YF-22 has engines built by General Electric, which lost to P&W in the Advanced Tactical Fighter competition. That aircraft has been cannibalized for parts.

Asked what could have caused the accident, General McPeak said that he could only speculate, but there was a chance it was caused by a logic problem in the flight control software. "I am utterly convinced that this is a meritorious design, . . . a splendid design," General McPeak said.

The Chief of Staff said that the Air Force could fix a software problem with relative ease, but a design flaw could have a serious impact on the program. House Armed Services Committee Chairman Rep. Les Aspin (D-Wis.) said the existence of such a design problem would require the government to reevaluate the high-priority fighter program.

Relief Flights to Turkey

Military Airlift Command aircraft carried out emergency relief operations in Turkey in the wake of a series of earthquakes in March that left hundreds dead and numerous villages destroyed in the eastern part of that nation.

MAC began the relief flights on March 14. The Air Force News Service reported that C-130 crews deployed from Little Rock AFB, Ark., to RAF Mildenhall, UK, and delivered more than 50,000 pounds of equipment and supplies to the stricken region within forty-eight hours. The C-130s, along with three MH-60 helicopters from Incirlik AB, Turkey, and Pirinclik AB, Turkey, went into action only twelve hours after the first quakes hit.

Initial relief supplies included food, water, warm clothing, and blankets, the service said.

US, Russia Cooperate on POWs, MIAs

The United States and Russia formed a joint commission to probe unresolved cases of US servicemen who became prisoners of war or were missing in action during World War II, the Korean War, and the Vietnam War.

Malcolm Toon, US ambassador to the Soviet Union during the Reagan Administration, has been designated the President's representative and Chairman of the US delegation to the commission. Also included in the commission are Sens. John F. Kerry (D-Mass.) and Robert Smith (R–N. H.) and Reps. Pete Peterson (D-Fla.) and John Miller (R-Wash.).

The Russian delegation will be chaired by Gen. Dmitri Volkogonov, senior advisor to President Yeltsin. The first meeting was held in late March, shortly after Washington and Moscow set up the panel.

Gen. H. T. Johnson Nominated

President Bush nominated Gen. H. T. Johnson to become the first

The YF-22 crashed and burned after severe oscillation of the thrust-vectoring nozzles forced it into a gear-up landing. The Air Force said that about ninety percent of the aircraft's testing had been completed. Air Force Chief of Staff Gen. Merrill A. McPeak speculated that an investigation would reveal flight-control software problems.

Texas Instruments' OmniView laser-based computer display system produces a true three-dimensional image (here, antitank and antiradar missiles) in real time. The system allows one to view the image from any angle without viewing aids. The image's visual perspective changes with the viewing angle, as with real objects.

commander of Air Mobility Command, a newly formed USAF major command that has authority over long-range airlifters, many tactical airlifters, and the majority of refueling aircraft. The new command, activated June 1, is based at Scott AFB, Ill.

General Johnson was commander in chief of Military Airlift Command, which deactivated June 1.

Secretary of Defense Cheney announced the nomination in March. He said that the President had nominated General Johnson for reappointment to the grade of general and assignment as commander in chief of US Transportation Command, a position he held previously.

Nunn Calls For More Cuts

Sen. Sam Nunn, the Georgia Democrat who chairs the Senate Armed Services Committee, called for cutting President Bush's five-year defense spending plan by another $30 billion to $35 billion. He said the reductions should not come this year, but in the outyears.

In his revised Fiscal 1992–97 program, disclosed in January, the President proposed trimming $50 billion from the defense plan over the six-year period. Senator Nunn's view is that the $50 billion figure could safely be increased to $80 billion or $35 billion.

The Senator, however, supported the White House's defense request for Fiscal 1993. In a letter to the chairman and ranking Republican of the Senate Budget Committee in March, he claimed that tampering with the President's plan would be unwise. Said the senator, "I do not believe it is possible or desirable to reduce the military or civilian personnel levels in the Defense Department at a faster rate than that proposed."

He noted that, just to make the reductions already proposed by the President in 1993, the Pentagon will shed about a million troops and civilians by 1996, while an additional million positions will be lost in the defense industry. Senator Nunn pointed out that this drawdown is unlike any other in history because US military forces are made up solely of volunteers.

Senator Nunn's letter was short on specifics, although he did highlight the possibility of further reductions in troops in Europe and reductions in "old cold war operating tempos of our forward deployed forces." He said that the savings should be applied to deficit reduction.

Doolittle Raid Reenacted

The famed World War II "Doolittle Raid" was reenacted in mid-April with the US aircraft carrier *Ranger* launching two vintage B-25 Mitchell bombers from its deck. The carrier did not fling the plane into the air with steam-powered catapults, as is the practice on modern carriers. Rather, the plane powered up on the fantail, rolled forward, and became airborne, just as the Doolittle Raiders did.

The original raid, led by Lt. Col. James H. Doolittle, was composed of sixteen B-25s and their crews. The aircraft took off from the deck of the Navy carrier *Hornet* on April 18, 1942, and struck targets in Tokyo 650 miles away. The mission boosted morale in the US and caused the Japanese to return some forward deployed units to the home islands. *[See "The Doolittle Raid," April 1992, p. 54.]*

Total Weapon Costs Plunge

The Pentagon's latest Selected Acquisition Report, released in April, decreased in cost by $58.8 billion in the last quarter of 1991. The SAR reflects the projected long-term cost of all major Defense Department weapons and hardware programs. It was the largest such dip since 1987 and was caused largely by numerous reductions in major weapons.

Of the total reduction, $36 billion can be attributed to reduced quantities, $18.5 billion to price adjustments, and $1 billion to revised estimates.

The report revealed for the first time the total program estimate for the F-22 air-superiority fighter, with the figure set at $96.4 billion in current dollars for 648 aircraft. Of that amount, $79.6 billion is for procurement and military construction and $16.8 billion for development.

The projected cost to develop the F/A-18E/F jumped from $3.97 billion to $5.11 billion, a leap attributed to revised estimates, according to DoD.

The Air Force saved $1.6 billion on the Advanced Cruise Missile program after terminating the program well short of the 1,000 it once planned to buy. Termination of the Small ICBM, SRAM II, and SRAM-T saved several billion dollars.

VISTA/F-16 Flies

The Air Force's Variable Stability In-Flight Simulator Test Aircraft (VISTA)/F-16 flew for the first time in April at the Fort Worth, Tex., General Dynamics facility.

The aircraft is to be used for in-flight testing of high-speed control systems. The fifty-two-minute flight was followed by four more test flights, which completed the customer-acceptance phase of the program. The VISTA/F-16 will replace the existing variable stability T-33 aircraft.

Patriot Success Claims Modified

In April, the Army gave Congress a modified picture of the Patriot missile's success rate in the Persian Gulf War, scaling back somewhat its bullish assessment of the system's performance against Iraqi Scud missiles.

Maj. Gen. Jay M. Garner, the Army's assistant deputy chief of staff for Operations, Plans, and Force Development, said that the Army, using a new methodology, found that more than forty percent of the engagements of Iraqi Scud missiles over Israel and seventy percent of the engagements over Saudi Arabia were successful.

The original Army assessment, released in December 1991, set the success rate at fifty percent over Israel and eighty percent over Saudi Arabia.

Congressional staffers voiced skepticism about the original estimate, causing the Army to take a second look, which focused to a larger extent on damage caused by the Scuds on the ground.

Despite the diminished assessment, General Garner maintained that the performance of the Patriot was "an American success story."

ERIS Close, but No Cigar

An SDI Exoatmospheric Reentry Interceptor Subsystem (ERIS) test failed to destroy a mock warhead in space but was able to differentiate between the real target and a decoy, according to the Army's Strategic Defense Command.

The command claimed in March that ERIS failed to come close enough to the target to kill it. The test included the launch from Vandenberg AFB, Calif., of a Minuteman I target vehicle and one balloon decoy. The ERIS missile was launched from Kwajalein Atoll in the central Pacific. ERIS is a kinetic-kill vehicle.

This was the second test of its kind. The first test of ERIS took place in January 1991 and was successful against two decoys. The second test was the last for ERIS, with the results being used to aid the Ground-Based Interceptor program.

Cheney Pans Intelligence Bills

Secretary Cheney criticized congressional attempts to reorganize the US intelligence community. In a March letter to Rep. Les Aspin, the Wisconsin Democrat who chairs the House Armed Services Committee, the Pentagon leader expressed numerous concerns and called for a presidential veto should any of several current reform measures be approved.

H.R. 4165, the "National Security Act of 1992," and Senate bill S. 2198, the "Intelligence Reorganization Act of 1992," both sought to reorganize US intelligence under a single national intelligence czar.

In his letter, Secretary Cheney said, "Both bills are unnecessary and so severely flawed that selective amendments would not make either of them acceptable. They contain a number of provisions which needlessly duplicate actions already under way, or completed, to improve the functioning of the intelligence community, without legislation."

Secretary Cheney said that the roles of the Defense Secretary and the Director of Central Intelligence have evolved to meet US needs. He added that Congress, by proposing the establishment of a Director of National Intelligence, would create a position that would usurp certain responsibilities of the Defense Secretary that, "in the interest of efficiency and effectiveness," should remain at the Pentagon.

F/A-18E/F Rates Proposed

The Navy's official plans call for building 1,000 F/A-18E/F Hornet strike fighters, with annual production peaking at seventy-two aircraft in 2007.

The service has produced and provided a funding profile carrying the program through 2015. It calls for twelve aircraft each year in 1997 and 1998, eighteen in 1999, thirty in 2000, forty-eight per year from 2001 through 2006, and seventy-two in 2007–15. The Navy figures add up to 1,008 aircraft.

If a number of F/A-18C/Ds can be kept in service longer, the overall number of F/A-18E/Fs could be reduced. However, the overall production rate will not affect initial production ramp-up.

The Navy said in March that the overall production of the F/A-18E/F would cost nearly $5 billion, a considerable jump from the 1991 estimate of $3.3 billion.

Supersonic Performance Testing

In April, NASA began supersonic flight tests of a new electronic control system, called Performance Seeking Control, that will improve the performance, reliability, and safety of high-speed military aircraft, future commercial supersonic transports, and the X-30 National Aerospace Plane (NASP).

A NASA F-15 research aircraft is testing the system at NASA's Ames Dryden Flight Research Facility at Edwards AFB, Calif. The system monitors the plane's various computerized control systems in flight and automatically adjusts the combination of such factors as fuel flow and airflow into the engines to get the most thrust from the fewest possible revolutions per minute.

NASA said that researchers expect Performance Seeking Control to produce about nine percent greater thrust and ten percent less fuel consumption in the F-15 when it cruises above the speed of sound.

New PEP for SFW

Under Secretary of Defense for Acquisition Donald Yockey approved low-rate initial production for the Air Force's Sensor-Fuzed Weapon in March but ordered that production be maintained at minimum rates for four years to allow for the development of a Producibility Enhancement Program (PEP).

Mr. Yockey explained that recent changes in acquisition policy require a closer look at SFW producibility and cost as a result of the "extraordinary" length of the system's development cycle, which lasted about twelve years. Mr. Yockey indicated that, because of the time lapse, "the current SFW design is far from today's state of the art."

He added, "We now have the opportunity to improve the producibility of this weapon while concurrently

Senior Staff Changes

RETIREMENTS: B/G John W. **Douglass;** L/G Vernon J. **Kondra;** L/G Robert H. **Ludwig;** L/G Leo W. **Smith** II; M/G John H. **Voorhees;** L/G C. Norman **Wood.**

PROMOTIONS: To be **Lieutenant General:** Malcolm B. **Armstrong;** John E. **Jackson,** Jr.; James L. **Jamerson;** Walter **Kross.**

To be **Brigadier General:** Kurt B. **Anderson;** William J. **Begert;** Allen D. **Bunger;** Roger E. **Carleton;** John P. **Casciano;** James S. **Childress;** William J. **Donahue;** Marvin R. **Esmond;** Bobby O. **Floyd;** George A. **Gray** III; Jeffrey R. **Grime;** John W. **Hawley;** William S. **Hinton,** Jr.; Walter S. **Hogle,** Jr.; Clinton V. **Horn;** Hal M. **Hornburg;** Dennis K. **Hummel;** Robert G. **Jenkins;** Leonard F. **Kwiatkowski;** Thomas J. **Lennon;** Lance W. **Lord;** Stephen C. **Mannell;** Michael J. **McCarthy;** Thomas R. **Mikolajcik;** George W. **Norwood;** Richard R. **Paul;** Donald L. **Peterson;** Richard H. **Roellig;** David A. **Sawyer;** Ervin C. **Sharpe,** Jr.; Lawrence E. **Stellmon;** Thomas A. **Twomey;** David L. **Vesely;** John L. **Welde;** John R. **Wormington;** David L. **Young.**

CHANGES: M/G (L/G selectee) Malcolm B. Armstrong, from Vice CINC, Hq. PACAF, Hickam AFB, Hawaii, to Cmdr., 21st AF, AMC, replacing retired L/G Vernon J. Kondra . . . **B/G Richard C. Bethurem,** from IG, Hq. TAC, Langley AFB, Va., to IG, Hq. ACC, Langley AFB, Va. . . . **M/G Lawrence E. Boese,** from DCS/Ops. and Dep. Dir., Ops., TACOS, Hq. TAC, Langley AFB, Va., to DCS/Ops., Hq. ACC, Langley AFB, Va. . . . **Col. (B/G selectee) Allen D. Bunger,** from DCS/Financial Mgmt. and Comptroller, Hq. MAC, Scott AFB, Ill., to Dir., Budget Ops. and Chairman, OBRC, OSAF, Washington, D. C. . . . **Col. (B/G selectee) John P. Casciano,** from DCS/Intel., Hq. TAC, Langley AFB, Va., to DCS/Intel., Hq. ACC, Langley AFB, Va. . . . **M/G Robert E. Dempsey,** from Cmdr., 3d AD, SAC, Hickam AFB, Hawaii, to C/S, Hq. AMC, Scott AFB, Ill., replacing M/G William H. Sistrunk.

Col. (B/G selectee) William J. Donahue, from DCS/Communications-Computer Sys., Hq. TAC, Langley AFB, Va., to DCS/Communications-Computer Sys., Hq. ACC, Langley AFB, Va. . . . **B/G (M/G selectee) Phillip J. Ford,** from DCS/P&P, Hq.MAC, Scott AFB, Ill., to DCS/P&P, Hq. AMC, Scott AFB, Ill. . . . **B/G Thomas D. Gensler,** from Command Surgeon, Hq. TAC, Langley AFB, Va., to Command Surgeon, Hq. ACC, Langley AFB, Va. . . . **B/G (M/G selectee) Thomas R. Griffith,** from DCS/Plans, and Dep. Dir., Plans, TACOS, Hq. TAC, Langley AFB, Va., to DCS/Plans, Hq. ACC, Langley AFB, Va. . . . **Col. (B/G selectee) Jeffrey R. Grime,** from IG, Hq. PACAF, Hickam AFB, Hawaii, to Dep. Dir., Legislative Liaison, Hq. USAF, Washington, D. C., replacing B/G John O. McFalls III . . . **M/G Kenneth L. Hagemann, Sr.,** from Dir., Ops., Hq. DNA, Washington, D. C., to Dir., Hq. DNA, Washington, D. C.

B/G John W. Handy, from Cmdr., Airlift Control Ctr., MAC, Scott AFB, Ill., to Cmdr., Tanker Airlift Control Ctr., AMC, Scott AFB, Ill. . . . **B/G Charles R. Heflebower,** from Dir., Assignments, Hq. AFMPC, Randolph AFB, Tex., to Dir., Personnel Prgms., DCS/Pers., Hq. USAF, Washington, D. C., replacing retiring M/G William J. Porter . . . **M/G Larry L. Henry,** from DCS/P&R, Hq. ATC, Randolph AFB, Tex., to Spec. Ass't to DCS/P&O, Hq. USAF, Washington, D. C. . . . **Col. (B/G selectee) Thomas L. Hemingway,** from Staff Judge Advocate, Hq. MAC, and Chief Counsel, Hq. USTRANSCOM, Scott AFB, Ill., to Staff Judge Advocate, Hq. AMC, and Chief Counsel, Hq. USTRANSCOM, Scott AFB, Ill. . . . **B/G Henry M. Hobgood,** from C/S, Hq. TAC, Langley AFB, Va., to C/S, Hq. ACC, Langley AFB, Va. . . . **M/G (L/G selectee) John E. Jackson, Jr.,** from Cmdr., Hq. AFMPC, Randolph AFB, Tex., to Cmdr., 15th AF, and Dir., 15th AF Combat Ops. Staff, AMC, March AFB, Calif., replacing retiring L/G Robert D. Beckel.

M/G (L/G selectee) James L. Jamerson, from ACS/Ops., SHAPE, NATO, Mons, Belgium, to Vice CINC, USAFE, and Dir., EACOS, Ramstein AB, Germany, replacing retiring L/G Clifford H. Rees, Jr. . . . **Gen. Hansford T. Johnson,** from CINC, Hq. USTRANSCOM, and CINC, Hq. MAC, Scott AFB, Ill., to CINC, Hq. USTRANSCOM, and Cmdr., Hq. AMC, Scott AFB, Ill. . . . **M/G John P. Jumper,** from Dep. Dir., Political Mil. Affairs, J-5, Jt. Staff, Washington, D. C., to Senior Mil. Ass't, OSD, Washington, D. C. . . . **M/G (L/G selectee) Walter Kross,** from Cmdr., AMC (Prov.), Scott AFB, Ill. to Vice Cmdr., Hq. AMC, Scott AFB, Ill. . . . **M/G Paul E. Landers, Jr.,** from DCS/Ops. and Transportation, Hq. MAC, Scott AFB, Ill., to DCS/Ops. and Transportation, Hq. AMC, Scott AFB, Ill. . . . **B/G Donald E. Loranger, Jr.,** from DCS/Quality Support and Readiness, Hq. MAC, Scott AFB, Ill., to DCS/Quality Support and Readiness, Hq. AMC, Scott AFB, Ill.

Col. (B/G selectee) Stephen C. Mannell, from Chief, P&P, Security Police, Hq. USAF, Washington, D. C., to Chief, Security Police, Hq. USAF, Washington, D. C., replacing retired B/G Frank K. Martin . . . **B/G Michael A. McAuliffe,** from DCS/Engineering and Services, Hq. TAC, Langley AFB, Va., to DCS/Engineering and Services, Hq. ACC, Langley AFB, Va. . . . **B/G John O. McFalls III,** from Dep. Dir., Legislative Liaison, Hq. USAF, Washington, D. C., to DCS/Ops. and Readiness, Hq. ATC, Randolph AFB, Tex., replacing B/G (M/G selectee) Everett H. Pratt, Jr. . . . **B/G (M/G selectee) Michael D. McGinty,** from Vice Cmdr., Hq. AFMPC, Randolph AFB, Tex., to Cmdr., Hq. AFMPC, Randolph AFB, Tex., replacing M/G (L/G selectee) John E. Jackson, Jr. . . . **B/G George K. Muellner,** from DCS/Requirements, Hq. TAC, Langley AFB, Va., to DCS/Requirements, Hq. ACC, Langley AFB, Va. . . . **M/G John M. Nowak,** from DCS/L&E, Hq. MAC, Scott AFB, Ill., to DCS/L&E, Hq. AMC, Scott AFB, Ill.

M/G Carl G. O'Berry, from Dir., Command Control Sys. and Logistics, J-4/6, Hq. USSPACECOM, and DCS/Sys. Integration, Logistics, and Support, Hq. AFSPACECOM, Peterson AFB, Colo., to DCS/C^4, Hq. USAF, Washington, D. C., replacing retired L/G Robert H. Ludwig . . . **B/G (M/G selectee) Everett H. Pratt, Jr.,** from DCS/Ops. and Readiness, Hq. ATC, Randolph AFB, Tex., to DCS/P&R, Hq. ATC, Randolph AFB, Tex., replacing M/G Larry L. Henry . . . **B/G Charles H. Roadman II,** from Command Surgeon, Hq. MAC, Scott AFB, Ill., to Command Surgeon, Hq. AMC, Scott AFB, Ill. . . . **L/G Robert L. Rutherford,** from Vice CINC, Hq. MAC, Scott AFB, Ill., to Vice CINC, Hq. PACAF, Hickam AFB, Hawaii, replacing M/G (L/G selectee) Malcolm B. Armstrong . . . **M/G Ronald C. Spivey,** from Spec. Ass't to Cmdr., Hq. TAC, Langley AFB, Va., to DCS/Log., Hq. ACC, Langley AFB, Va. . . . **M/G Frank E. Willis,** from DCS/Requirements, Hq. MAC, Scott AFB, Ill., to DCS/Requirements, Hq. AMC, Scott AFB, Ill.

SENIOR EXECUTIVE SERVICE (SES) CHANGES: Alan P. Babbitt, from Principal Ass't DCS/Financial Mgmt. and Comptroller, Hq. AFSC, Andrews AFB, Md., to Dep. for Hazardous Materials and Waste Mgmt., Hq. USAF, Washington, D. C. . . . **Louis K. Dumas,** from Ass't DCS/P&P, Hq. AFLC, Wright-Patterson AFB, Ohio, to Dir., Technical and Industrial Support, Sacramento ALC, McClellan AFB, Calif., replacing Edward Riojas . . . **Blaise J. Durante,** to Assoc. Dep. Ass't Sec., Mgmt. Policy and Prgm. Integration, OSAF, Washington, D. C. . . . **John E. Lang,** from Ass't DCS/Financial Mgmt., Hq. AFLC, Wright-Patterson AFB, Ohio, to Dir., Commodities Mgmt., Oklahoma City ALC, Tinker AFB, Okla., replacing Thomas L. Miner . . . **Thomas L. Miner,** from Dir., Commodities Mgmt., Oklahoma City ALC, Tinker AFB, Okla., to Ass't DCS/Financial Mgmt., Hq. AFLC, Wright-Patterson AFB, Ohio, replacing John E. Lang . . . **Edward Riojas, Jr.,** from Dir., Technical and Industrial Support, Sacramento ALC, McClellan AFB, Calif., to Dir., Financial Mgmt., San Antonio ALC, Kelly AFB, Tex., replacing James C. Wallin . . . **James C. Wallin,** from Dir., Financial Mgmt., San Antonio ALC, Kelly AFB, Tex., to Ass't DCS/P&P, Hq. AFLC, Wright-Patterson AFB, Ohio, replacing Louis K. Dumas. ■

improving reliability, thereby substantially reducing life-cycle cost."

Mr. Yockey ordered that the PEP be funded through reprogramming actions in Fiscal 1992 and 1993. Once those are completed, a Defense Acquisition Board review will be required before full-rate production. The DAB will also consider potential follow-on applications for the more cost-effective SFW munitions.

Mr. Yockey directed the Air Force to "address the SFW integration with the Advanced Interdiction Weapon System (AIWS) program at the AIWS DAB, submit updated criteria related to Milestone III production approval, revise the Acquisition Program Baseline and the Acquisition Strategy Report accordingly and submit them to Mr. Yockey for his approval, prepare and forward a SFW Program Protection Plan and other documents in accordance with the decision to OSD, and submit a revised [Testing and Evaluation Master Plan] that includes follow-on operational test and evaluation activities with PEP-configured SFW units."

Shipboard JTIDS Delivered

A joint program office at Air Force Systems Command's Electronic Systems Division delivered the first production-model, Class 2H, Navy shipboard Joint Tactical Information Distribution System (JTIDS). It was installed on the guided missile cruiser USS *Arkansas* in February.

The second JTIDS system was delivered to USS *Carl Vinson,* a *Nimitz*-class aircraft carrier, later that month.

JTIDS is a jam-resistant, secure, high-capacity digital data and voice information distribution system. It transfers tactical information among combat elements, data collection elements, and command-and-control centers within the tactical theater of operations.

The first terminals were built by GEC-Marconi. Rockwell-Collins will also produce JTIDS terminals.

New Requirements for ASPJ

The Defense Department's Inspector General recommended that cost estimates and independent cost analysis be obtained for the Airborne Self-Protection Jammer (ASPJ), that no further contracts be issued until operational test and evaluation is completed, and that the Navy immediately move to a competitive selection decision on the program. The results of the IG's audit were released in March.

The ASPJ was developed to provide a common defensive electronic countermeasures system for tactical

USAF photo by SSgt. Joseph Haughwout

Richard D. Schultz, executive director of the National Collegiate Athletic Association, is strapped into an ejection seat simulator by Capt. Dave Evans of the 27th Fighter Squadron, Langley AFB, Va. Mr. Schultz learned ejection seat procedures, toured areas of the flight line, took an F-15 orientation flight, and was briefed on Air Force restructuring.

aircraft. It is a radio frequency jammer that gives the enemy a false location of US aircraft. The Air Force was once a joint member in the program but terminated its participation. The Navy ASPJ program will cost $3 billion overall.

The ASPJ was a joint venture by ITT and Westinghouse Electric Corp.

When the Air Force opted out of the program, the Navy reduced its requirement for the jammers to about 400 systems. The IG recommended that the Navy revise its acquisition strategy to account for the significant reductions in the ASPJ program and the lack of operational test and evaluation on representative ASPJ systems. The Air Force and Navy originally planned to procure 2,300 jammers jointly.

Brilliant Eyes Deployment

The Brilliant Eyes space-based sensor cannot be deployed in time to meet the 1996 congressional deadline for fielding a treaty-compliant missile defense, Strategic Defense Initiative Organization (SDIO) Director Henry Cooper said in April.

Brilliant Eyes would work in tandem with ground-based interceptors. In testimony before the House Appropriations Committee, Dr. Cooper said a single site at Grand Forks, N. D., could protect the continental United States from a ballistic missile attack. Brilliant Eyes could be deployed by the end of the century.

Dr. Cooper said SDIO was exploring the possible use of three other types of systems in the interim, ranging in cost from $400 million to $1.4 billion over the next five years.

Topaz Space Reactor Buy

The Bush Administration approved the purchase of an unfueled, Soviet-built Topaz II nuclear space reactor—at a cost of $7.5 million—plus four satellite thrusters and plutonium fuel for space probes.

White House Press Secretary Marlin Fitzwater said that, because of the changes taking place in the former Soviet Union, unique opportunities have opened for the US and private industry to expand trade relations with the new republics. Testing on Topaz, which is not for operational use, will be conducted by the University of New Mexico, Air Force Phillips Laboratory, and Los Alamos and Sandia national laboratories.

Defense Industry Preservation

The House Armed Services Committee's defense industrial base panel recommended that the country use a portion of next year's defense savings to meet urgent national needs for cleanup of the environment, transportation, energy conservation, and communication. It also called for preserving elements of the defense industrial base.

The panel specifically suggested that development of dual-use technologies, such as the V-22 tiltrotor aircraft and the National Aerospace Plane, be accelerated. This would allow those systems to be introduced to the commercial market sooner, said the panel members.

The House panel also recommended that "silver bullet" production be promoted for systems like the F-117 Stealth fighter.

The panel's other short-term recommendations included investing in Industrial Modernization Improvement Program and Manufacturing Technology programs to promote facility modernization, increasing the role of the Defense Advanced Research Projects Agency in technology applications and advanced manufacturing technology, and reducing barriers to closer integration of civilian and military production.

According to Rep. Dave McCurdy (D-Okla.), the panel's chairman, "The recommendations can be viewed as an insurance policy for our future. By applying unique defense industry worker skills to national infrastructure needs, we preserve our economic health while retaining a critical technical skills base in the event of an unforeseen military threat."

News Notes

- In early April, Thomson-CSF and the Carlyle Group defeated Lockheed and Martin Marietta in a bid to buy out LTV's Aerospace and Defense Co. The Thomson team, which also includes Hughes, will pay $450 million for the aircraft and missile divisions of the Dallas-based contractor. Thomson and Hughes will take LTV Missiles and Electronics, and Carlyle will take LTV Aircraft Products.
- Orbital Sciences Corp. and Boeing Canada successfully completed two test flights of the Excalibur Supersonic Target Missile System in March. The two missiles were fired from a Canadian Forces auxiliary vessel at sea on the NASA Wallops Island test range. The missile is made to counter several different offensive threats.
- Wright Laboratory issued a request for proposal to General Electric and Martin Marietta in April for development and demonstration of the Advanced Infrared Search and Track System, which could be used to upgrade the F-22.
- Turkey will build at least forty additional F-16 fighter aircraft under a letter of offer and acceptance signed by the Turkish government and DoD. Turkish Aerospace Industries, in a joint venture with General Dynamics, will do most of the work.
- In March, the C-17 airlifter was grounded for the third time because of fuel leaks. The aircraft resumed flights in early April.

Index to Advertisers

■ The Air Force decided to split the annual fighter engine competition between Pratt & Whitney and General Electric. It will buy fourteen P&W F100-PW-229s and twelve GE F110-GE-129 engines in March. Almost all of the engines will be used in F-16s.

■ Army Assistant Secretary for Research, Development, and Acquisition Stephen Conver said in April that Congress should be more "benign" toward foreign military sales if the industrial base is to survive. This would not only keep production lines warm but also keep foreign competitors from growing too strong.

■ In April, Texas Instruments delivered its first laser-based computer display system that produces true three-dimensional images in real time to an undisclosed DoD intelligence organization. The 3-D system is called OmniView. The system generates a 3-D image by projecting light beams on a rotating helical surface. Points are plotted in X, Y, Z space to provide a real spatial (3-D) image.

■ The Air Force successfully demonstrated in mid-April the ability of a test interceptor kinetic-kill vehicle to acquire, track, and define a missile body during flight. This test was important to SDIO's space-based interceptor technology because space-based interceptors will be required to track and maneuver virtually the same way. The test took place at the National Hover Test Facility at Edwards AFB, Calif. The vehicle hovered for eight seconds while tracking a burning rocket motor half a mile away.

■ Gen. John Michael Loh, Air Combat Command Commander and former Commander of Tactical Air Command, told the Senate Armed Services Committee in April that he is confident that the F-22 will move into production on schedule. Despite the Pentagon's new acquisition strategy that limits production of new systems, said the General, the program will be strengthened by the need to replace the Air Force's aging F-15s.

Purchases

The Army awarded McDonnell Douglas Helicopter Co. a $21 million modification to a firm fixed-price contract for advanced procurement funding for the United Arab Emirates' production buy of twenty AH-64 aircraft and twelve AH-64A for Greece. Expected completion: February 28, 1995.

The Air Force awarded Northrop Corp. a $219 million face-value increase to a fixed-price incentive contract for funding of Fiscal 1991 long lead requirements for the last five B-2 production aircraft. Expected completion: May 1996.

The Air Force awarded Pratt & Whitney an $8.8 million face-value increase to a firm fixed-price contract for long lead funding for twenty two F100-PW-220 engines in calendar year 1992 and fifteen F100-PW-220 engines in calendar year 1993, applicable to the F-16. Expected completion: December 1993.

Awards

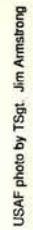
The American Defense Preparedness Association presented Defense Secretary Cheney with its 1992 Defense Industry Award at its annual meeting in April. The award is given to an American who has made an outstanding contribution toward increasing public awareness about US defense.

The Eisenhower World Affairs Institute awarded National Security Advisor Brent Scowcroft the first Eisenhower Leadership Prize on June 5. Mr. Scowcroft declined the $25,000 cash award. ■

The Air Force revises its program to fit smaller budgets and changing circumstances.

Adjusting to Hard Times

By Robert S. Dudney, Executive Editor



USAF photo by TSgt. Jim Armstrong

With budgets declining, the Air Force will have to place greater emphasis on high-quality upkeep to get the most out of the existing air fleet. SrA. Steve Chavez, right, cleans an F-16 canopy as part of his duties with the 63d Aircraft Maintenance Unit, MacDill AFB, Fla.

VIRTUALLY every part of the operational Air Force is undergoing rapid, sometimes dramatic, change. As USAF's new budget blueprint makes clear, the service has produced a revamped force program to match.

In this program, the relative importance of strategic nuclear forces declines. Conventional capabilities, however, gain in strength and prominence. Topping the list of the favored conventional systems are the F-22 fighter, C-17 airlifter, AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM), and E-8 Joint Surveillance and Target Attack Radar System (Joint STARS) airplane.

The service is determined to maintain a high state of combat readiness. The Air Force, moreover, looks to a very strong future in space and in command, control, communications, and intelligence (C^3I).

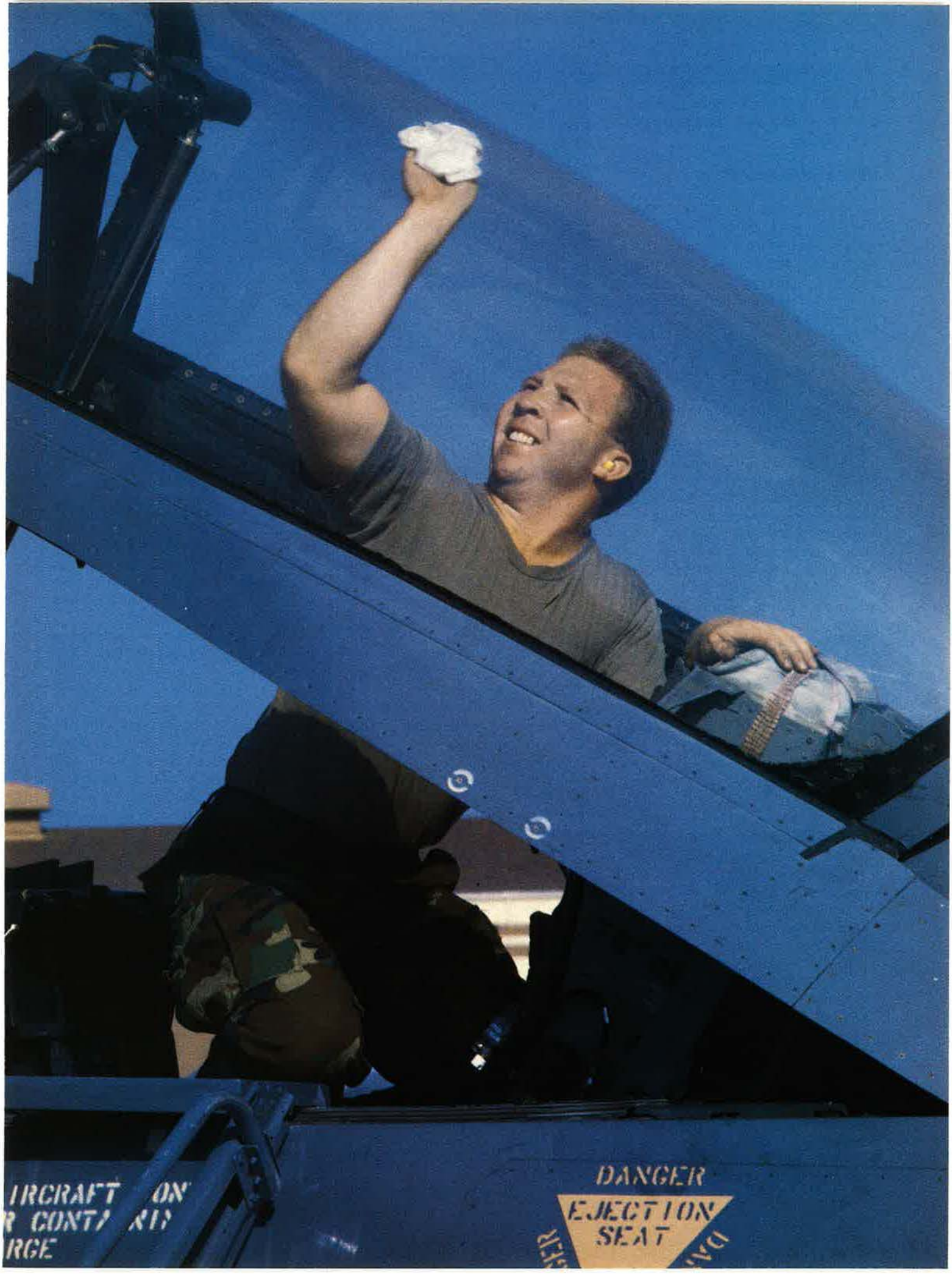
Air Force budget experts have prepared a number of charts that plot trends with respect to the financing of vital missions. They demonstrate important shifts in the ratio of expenditures, by mission, over the six-year period 1987–93.

What do these charts show? The big budgetary winner is the global mobility mission, funding of which goes up 3.2 percentage points between 1987 and 1993. Next in line among winners are space and C^3I, up by two percentage points over the six-year period. Support for the care and training of Air Force personnel increases by nearly a full percentage point. The funding of power projection rises by a lesser amount.

The big loser, in budgetary terms, is strategic nuclear deterrence. Its funding, as a share of budget, falls by a whopping 4.4 percentage points during the six-year period. Various materiel programs also suffer.

The Air Force's program focuses more on current operations than modernization. The service reckons that, in Fiscal 1993, it will commit 50.7 percent of its budget to fund such day-to-day activities as flying hours and weapon maintenance. It will use 49.3 percent of the 1993 budget for long-term investment, mostly in hardware. By 1997, however, the gap will have widened, with the Air Force spending fifty-two percent of its funds on operations and forty-eight percent on modernization.

The FY 1993 USAF budget comes to $83.9 billion in budget authority,


DANGER
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measured in 1993 dollars. The figure marks a real, inflation-adjusted drop of $2.7 billion—some three percent—from the Fiscal 1992 budget enacted by Congress.

Where the Money Goes

One year ago, when the Air Force submitted its two-year, Fiscal 1992–93 budget proposal, the service thought the Fiscal 1993 total would be $88.1 billion in 1993 dollars. After many cuts and revisions, the revised 1993 budget that went to Congress in January had lost $4.2 billion.

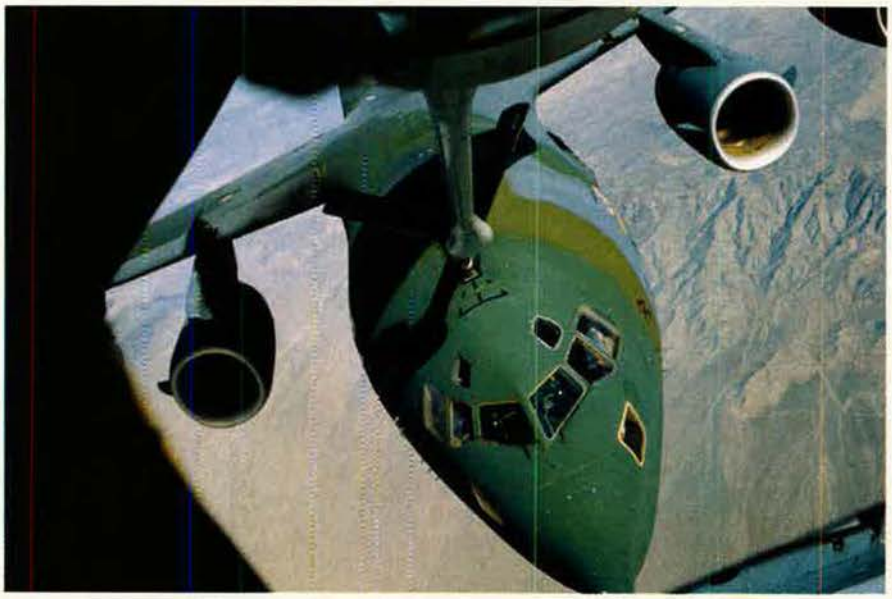
Of the 1993 amount that the Pentagon allocated to the three military departments, the Air Force got 36.2 percent. The Navy Department got a shade more—36.5 percent—but it must fund both the Navy and Marine Corps. The Army wasn't close to either.

The Air Force's 1993 plan calls for spending $14.5 billion for research and development, $24.6 billion for hardware procurement, $18 billion for operations and maintenance, $18.6 billion for military personnel, $1.1 billion for military construction, and $1.3 billion for family housing. Another $5.9 billion goes to fund programs in the Air National Guard and Air Force Reserve.

The full portrait of the future Air Force program won't be known until the Pentagon and the Air Force shake hands over the Fiscal 1994–99 Six-Year Defense Plan, a long-range blueprint now being debated and due to be made public early next year. However, the general trends are clear.

The future Air Force will be a lean outfit. Secretary of Defense Dick Cheney says that, over the past three years, the US slashed more than 1,000 aircraft from USAF holdings. The number of aircraft in the active force, he adds, is lower than at any time since the Korean War, and more cutting is in store.

The nuclear deterrence mission is to be deemphasized in program terms. The most conspicuous sign is that, in its most recent spending blueprint, the Air Force finances no long-range strategic nuclear missile program and commits only $40.3 million—a relative pittance—to sprucing up those that exist. The budget carries out the cancellations of the Air Force's last active programs—the Peacekeeper rail-garrison mobility system and the Midgetman Small ICBM and its associated mobility system.



The first C-17 transport takes on fuel high over Edwards AFB, Calif. The advanced long-range airlifter is among a handful of new systems at the top of the Air Force's list of favored conventional programs. The service plans to spend $2.7 billion in 1993 for eight more C-17s.

To help compensate for the terminations, the Pentagon will fund an improved guidance package for the Minuteman III and will take steps to extend its useful service life well into the next century. Nevertheless, the days of the big missile research and production programs are over.

Meanwhile, plans call for the Air Force's complement of intercontinental ballistic missiles to drop from 930 today to 852 at the end of Fiscal 1993. The entire cut will be taken out of the Minuteman force. Pentagon officials, in their planning for the Base Force, envision reductions that would shrink the ICBM force to only 550 missiles—500 Minuteman IIIs and fifty Peacekeepers.

Elsewhere in the nuclear force, production of the stealthy AGM-129 Advanced Cruise Missile, once projected to hit 1,000 weapons, will be halted at no more than 640 weapons and perhaps at 580. Also canceled is the SRAM II for nuclear bombers.

Heavy Political Pressure

The most dramatic shift in the Air Force's program concerned the B-2 Stealth aircraft, once viewed primarily as a penetrating bomber for the strategic nuclear mission. Under heavy political pressure, USAF agreed to accept termination of the B-2 program after production of twenty aircraft, rather than the seventy-five it wanted.

The Air Force plans additional work to enhance the conventional capability of the B-2. In the conventional role, the B-2 would serve as the Air Force's ultimate "silver bullet," short on numbers but long on combat payoff. The bomber can carry sixteen precision guided weapons.

The B-2 program is expected to cost $4 billion in Fiscal 1993—$1.3 billion for development work and $2.7 billion to buy the final four aircraft of a twenty-plane buy. After that, the Pentagon will shut down the program and, in so doing, avoid $14.5 billion in procurement costs through 1997. Still, the B-2 will consume a big chunk of available funds for aircraft procurement. The aircraft procurement budget comes in at $10.9 billion this year, about the same as last year.

Within this amount, the Air Force's allowance for new purchases of combat aircraft—fighters and bombers—comes to $3.6 billion. The budget funds only twenty-eight new combat aircraft—the four B-2s and twenty-four F-16 multirole fighters.

The F-16s will cost $759.1 million. General Dynamics will continue to produce the airplane for the foreign market for a few years to come, but, with the 1993 purchases, the Air Force closes out its participation in the production program. During 1994 and 1995, the Air Force will build no new combat aircraft of any type.

Other combat aircraft are in the wings, however. These include the F-22 Advanced Tactical Fighter, the

Multirole Fighter, and the Advanced Strike Aircraft. The F-22 would replace the F-15, the MRF would replace the F-16, and the Advanced Strike Aircraft—which the Navy calls "A-X"—would replace the F-111 and other Air Force strike aircraft. One Pentagon budget document says that the US "will follow a prudent and deliberate acquisition strategy" for the three.

The next big aircraft modernization program would be the stealthy F-22, the first production model of which is set to be funded in Fiscal 1996. USAF officials view the F-22, the air-superiority successor to the venerable F-15, as critical to the future of the Air Force.

The Air Force's 1993 budget, which richly funds the F-22 program, reflects this sentiment. It contains $2.2 billion for continued work on the fighter, currently in the engineering and manufacturing development phase. The Air Force now plans to buy 648 of the twin-engine fighters, though that figure may eventually drop.

This summer, the Air Force is set to begin "concept exploration" of the MRF. The service also is keeping an eye on the Navy's development of the A-X.

The Air Force's next big modernization program will be the F-22, a stealthy, maneuverable air-to-air fighter. USAF's 1993 budget proposed spending $2.2 billion for continued F-22 development. This YF-22 prototype was lost in a landing mishap after most testing had been completed.

Not Backing Off

The prominence of conventional warfare is apparent in the Air Force's plans to spend $361.3 million this year to build the first production model of the E-8A Joint STARS, the newly developed system whose ground-scanning radar performed remarkably well during limited action in the Persian Gulf War. The Air Force will spend $356 million for more research and development of Joint STARS systems. Though the airplanes are expensive, the Air Force shows no signs of backing off from its plan to buy twenty.

The amount of money set aside for procurement of airlift aircraft is $3 billion, $2.7 billion of which goes to buy eight more C-17 advanced transports. The Air Force originally had planned to buy twelve of these airlifters in Fiscal 1993 but came up short of available money. Air Force documents say that the service continues to seek 120 C-17s.

The Department of Defense, in its most recent budget statement, says it has examined a range of options for retaining the nation's existing airlift capacity and has found that the C-17 provides the greatest return on investment, given that the US is most likely to find itself having to cope with regional, brushfire wars in the years to come.

Under certain questionable assumptions, said the Pentagon statement, one might make a case for buying more C-5s rather than C-17s, but DoD has no plans to do so. Further, the Pentagon reported, "in no case was extending the service life of the C-141 and the subsequent procurement of a replacement aircraft the preferred alternative."

The C-141 fleet will be nearing the end of its useful life in a decade or so. As the C-17 is phased in, the total capacity of the US military and civil airlift fleets will grow from today's level of forty-eight million ton-miles per day to fifty-three million ton-miles per day. If the Air Force does not purchase additional C-17s beyond the 120 planned, capacity will return to forty-eight million ton-miles per day when the C-141 fleet retires.

The Air Force also will spend $300 million in 1993 to build eight new C-130H tactical transports.

USAF photo by MSgt. Boyd Belcher

Though it entered service in the mid-1970s, the F-15 will continue to carry a major part of the air-superiority mission for years to come. In 1993, the active-duty force will shed twelve older F-15Cs but will pick up thirty-six new F-15E strike fighters.

The budget documents show that funding for modifications of in-service aircraft will hit $1.7 billion, down slightly from $1.8 billion this year but up fifteen percent over the amount spent in 1991. With procurement money tight for years to come, outlays for such modifications could be expected to rise.

Senior Air Force officials have said they would like to give some B-1Bs new capabilities that would allow them to function as state-of-the-art conventional bombers as well as strategic nuclear aircraft. The conversion, the Air Force says, would require installation of a new fire-control system, among other features. The budget contains $50.3 million to conduct various B-1 modifications. Some $25 million is earmarked to reassess the utility of a defensive countermeasures core program for the aircraft.

Elsewhere in the bomber fleet, $76.7 million will go to upgrade some B-52s in the conventional role.

Pentagon documents note that the Air Force will continue to field two wings of A-10 close air support aircraft, which will be updated with a night attack capability and other advances.

One modification program, however, didn't make the cut. The Air Force will curtail the reengining and modernization of its KC-135 aerial refueler fleet. Only last year, the Air Force had planned to spend $1 billion over several years to install new engines, nacelles, pylons, and subsystems. With the overall shrinkage of the force, however, the Air Force decided it no longer needed to carry out the full program.

The budget for procurement of new missiles was pegged at a relatively meager $5.4 billion, unchanged from this year but down by eighteen percent from a budget of two years ago. Missile funding will remain more or less stable for a few years to come.

Staff photo by Guy Aceto

At Eglin AFB, Fla., workers load an F-15 with Advanced Medium-Range Air-to-Air Missiles. The Air Force has committed some $730 million in 1993 to procure more than 1,000 AIM-120 AMRAAMs, which will improve USAF fighter crews' ability to strike beyond visual range.

The AIM-120 AMRAAM continues in low-rate production, with the Air Force committing $731.4 million for a bit more than 1,000 models. Though that level is far below the maximum rate, it is up considerably from the 700 AMRAAMs being bought this year at a cost of $532.4 million.

The Air Force plans to buy a limited number of advanced, standoff air-to-ground weapons. Budget plans include $96 million for 149 new AGM-130 rocket-powered variants of the GBU-15 glide bomb. It will spend $18.6 million on the Sensor-Fuzed Weapon.

Given multiple demands on its funds, the Air Force can afford to buy only a limited quantity of high-technology standoff weapons such as the AGM-130 (above), a rocket-powered variant of a standard GBU-15 glide bomb. The Air Force also plans to continue development of the Sensor-Fuzed Weapon.

A Smaller Aircraft Inventory

The Air Force's program plans say that 1993 will bring more changes in the size and composition of the service's fleet of aircraft.

Between now and the end of Fiscal 1993, say service projections, the total USAF aircraft inventory will fall by four percent, from 6,432 to 6,175. The latter figure reflects a net reduction in the Air Force inventory since 1987 of nearly 2,000 aircraft. The fleet at that time had 8,115 planes.

Further reductions will be imposed on most types of combat aircraft in the inventory.

The already slashed fleet of long-range bombers will shrink by another thirteen percent in Fiscal 1993, dropping from 242 to 211 primary aircraft authorized (PAA). The bomber fleet is expected to bottom out at around 180 aircraft of all types.

The most obvious target for reductions will be the force of fighter and attack aircraft, in both the active and reserve forces. The Pentagon says that this group of aircraft, numbering some 2,103 today, will drop by 5.4 percent to a new low of 1,989 aircraft. The number of fighter and attack combat squadrons will also decline.

According to the Air Force, the service will go down by the end of Fiscal 1993 to 27.4 fighter wing equivalents, fifteen of which will be in the active-duty force. The Air Force plans to hold the line at 26.5 wings in 1995.

There will be more shrinkage in numbers of primary aircraft authorized. During Fiscal 1993, fighter and attack units will lose 127 A-7 and ninety A-10 attack aircraft, twenty-four F-4 fighters, twelve F-15 air-superiority aircraft, and fifty-four F-111 interdiction planes.

In two specific types of fighter aircraft, the active force will see an increase in numbers. USAF will add thirty-six dual-mission F-15E fighters and 168 multirole F-16s to its existing holdings. The number of PAA F-117 Stealth fighters—thirty-six—remains unchanged.

In strategic nuclear aircraft units, more cuts are in the works. Plans call for strategic B-52 squadrons, containing 125 PAA today, to shed forty-one planes by October 1, 1993. The Pentagon reports that it will retire all forty-one B-52G strategic nuclear bombers, though the Air Force will continue to deploy thirty-three B-52Gs for conventional missions.

The number of PAA B-1B bombers will hold at eighty-four.

Today, according to the Air Force, Air Combat Command missile wings (formerly part of Strategic Air Command) have some 880 operational, on-line Minuteman ICBMs. By the end of 1993, under current plans, the command will have only 802 Minutemen. There are at present no official plans that would disturb the force of fifty Peacekeeper ICBMs, but they are in jeopardy. President Bush has offered to inactivate them in return for new Russian concessions on strategic arms.

The strategic components of ANG and AFRES will maintain about the same number of F-15 and F-16 air defense fighters—some twelve squadrons containing 216 aircraft. In light of the reduced threat of intercontinental bomber attack, however, the Pentagon plans to cut this number to ten squadrons by Fiscal 1994 and to save money by mothballing the newly activated over-the-horizon backscatter radar system.

The fleet of ninety-seven B-1B bombers, built mainly for the strategic nuclear deterrent mission, is cast for a starring role in the future Air Force. Senior officers said they want to give some B-1Bs new capabilities that would let them also function as advanced conventional weapons.

Elsewhere, little major change is anticipated. The Air Force will retain all 109 of its C-5s and almost all of its C-141 and C-130 transports as well as its KC-10 and KC-135 tankers.

Under the Pentagon's latest budget proposal, the services will not be obliged to make force structure cuts that go deeper than the levels established in Fiscal 1992. For the moment, moreover, Congress is not pressing the issue. Still, the Air Force is under orders to reduce its end strength by 177,000 active-duty troops, moving from the 1987 peak of 607,000 to 430,000 in 1995. That is a thirty percent cut. The next fiscal year will bring about a significant reduction in personnel. Total active-duty strength, 485,000 today, will fall to 450,000.

Over the last two years, the Air Force will have lost twelve percent of its active-duty strength. During this time, however, there has been little change in the size of the Air Force reserve component. At the end of Fiscal 1993, the Air National Guard will have 121,000 members and the Air Force Reserve will have 82,000 members.

Air Force officials maintain they are intent on keeping the combat readiness of the force at a high level.

Reductions in the number of primary aircraft authorized will bring a reduction in the Air Force flying hour program. Overall, the Air Force will maintain an operational tempo that generates 1,640,000 flying hours, a figure down twenty-five percent from where it stood two years ago.

However, flying hours per individual aircrew will remain about the same and may increase. Flying time for active tactical aircrews will hold at about twenty-one hours per month. In the Air National Guard and Air Force Reserve, tactical crews will fly an average of between 10.5 and eleven hours per month.

Strategic aircraft pilots will have about eighteen hours of flying time per month, up slightly from the 1992 level. The Air Force will provide twenty-eight hours per month to airlift crews, unchanged from last year.

In another readiness-related measure, the Air Force plans to increase expenditures for aircraft spare parts, from $510.7 million in Fiscal 1991 to $724.4 million in Fiscal 1993.

The Air Force budget continues the service's emphasis in recent years on maintaining a robust space capability. For one thing, it includes $1.3 billion to continue work on ground terminals for the Milstar communications satellite. In addition, there is $287 million in advance procurement money for a Defense Support Program satellite, $81.5 million to continue research on the Navstar Global Positioning System satellite constellation, and $247 million for new spacecraft. ■

All over the Air Force, vertical and top-heavy command chains are rapidly disappearing.

The End of the Stovepipe

By James W. Canan, Senior Editor

Air wings and space wings, keystones of aerospace power, are at the leading edge of Air Force reorganization. Big changes in their composition and chains of command have come swiftly and undergird many others, such as the rearrangement of major commands, in the historic restructuring that began less than a year ago.

At that time, the Air Force had 164 air wings. It has since converted roughly eighty-five percent of them to so-called "objective wings" built around groups. Each remodeled wing embodies an operations group, a logistics group, and a support group, all commanded by colonels. Squadron commanders, normally lieutenant colonels, now report directly to group commanders rather than to wing commanders.

"This is a very important reorganization move, and it is happening very quickly," asserted Gen. Merrill A. McPeak, the Air Force Chief of Staff, not long ago. "I believe all our wings will be in the tri-group structure, with stronger chains of command, by the first of next year."

This goes for space wings too. Air Force Space Command, the fastest-growing of all Air Force commands in recent years, planned to finish converting its four operational wings to the tri-group structure by this summer. To make things simpler, Space Command also set about separating the space-surveillance and missile-warning missions long vested in one wing. By the end of this summer, all surveillance operations will have been consolidated in a new space surveillance group.

Air Force Space Command grows in stature amid the makeover of the service. Whoever commands it will wear four stars, not three as had been the case. The Air Force four-star commander in chief of both the unified US Space Command and North American Aerospace Defense Command (NORAD) becomes commander of Air Force Space Command. This is expected to tighten and strengthen Air Force Space Command's connections with other warfighting commands, enhancing its combat support of them.

The Air Force is eliminating or scaling down autonomous "stovepipe" support organizations, such as those for maintenance and communications. Sgt. Harland McCallum, an AWACS assistant crew chief, exemplifies personnel affected by the historic restructuring.

Commands Come and Go

In the restructured Air Force, all but a few air wings in the lower forty-eight states will belong to one of two new major combatant commands: Air Combat Command and Air Mobility Command. ACC and AMC were

USAF photo by TSgt. Hans Deffner

scheduled to come into being June 1 at Langley AFB, Va., and Scott AFB, Ill., respectively, just as Strategic Air Command, Tactical Air Command, and Military Airlift Command were scheduled to stand down. ACC takes over all of TAC's missions and assets and most of SAC's. AMC assumes much of SAC's tanker force and becomes, in effect, a bigger, broader MAC.

With these steps, the Air Force closes in on one of its prime objectives: cutting the net number of major commands from thirteen—the number that existed in late 1991—to ten, as part of its move to consolidate, simplify, and streamline units, operations, missions, and personnel wherever practical across the service.

The finishing touch on major commands is scheduled for July 1, when Air Force Materiel Command comes into being at Wright-Patterson AFB, Ohio, merging Air Force Systems Command and Air Force Logistics Command. Two other longtime major commands are long gone. Air Force Communications Command went out of existence as a major command late last year, shortly after the reorganization began, and now does business as a field operating agency. Electronic Security Command was deactivated; a large share of its activities was transferred to Air Force Intelligence Command, another new major command, activated October 1, 1991, at Kelly AFB, Tex.

By all accounts, transitions to the new major commands have been relatively smooth. Shakedown periods are expected to be much rockier. Problems are inevitable amid the many organizational and operational adjustments that lie ahead.

Early indications are that the going will be roughest for ACC in melding TAC's and SAC's operations and personnel in a new command culture that subordinates their individual identities, traditions, and ways of doing things. AMC and AFMC are expected to have it easier. AMC is a natural outgrowth of MAC. AFMC integrates two hardware-oriented commands that have worked closely with one another in weapons acquisition and support.

Air Force leaders acknowledge that the service-wide reorganization has a long way to go in many respects but say they are pleased by its pace and progress thus far. A lot has happened. The Air Force has become a much different animal in almost no time, it seems.

There were nineteen air divisions when the reorganization began late last summer. All will be gone by the end of June. Dr. Donald B. Rice, Secretary of the Air Force, calls the elimination of air divisions as a separate level of command "a key development in our delayering" of USAF's management structure, an overarching objective of the reorganization plan.

The New Circuit Riders

Numbered air forces still exist, but they are not what they used to be. All have a leaner look and a new lease on life. Their headquarters staffs have shrunk. Their charter was once management; now it is operations. As a result, commanders of numbered air forces—three-star generals—are no longer deskbound. Secretary Rice notes that they "spend a lot of time as circuit riders," visiting bases and staying on top of combat wings.

Major commands and wings have taken on much of the administrative work load formerly borne by the numbered air forces. More and more, wing commanders are wearing two hats,

taking command of their air bases too. This is in keeping with a top reorganization goal reflected in the motto, "One base, one wing, one boss."

The Air Force is in no rush to reach that goal all at once. "We haven't been able to follow the one base, one wing, one boss model everywhere immediately," explains General McPeak, "because there are some rather strict limits."

Those limits lie in the divided nature of some bases housing wings that belong to Air Mobility Command and Air Combat Command. Designating a base commander from either type would be awkward and impractical. Malmstrom AFB, Mont., is one example, with its AMC tankers and ACC ICBMs. Others have AMC tankers and ACC aircraft, for instance.

"As the Air Force changes, as our force structure moves around, we'll work into that [one base, one wing, one boss] mold," says the Chief of Staff. "We have established it as our model, and we've done a fair amount of getting into it already."

The Air Force is creating the composite 23d Wing at Pope AFB, N. C., to team with the Army's 82d Airborne Division at nearby Fort Bragg, N. C., a rapid-deployment outfit featuring troopers like these. The 23d Wing is being formed around A-10s (below) from the former 23d TFW at England AFB, La.

Whether or not wing commanders double as base commanders, they are required to be more managerial and less operational in outlook and practice nowadays. As a result, they turn to their newly instituted operations group commanders for wing-wide, warrior-type, operational leadership.

Broader responsibility and authority translates into higher rank for an ever-increasing number of wing commanders. It is no longer rare to see them wearing stars.

Prior to the reorganization, virtually all wings were commanded by colonels. Only three wings, at MacDill AFB, Fla., Nellis AFB, Nev., and Lajes Field, the Azores, had general officers—all one-stars—in charge. This has changed dramatically.

By the second quarter of this year, brigadier generals were in command of twenty-two wings. General McPeak predicts that the number will rise to forty-five by the end of the year. "We hope to get to sixty, and we're moving very rapidly in that direction," he says.

The Air Force expects to bottom out at about 100 active wings of all types by the beginning of 1995. Brigadier generals will command three-fifths of them. The total force is expected to include about 150 wings at that point.

Numbers, Not Name

Wings are still known by number but no longer by name. Six months into the reorganization, Secretary Rice affirmed that "we have essentially eliminated 'tactical' and 'strategic' from the names of wings, and we have already established a significant number of composite wings."

The Air Force began forming composite wings—those composed of different kinds of aircraft—before the reorganization officially began. The number of such wings has gone up steadily and will keep rising through the next couple of years.

"In 1995, when we're down to 100 wings, at least half of them will be composite wings, and that's the lowest number I can conceive of," says General McPeak.

He emphasizes that "all wings will be organized as objective wings, whether or not they are composite wings. Our trend is clearly toward composite structures, and we're getting into the objective configuration for all our wings very quickly."

Thus far, USAF has taken what Secretary Rice calls "the straightforward approach" to composite

wings—"combining into a single wing and headquarters all the flying squadrons that were already operating at a given base." Prime examples are new wings at Seymour Johnson AFB, N. C., Andrews AFB, Md., Grand Forks AFB, N. D., and Kadena AB, Japan.

Those wings were relatively easy to cobble together. It will be more complicated and time-consuming to build composite wings from scratch, bringing together disparate units and planes from different places. The Air Force has begun forming such wings at only two bases—Pope AFB, N. C., and Mountain Home AFB, Idaho. Another is in the planning stage for Moody AFB, Ga.

Air Force officials refer to the Mountain Home wing as an "air intervention wing." They see it as the epitome of the "global reach, global power" strategy that the Air Force successfully implemented in the Persian Gulf War.

Secretary Rice says, "We are designing the wing at Mountain Home on a clean sheet of paper to deliver integrated airpower—air superiority and ground attack—in a single package anywhere in the world on a moment's notice."

The Mountain Home wing will include F-15C, F-15E, and F-16 air-to-air and attack fighters along with tankers and E-3A Airborne Warning and Control System (AWACS) planes. It will regularly train with, but will not incorporate, B-52 and F-111 bombers, F-117A Stealth attack planes, and F-4G Wild Weasels.

The Pope AFB composite wing is taking shape. It had a head start on the one slated for Mountain Home AFB. It will combine A-10 close air support aircraft, OA-10 forward air control planes, and C-130 intratheater airlifters, all already at Pope, plus F-16s from elsewhere.

"Pope and Fort Bragg are a lash-up," says Dr. Rice, meaning that the Pope wing will train and presumably deploy with the Army's 82d Airborne Division at nearby Bragg.

The North Carolina Neighborhood

The North Carolina connection goes beyond those two bases. Seymour Johnson AFB is in their neighborhood. Its composite wing of F-15Es and KC-10s richly augments the one at Pope and will train with it to provide integrated airpower. The Air Force is considering another composite wing like the one at Pope for Moody AFB, Ga., that would dovetail with Army units at Fort Benning and Fort Gordon in the state.

The Mountain Home air intervention wing is "the only one of its kind that we have under construction, and there won't be any more of them for a while," says General McPeak. "Once we operate it, we may find that it's not a good idea. I don't think that will happen. If it turns out to have been a good idea, it will be the prototype for others as the Air Force moves into the twenty-first century."

A welcome by-product of composite wings evident early on is "the broadening of our people, especially of our senior people," says General McPeak. "It is striking in the changes already implemented."

He cites the 4th Wing at Seymour Johnson AFB and the 23d Wing at Pope AFB as prime examples.

The commander of the Seymour Johnson wing comes from the fighter community and now finds himself in charge of tankers and their personnel as well. The wing's vice commander is a SAC bomber pilot who had to get up to speed in fighters and tankers. The group commander is a former SAC tanker type who is now checked out in the F-15E and knows fighters too.

The commander of Pope's 23d Wing is an airlifter pilot who, once the wing jells, will be in charge of two different kinds of attack jets, A-10s and F-16s. Other officers in the wing must also become knowledgeable about aircraft and operations formerly foreign to their experience.

"All those leaders are going to emerge from the composite wings with a much more comprehensive understanding of what integrated airpower is all about," General McPeak declares. He predicts that composite wings "will produce a new generation of officers who are much better prepared to run the Air Force of the future."

He adds, "We are probably the only air force in the world with the full range of capabilities—from forward air control, search and rescue, and special operations all the way up to space satellites. A problem that I've seen is that we haven't produced a lot of officers who understand what a comprehensive air force needs to do. Their experience hasn't prepared them to understand it. They're narrowly focused—a fighter pilot, a bomber pilot, a tanker pilot, or a missile shooter—and that's it."

Many critics of the new-look Air Force charge that it was designed to favor pilots—especially fighter pilots—over nonrated officers and to aggrandize combat leaders at the expense of their noncombat counterparts. They infer such motives from USAF's moves to shorten, tighten, and strengthen chains of command, to give precedence to combat missions over support functions, to decentralize responsibility and authority from headquarters to operational units, to consolidate functions under fewer

The composite 4th Wing at Seymour Johnson AFB, N. C., includes F-15E deep-strike fighters and KC-10 tankers, shown here training together to fight together. The 4th Wing will also train with the composite 23d Wing at nearby Pope AFB.

Staff photo b Guy Aceto

Malmstrom AFB, Mont., is one example of a dual-nature air base where the motto "One base, one wing, one boss" is difficult for the Air Force to apply. Malmstrom is home to Air Combat Command ICBMs, housed in silos like the one above, and to Air Mobility Command KC-135R strategic tankers like the one below.

commanders, and to enhance the power of lower-echelon leaders.

No More Stovepipe

All this is happening apace. Autonomous "stovepipe" support organizations, such as those for maintenance, weather forecasting, and communications, are being eliminated or scaled down. Operational commanders are taking charge of support personnel and functions at every turn. In the new group-structured wings, for example, squadron commanders are directly in charge of flight-line maintenance operations formerly under the control of base maintenance hierarchies.

That change, for one, seems all to the good. General McPeak says he has heard from the field that "everyone is ecstatic about the way it's working, and that includes a lot of people who were skeptical."

In the long run, nonrated specialists in many, if not all, support jobs may find the new Air Force setups and ways of doing things more—not less—to their liking. Squadron maintenance officers, for example, "may actually have a better deal" than before, says General McPeak. Why? Because squadron commanders, now directly responsible for the upkeep of their airplanes, are likely to appreciate their maintenance officers all the more.

The Chief of Staff notes that "most of the officers in an operational squadron are flyers—operators—and they're all kind of interchangeable, but the one maintenance officer in the squadron is not interchangeable and is absolutely critical to its success." The prospect, he says, is not that maintenance officers will be put upon, but rather that "they will be pampered" by squadron commanders.

General McPeak acknowledges that "some Air Force people were anxious or disquieted" by the reorganization "because they felt they might have been left out of the process. But they have not been left out."

He continues, "There are very few activities in the Air Force that don't make a direct contribution to our combat capability. Everybody in every career field ought to feel rather close to the combat elements. It should be good news for everybody that we're trying to sharpen the focus on our combat effectiveness."

The Sizzle Disappears

As the reorganization hit its stride, much of the sizzle seemed to go out of the sentiments pro and con in the blue-suit community. Critics who had preferred standing pat or going easier on changes changed their minds or recognized the restructuring as a *fait accompli*. Advocates appeared to tone down their expressions of enthusiasm, at least in public.

General McPeak concedes that some reorganization goals may have been overstated or misinterpreted. "Maybe too much has been made of the notion that we're trying to go to a more operationally oriented Air Force," he says. "Maybe too much has been made of the contrast and not enough has been made of the continuity. We're not making the Air Force turn 180 degrees to focus it more sharply on operational issues. We are moving in that direction on the margins."

He continues, "It's not that we're going from some bureaucratic, overhead-laden, fat operation to a combat operation. We've always been a combat outfit. What we're doing is tending away from a headquarters-heavy type of operation and toward one with sharp focus on combat operations and warrior values." ■

Photo by Alwyn T. Lloyd

It takes a world-class aircraft to train world-class pilots.

The Pampa 2000 will be the superior choice for turning future Navy and Air Force pilot trainees into world-class pilots.

This contender for the JPATS program is as cost-effective as it is mission-effective. It combines an affordable acquisition price with operating costs that are less than one-half the current primary trainer's. Not only will the Pampa 2000 meet all of today's requirements, it also has the growth potential for the training needs of the next century.

The Pampa 2000 has a stepped-up tandem cockpit which gives the instructor-pilot superior forward visibility from the rear seat. Maintenance is so straightforward that the engine can be changed by two people in under an hour. The plane can also be refueled in only 10 minutes so that it can fly more missions per day.

The Pampa 2000 is a team effort of LTV and Fabrica Militar de Aviones (FMA). Their combined 130 years of aviation experience makes the trainer an even more attractive choice.

Watch for this world-class aircraft as it continues its flight tours throughout the Americas and Europe.

LTV Aerospace and Defense
Aircraft Division

A replacement for the Air Force's T-37 and the Navy's T-34C should be on contract by 1994.

Staff photo by Guy Aceto

A Trainer Built for Two

By Frank Oliveri, Associate Editor

THEY can't fly very high, fast, or far. Their cockpits aren't pressurized, and some even lack ejection seats. They have antiquated, steam-gauge-type instruments. Their pilots suffer a disproportionate number of in-flight physical problems.

Such are the shortcomings of the Air Force T-37 and Navy T-34, the services' two primary aircraft training systems (PATS) and the reason the two services are looking for something new. One need not be an expert to see that the Air Force must soon field a replacement PATS; it has flown the T-37 since 1958, and all agree that it is outmoded. The same is true of the Navy's T-34C.

After mulling the problem over for several years, the services are now moving briskly to solve it. They will keep the old planes flying a while longer, but the Air Force and Navy have come to terms on, and are accelerating the pace of, a multibillion-dollar drive to produce the Joint Primary Aircraft Training System (JPATS), which shapes up as one of the largest aircraft programs of the next decade. Plans call for JPATS to be a small, nondevelopmental aircraft capable of flying at 250 knots at low

JPATS Contenders

	Aircraft	Engine
Beech/Pilatus/P&W	PC-9 Mk. II	PT6A-62 Turboprop
Grumman/Agusta/P&W	S211A	JT15D-5C Turbofan
Lockheed/Aermacchi/Rolls-Royce	MB-339 T-Bird II	RB582-01 Turbofan
LTV/FMA/Garrett	Pampa 2000	TFE731-2-2N Turbofan
Rockwell/MBB/P&W	Fan Ranger	JT15D-4 Turbofan

Only one contractor team will build the joint Air Force and Navy JPATS aircraft, but many contractors have been labeling their candidates with the acronym. JPATS will be one of only a few large production programs available to industry for some time.


DANGER

level. The program includes simulators.

In high-level meetings this year, the Air Force and Navy reached agreement on official JPATS requirements, giving the plan added momentum. The Pentagon scheduled a May meeting of the Defense Acquisition Board, its highest review body, to examine JPATS and give it official program status. The Pentagon also planned to release an operational requirements document.

Money has begun to flow into the effort. In Fiscal 1992, the Air Force is spending $3 million on JPATS. The service plans to allocate another $3 million in Fiscal 1993 and then, in Fiscal 1994, boost spending to $60 million. USAF's new Program Objective Memorandum for Fiscal 1994–99, now being formed, will set funding levels for the rest of the 1990s.

At Air Training Command headquarters, Randolph AFB, Tex., officers welcome these actions. Maj. Gen. Larry L. Henry, deputy chief of staff for Plans and Requirements, sums up the attitude with this rhetorical question: "If you had a son or daughter in pilot training, and they were going out to do aerobatics ten years from now, would you want them in a forty-five-year-old airplane?"

The Grumman/Agusta S211A trainer candidate is powered by the Pratt & Whitney JT15D-5C turbofan engine. Entry-level Air Force and Navy pilots must learn to fly the primary trainer before moving on to greater challenges.

The Fast Track

The program is moving onto a faster track. The services plan to issue requests for proposal in summer 1993, award a contract in February 1994, and take delivery of the first plane in 1996.

If all goes as planned, the Air Force will begin student training in the JPATS in April 1998, and the Navy will begin its program in June 2001. The Air Force plans to reach JPATS full operational capability in December 2004; the Navy, in September 2007.

Several contractor teams have formed to compete for the award *[see box on p. 38]*. Only one firm will receive a contract. In all likelihood, the winner will produce the airframe, and the builder of the simulator will be a subcontractor.

Initially, the Air Force planned to buy 535 air vehicles. That figure has since been reduced three times. Now, plans call for buying 417 air vehicles with associated simulators, which the Air Force unofficially says will number about forty.

The current Navy plan calls for buying 347 aircraft. That number, however, was set before changes in the undergraduate naval flight officer syllabus, which essentially doubled T-34 flight hours. Thus, the Navy buy could increase. Says the Navy's JPATS Requirements Officer, Lt. Cmdr. Clay Umbach, "We know we'll need somewhere around 350."

Service officials are reluctant to hang a price tag on the program. One rough estimate, given by General Henry but only with many qualifiers attached, is that the Air Force could spend about $4 billion for the total system. The Navy provides no overall figure, but signs are that its part of the program could come close to $4 billion.

In its 1988 Trainer Master Plan, the Air Force identified the need for a new PATS. A short time later, the Navy also began to search for its own new system. The Department of Defense suggested that the Air Force and Navy go for a single plane. The result was JPATS.

The Beech/Pilatus PC-9 Mk. II, powered by the Pratt & Whitney PT6A-62 turboprop engine, is the only prop-driven aircraft in the competition. The Air Force says it does not matter whether the aircraft is turbofan or turboprop, so long as the aircraft meets requirements.

The LTV/FMA Pampa 2000 (a variant of the IA 63) is powered by the Garrett TFE731-2-2B turbofan engine. Both services were seeking a nondevelopmental aircraft to avoid costs associated with developmental programs. Each candidate aircraft fits the bill, according to the Air Force.

Last October, Gen. Merrill A. McPeak, the Air Force Chief of Staff, called for a high-level program review. At a subsequent meeting, participants hammered out JPATS requirements. The services later issued the JPATS Joint System Operational Requirements Document (JSORD).

As the JSORD stipulates, the primary mission of JPATS is to train entry-level USAF and Navy pilots in primary flying to a level of proficiency that allows for transition to each of the service's advanced training tracks.

Note, however, that JPATS is a training *system*—not just an aircraft. The program is broken into two elements—the actual air vehicle and a ground-based training system, which would include operational flight trainers and instrument flight and cockpit procedural trainers. The system will also include an integrated package of courseware, syllabuses, academic training, and computerized data management. The air vehicle and the simulators will be common to both services, but the individual courseware, syllabus, and logistics support will be specific to the services' needs.

Information about the simulators remains sketchy, inasmuch as numerous decisions still must be made. It has not even been decided whether the simulators will be interactive. Requirements for the ground-based training system will be modified to reflect the findings of an ongoing training system requirements analysis (TSRA) and instructional systems development (ISD) study. Both studies will be completed late this summer.

Trade-offs are expected as both the services attempt to achieve a mix of performance and lowest possible cost. This is being done in the Air Force through the TSRA, while the Navy is performing the more comprehensive ISD study.

According to the JSORD, the Air Force's aircrew training devices will "duplicate the selected aircraft system in form, fit, function, mission performance, and operation for the task or part task required." The document adds that "the intent is to allow instruction to occur in a device with only the level of fidelity appropriate for the training required."

The document requires the ground training devices to help students train and practice contact overhead pattern procedures, visual approaches (day, dusk, or night), visual flight maneuvering, basic formation, instrument, navigation, transition to land, and cockpit emergency procedures.

In addition, the devices should also train students in cockpit spatial relationships, system operating procedures, equipment location, communication and terminology procedures, and egress and ejection procedures.

Critical Needs

In outlining the needs for a JPATS air vehicle, the JSORD highlighted four basic areas that will be of supreme importance in the system's selection. It spelled out the deficiencies of present systems to underscore the most critical needs:

- Training effectiveness. Both the T-37B and the T-34C use 1950s-vintage analog instrumentation and navigation subsystems. With new

digital cockpit displays and navigation systems like the Global Positioning System proliferating in military aircraft, said the JSORD, it is becoming necessary to train student pilots in these technologies during the primary phase.

The T-37 does not use the standard "T" cockpit instrumentation configuration employed in modern aircraft. This "creates negative learning habits in student instrument scan patterns," the JSORD said. In addition, the T-37's side-by-side seating arrangement requires additional instruction because flight references change depending on the direction of the traffic pattern, aerobatics, or formation maneuver.

As for the T-34, its low-powered engines are capable of providing only the most basic flight training to Navy students. The service acquires scant information for classifying students for any of its four advanced tracks. This increases attrition rates in those tracks. In addition, the T-34 flight simulator has no visual system.

■ Operational safety. The T-34 lacks an ejection seat. If trouble should occur, reports one Navy official, the pilot must open the canopy and leap from the plane.

The Lockheed/ Aermacchi MB-339 T-Bird II is powered by the Rolls-Royce RB582-01 turbofan. Each aircraft provides stepped tandem seating, as opposed to the T-37's side-by-side seating. At left is the instructor's view from the T-Bird II.

The T-34 does not have a backup attitude reference system. "In the event of alternating current electrical failure in instrument meteorological conditions," said the JSORD, "the crew must bail out of the aircraft." Recently, an aircrew flying the T-34 was forced to bail out at 1,000 feet, according to Navy officials. Neither crew member survived the fall because their parachutes failed to open in time.

The Air Force T-37 is equipped with an ejection seat, but it does not cover the flight envelope in some routine situations. For example, the T-37 ejection seat requires the plane to be at an altitude of at least 100 feet and be traveling at least 120 knots. The normal approach-to-landing speed, however, is 100 knots, meaning that the seat might not work properly during an emergency landing.

Then there is the problem of "physiological incidents"—in-flight maladies that range from a simple nosebleed to dangerous blackouts. The unpressurized T-37 accounts for some fifty percent of all pressure-related "physiological incidents" in the Air Force, even though the plane accounts for only seven percent of USAF's total flying. In both the T-37 and T-34, pilots suffer what the services consider very high rates of G-induced loss of consciousness.

■ Performance and design. Both the T-37 and the T-34 are severely underpowered, forcing them to fly at altitudes that are among the most densely populated by aircraft. This constrains training opportunities and adds to safety problems. Moreover, pilots in these aircraft spend a large part of their flight time climbing to training altitude. As the altitude increases, the aircraft's performance decreases.

In addition, each powerplant is fuel inefficient and, in the T-34's case, emits two to five times the noise allowed by Federal Aviation Regulations. Because it has been fitted with so much equipment, the T-34 also exceeds maximum design gross weights.

■ Supportability. Because production of both trainer aircraft ended decades ago, normal attrition rates will continue to cause shortfalls in the inventory. Parts for each aircraft grow ever more expensive and difficult to procure because production has ceased. Studies show that the Air Force could save forty to seventy-five percent of trainer fuel costs by switching to a modern engine.

In sum, the message from the Air Force and the Navy seems to be that the winner of the JPATS competition will be the aircraft that most comprehensively and economically addresses problems identified in the JSORD.

The JSORD also laid out specific requirements, including selectable nose wheel steering, toe-activated wheel brakes, strength to sustain hard touch-and-go landings, and the ability to climb to 18,000 feet, from a fully fueled sea-level takeoff, in eight minutes or less on a standard day.

The Rockwell/MBB Fan Ranger (above, models) will use the Pratt & Whitney JT15D-4 turbofan engine. Each proposed JPATS aircraft will require up to twenty percent missionization—the addition of specific technology to enable the aircraft to meet service requirements.

No Preference

The Air Force and Navy declare that they have no preference for either jet or turboprop power, so long as the system meets requirements. General Henry said that, with missionization, every aircraft proposed thus far would meet requirements.

The two services plan to settle on a nondevelopmental system, with the Air Force taking the lead. A nondevelopmental system has advantages: developmental programs usually take twice as long to field and cost much more.

What, however, does "nondevelopmental" mean? Officials define it as a type of system that is neither totally commercial nor totally new in its development. Both services wanted something in the middle, so a new term—nondevelopmental—was coined. Large portions of the aircraft and supporting systems will come "off the shelf." Component systems will be integrated into the package. Between five and twenty percent of the system will require missionization, meaning specific technology will be added to allow the aircraft to meet service standards.

Some critics argue that, given the decline of Pentagon spending, both services should upgrade the old trainers and carry on as best they can.

The Air Force already is conducting a Service Life Extension Program (SLEP) that would allow the T-37 to remain operational beyond its current service life limit of 18,000 flight hours. With new parts, the T-37 would gain 8,000 hours of service life, enough to last until 2005. Air Force officials point out that the SLEP is necessary under any circumstances just to keep the old trainers flying until JPATS arrives in adequate numbers.

"We have a structural life enhancement program that will carry the airplane on until we get the JPATS," General Henry says. "These airplanes are used every day in student training. Therefore, they're put under stress of G forces and aerobatics, formation, etc., and as the airplane has gotten to be in its thirties, it's worn."

One Air Force JPATS official maintains that it is not sufficient simply to calculate how long the service can keep the old T-37 flying. "You need to balance that against physiological incidents, against fuel-inefficient engines," he says. "There is a whole range of issues that come up with supporting an airplane that is over thirty years old. Yes, you could just upgrade, but then you need to ask yourself, 'At what point do I really need to make the investment to go ahead and have students train properly in modern aircraft?' "

Writing on the Wall

The joint nature of JPATS is a clear political plus, say service officials. They note that Congress has mandated jointness in search of lower cost.

"Being joint was really important," reports the Navy's Commander Umbach. "Congress wanted that. We saw the writing on the wall." Adds the Air Force's General Henry, "I think that, in light of today's environment, it's going to take jointness to get this program through. I don't think it would fly if it were a single-service program."

Historically, the Air Force and Navy have had difficulty developing aircraft jointly, but this has usually been caused by the divergent needs of carrier-based and landbased aircraft. Both services would launch this air vehicle from the ground. Moreover, it has the same basic mission.

"We have no problems with the Navy in this program," said Col. Jim Wansack, director of the Flight Training System Program Office at Air Force Systems Command's Aeronautical Systems Division, located at Wright-Patterson AFB, Ohio. "There's a really close working relationship."

General Henry stressed the importance of JPATS. "Obviously, it's the cornerstone of our training because this is how both the Air Force and the Navy will do their primary flight training," he said. "This is where we bring our kids in that don't know how to fly and train them how to fly for the first time." ■

Bombs from the B-52s shook the earth and lit the sky for miles around.

The BUFF at War

By Capt. Doug Fries, USAF

IN THE early morning hours of January 17, 1991, at bases across Saudi Arabia and on board aircraft carriers, hundreds of aircrews got final combat briefings and headed out to their planes. By that time, however, twenty B-52s already had been airborne for hours and were bearing down on Iraqi targets.

One group of thirteen B-52G bombers, flying northward high above the southern Arabian peninsula, refueled from KC-10 tankers for the second time that night. Soon after topping off, the huge planes descended to begin preparation for the B-52's first-ever low-level combat missions. Meanwhile, a second group of seven B-52s, launched from Barksdale AFB, La., and flying eastward over the Mediterranean, neared the war theater. Crews prepared dozens of AGM-86C conventional cruise missiles.

The crews of the first group of bombers got much busier quickly. At 3:00 a.m., F-117 Stealth fighters struck vital targets in Baghdad. One hour later, two- and three-plane flights of B-52s were racing across southern Iraq en route to their targets. To stay below Iraqi radar coverage on that moonless night, the bombers barreled along at altitudes just a few hundred feet above the desert floor. The lumbering bombers were guided by terrain-avoidance radar. Their pilots peered into the darkness through night vision goggles (NVGs).

On one plane, the pilot watched his two wingmen turn away from each other and depart as the flight split up to attack a key target from different directions. In the offense compartment below the cockpit, the navigator and radar nav—or bombardier—completed their final rundown of items on the checklist.

This done, the offensive team returned to monitor the plane's altitude closely. Behind the pilots, the electronic warfare officer (EWO) and gunner intently watched their equipment, waiting for any indication of the presence of an unexpected radar threat or a hostile fighter.

The EWO announced, "No radars up."

Don't Be Late . . . or Early

The huge bomber turned toward the night's target: an Iraqi air base with hardened concrete fighter shelters, now only twenty miles distant. The pilot pushed up the speed to make sure that

A fully loaded B-52 moves along a taxiway in preparation for another sortie against Iraqi targets. The Persian Gulf War was an opportunity for B-52s to prove their value as conventional bombers, after thirty-eight years in a strategic nuclear mission.

USAF photo by TSgt Rose S. Reynolds

The 4300th Provisional Bomb Wing included B-52G bombers, KC-135R and KC-10 tankers, and rescue helicopters. After taxi, takeoff, and refueling of all these aircraft, quipped some crew members, the mission itself would be a snap.

the bomber would arrive at exactly the planned time. To be off by a few seconds, early or late, could mean a collision with another B-52. The night's targets were among the most important of the war. Hundreds of allied aircraft depended on these bases' being put out of business on the first night of action.

Four miles ahead, the B-52 crew members saw a spectacular eruption of antiaircraft artillery into the darkness. Then a ground-based spotlight lit up the lead bomber as he released his load of CBU-89 Gator mines across the base's maintenance areas. Thousands of minelets fell past the curtain of antiaircraft fire. The number two aircraft dropped down to avoid early detection.

"Twenty seconds, climb!" That was the nav's cue for the pilot to climb another hundred feet so that the falling bombs could nose over enough to stick into the ground instead of bouncing off into the desert.

Tracers and spotlights lit the way. The pilots pushed up their NVGs. "Target in sight," answered the pilot, making one final steering correction.

The navigation computer opened the bomb bay doors and dropped the weapons into the darkness.

Three dozen 1,000-pound bombs plunged into the taxiways linking the aircraft shelters to the runway. Seconds later, the formation's third B-52 dropped an identical load on the taxiways at the runway's far end.

The attack was over in less than a minute. Iraqi troops on the ground had just a few moments to wonder what had happened when the first of seventy-two delayed-action bombs exploded, shattering a taxiway and burying the others with sand and concrete.

Throughout southern Iraq, the explosions of minelets and cratering bombs continued for several hours. The explosions at first paralyzed and then slowly destroyed four airfields and an improvised highway landing strip.

Flying Over Deserts

In August 1990, Strategic Air Command's 42d Bomb Wing from Loring AFB, Me., was preparing to return home from a Green Flag exercise at Nellis AFB, Nev., when news came of the Iraqi invasion of Kuwait. Our last day of sneaking across Nevada's deserts to bomb simulated airfields was spent wondering how soon we might be flying over deserts again.

It didn't take long to find out. With only three days' notice, the Loring B-52s began deploying, nonstop, to our forward operating location (FOL) at a site near the Middle East. Seven fully armed B-52s took off on August 12, carrying full loads of M117R iron bombs, bullets, chaff, and flares so that they could be turned quickly after their arrival in the theater.

Our route took us across the Atlantic, across the Mediterranean, down the Red Sea, and through Saudi Arabian airspace. Eventually we ended up at the wartime FOL after a twenty-hour flight. We refueled three times from KC-10s on the way, taking on about seventy tons of fuel each time. Everyone was wide awake passing Libya. We didn't know how Libya would react to seeing all the B-52s drive past.

Over the next three days, the FOL saw the arrival of additional bombers and crews from Loring AFB; Castle AFB, Calif.; Griffiss AFB, N. Y.; and Barksdale AFB, La. KC-135R and KC-10 tankers poured in from several active-duty units and from the Air National Guard. By August 16, two weeks after the Iraqi attack, the 4300th Provisional Bomb Wing had been formed. Twenty fully armed B-52s and their crews were on alert, ready for combat.

We quickly overwhelmed the facilities of our host base. Flooding the premises, virtually overnight, were more than 3,000 maintenance troops, flyers, planners, security police, and the like. The visitors' quarters filled up instantly, and a huge tent city was erected across the street from the B-52 parking ramp.

Since we were among the first bomber-attack assets in the theater, we were given some unexpected taskings in case of an Iraqi invasion of Saudi Arabia. For example, alert crews were tasked, in the event of an attack, to rush across the invaded area at low altitude, seeking out and bombing enemy forces before egressing over the Persian Gulf. After three weeks, enough A-10s and F-16s had arrived to take over that duty. We were given more traditional fixed targets within Iraq against which we were to plan our attacks.

Elements of the new provisional bomb squadron pulled together and conducted intensive studies of Iraqi air defenses and our taskings. The planners standardized the procedures for aircrews sent from different bases. Flyers with little exposure to the latest B-52 modifications were brought up to speed.

The wing formed a Consolidated Aircraft Maintenance Squadron (CAMS), which integrated all maintenance and munitions functions into one giant organization. The CAMS had to conduct its own training program, since it was getting technicians from many bomber bases and many of them had never dealt with B-52G systems or conventional weapons.

The Nuclear Stigma

When the immediate threat of war seemed to recede in the early fall of 1990, the aircrews began to fly training missions to stay proficient. We removed the bombs from some of the planes and began to plan low-level training sorties over Saudi Arabia. These sorties mirrored some of our actual mission profiles.

The B-52s, which for thirty-eight years had been principally in the business of strategic attack, carried a kind of nuclear stigma. It was one reason that the squadron was based at a secluded naval base where the bombers would not offend local sensitivities. Even though we were there with a conventional mission, the Saudi Arabian government was hesitant to allow us to train over their deserts.

The Saudis eventually agreed, and when the low-level training sorties started, the kingdom's deserts provided much more realistic training than is available in peacetime. In some cases, we would fly over terrain so dark that our NVGs and the plane's low-light camera proved nearly useless. The pilots gained confidence using the terrain-avoidance radar display while flying only a few hundred feet above the sand.

Downstairs, the navigator and radar navigator would watch the radar altimeter as the hot desert rocks zipped past in the forward-looking infrared display. With four sets of eyes watching the terrain, the B-52s were able to train safely at low altitude in almost any visibility.

Munitions troops use a "jammer" (a wheeled cart) to lift M117R high-drag iron bombs to the pylon of a B-52, where a technician fastens them in place. These weapons were delivered from low altitude on the second and third nights of the war.

Gunners practiced their duties against US and British fighters, which would pursue us as we flew at low levels. The gunners would "shoot" at opponents while directing maneuvers designed to spoil their intercepts. While flying over our own base, the EWOs could practice jamming a "threat" emitter shipped out especially for that use.

Back within the local SAC operations building, the operations planning team (OPT) was in session for up to twenty-four hours a day. The OPT integrated mission planners, intelligence staff, and targeteers into a single team that constantly trained to produce mission packages. Before the war started, hundreds of missions were built in response to various defensive taskings. Eventually, an offensive Air Tasking Order began to take shape. The OPT began work on targets for the first nights.

One spirited debate among mission planners was whether to begin the B-52s' war by bombing from high or low altitude. Those arguing for high level wanted to avoid the intense AAA fire that we would encounter low, while those voting for low-level bombing wanted to avoid the surface-to-air missiles (SAMs) and enemy fighters that might survive the coalition's first attack. In the end, the planners decided to sneak in below radar cover for the first few nights and then go to high bombing when it was safer.

In mid-December, the crews were briefed on first-night targets. We spent the next month memorizing the targets, routes, and mission timing. Crews discussed coordination with wingmen, had "chair-fly" sessions to discuss what could go wrong, and worked to personalize their charts.

Annotations such as "IFF on here!" were common. The capability of the coalition's own air defenses was one of our biggest fears.

In one study session, an OPT chief

Jet engine mechanics service a thirty-four-year-old J57 engine. Maintenance troops worked fourteen- to sixteen-hour days from the beginning of deployment. The B-52 fleet held an eighty-percent-plus mission capable rate throughout the war.

B-52s flew more than 1,624 missions and dropped 72,000 bombs on targets during the Gulf War. The first night of the war, a group struck Iraq from Barksdale AFB, La., refueling four times during the 14,000-mile flight.

laid out thirty-one cards, representing the thirty-one bombers and tankers our base was to launch on night one. Each card bore a tail number and load information. Crew members began to laugh watching the team chief try to move around this huge mass of symbolic airplanes. We thought that, if we could get through taxi, takeoff, and refueling without crashing into each other, the mission would be a snap.

Two Hours Before Bus Time

We had no idea when the war would start. The arrival one day of six additional KC-10s and the loading of certain weapons on the planes indicated that the war could begin soon, but crews did not find out when until only two hours before our bus time.

Most of us had been up all day, so adrenaline was powering the crowd as we arrived at SAC Ops that evening. We picked up our helmets, guns, nerve gas antidote kits, and vests. We already knew the mission, so the OPT briefing covered last-minute changes in the radio schedule and a quick review of how rescue forces would identify us if we were downed behind enemy lines. Then it was out to the ramp to conduct preflight inspections of weapons, start engines, and launch.

At 8:09 p.m. Baghdad time, January 16, about the same time that those seven Barksdale B-52s were overflying the Strait of Gibraltar and starting the long trip over the Mediterranean,

the first B-52s from our base taxied out and began to take off. As we did so, hundreds of maintenance troops and spectators lined the taxiways, giving us a rousing send-off.

Eighteen bombers and thirteen tankers became airborne without a single late takeoff or abort. Soon the "air spares" peeled off and returned to base, leaving thirteen B-52s to go on toward the Iraqi targets. Twelve of the thirteen B-52s were able to reach their targets successfully. (A malfunction turned one around at the Iraqi border.)

Within hours of the opening blows, B-52s were operating out of two more bases. Bombers from Barksdale AFB and from the 801st Provisional Bomb Wing flew out of Moron AB, Spain. B-52s from Wurtsmith AFB, Mich., Castle AFB, Calif., and the 1708th PBW deployed to an allied airfield on the Arabian peninsula.

Two weeks later, aircraft from Eaker AFB, Ark., formed the 806th PBW and flew missions out of RAF Fairford, UK. Bombers and crew members from every B-52G base participated in the war, flying more than seventy aircraft, and B-52H crews were soon sent into the theater to supplement the G-model crews.

Night Missions, Brute Force

B-52 interdiction targets included ammunition factories, storage areas, fuel depots, industrial sites, and air bases, among others. Most of the missions were flown at night, with the B-52s dropping bombs from 32,000 to 37,000 feet. The most common weapon for this was the M117, a 750-pound iron bomb. Depending on aircraft configuration, a B-52 can carry either forty-five or fifty-one of these weapons.

About half of all the bombs dropped by B-52s were M117s. From high altitude, our bombs usually hit within a few hundred feet of the target. That, of course, was no match for the accuracy of a laser-guided bomb, but it was ideal for the large area targets we were sent to destroy.

B-52s were active in the campaign to suppress Iraq's defenses. Because the bomber's arsenal does not include

USAF photo by TSgt. Joe Colman

A damaged hangar at Ali Al Salem AB, Kuwait, shows the devastating effect of the 750-pound M117 bombs, which had psychological effects as well. Twenty to forty percent of Iraqi deserters mentioned the B-52s' ground-shaking bomb runs.

antiradar missiles, we used the brute-force approach. During one night early in the war, nine B-52s conducted near-simultaneous cluster-bomb attacks against three major Iraqi radar facilities defending the western approaches to Baghdad. The explosions from 88,000 orange-sized bomblets shredded and silenced each site.

On another occasion, a dozen B-52s hit a major ammunition factory twenty miles south of Baghdad. My crew was fifth in a group of six bombers and could see the clouds below and the icy vapor trails of the other planes. The contrails and clouds all flickered brightly for three seconds each time another sixteen-ton load of bombs hit the target. Photos later showed the plant had been replaced by a large black smear in the desert.

The B-52s enjoyed great success directing their firepower against the Iraqi Republican Guard and Iraqi Army in the field. These missions were flown around the clock to deny enemy troops any rest. When a flight of two or three B-52s was still an hour or so distant, reconnaissance would locate a suitable target in Kuwait or Iraq and transmit its coordinates to an E-3 Airborne Warning and Control System aircraft. The AWACS plane would forward the information to the bomber via coded message.

When we got such data, we entered them into our navigation computer and headed toward the target. When we were a few minutes out, we would refine the aim with either high-resolution ground-mapping radar or an infrared camera.

The B-52s' battlefield air interdiction (BAI) targets were usually armor or artillery units, but we often bombed supply facilities and troop concentrations. B-52s also joined the "great Scud hunt," working alongside the F-15E to track down the missile launchers and destroy them with CBU-87 antitank cluster bombs.

The weapons used most often against tanks and artillery were the M117, its smaller cousin the 500-pound Mk. 82, and the CBU-87. For softer targets, we used the CBU-58 and CBU-52 cluster bombs—some of the B-52's deadliest conventional weapons. As the ground war approached, these were used with devastating effect to thin out Iraqi troop strength.

Maintenance and munitions troops who kept the planes flying and the bombs flowing worked under extreme weather conditions, sometimes sixteen hours a day, for seven months. Their hard work paid off with a mission capable rate far above peacetime rates.

For the B-52s flying deep into Iraq, the F-4G Wild Weasel was a great teammate. By scaring the Iraqi radars into silence with their antiradiation missiles, they rendered the B-52 nearly invisible, vastly increasing the areas in which we could operate.

Also required was massive air refueling support. The KC-10s and KC-135Rs provided immense offloads. The 4300th PBW's tankers alone provided more than 27,000 tons of fuel to our bombers.

Most of the B-52s had been modified with the Global Positioning System. Its superaccurate navigation data kept our systems reliable as we crossed Iraq with our radars off, and the final radar aiming on our bomb runs needed little or no adjustment by the bombardier.

Staying in Formation

Night vision goggles were useful. The desert landscape was often too dark even for the NVGs, so our pilots found other uses for them. We could stay in formation at night by the faint glow of our wingman's engines, and pilots could see AAA sites or their tracers early enough to steer clear of them.

No B-52s were lost in combat, although there were some close calls. One bomber was struck at low altitude by an unidentified missile. It landed safely despite serious damage to its tail and empennage. One other bomber was hit from below during a high bomb run and returned to base safely, despite damage to some systems. AAA damage was surprisingly light, given the intense fire that B-52s flew through in the first three nights of low-level bombing.

The 4300th PBW flew 248 bombing missions against 141 BAI targets during the war. Theater-wide, B-52s hit 440 Iraqi Army and Republican Guard units with more than a thousand loads of bombs, each averaging sixteen to eighteen tons. Groups of three B-52s, dropping their loads from high altitude, could strike with total surprise in any weather, day or night. Iron bombs would shake the earth and light the sky for miles around.

The psychological impact was confirmed by many of the Iraqi soldiers who deserted during the air campaign. When the ground war began, Iraqi soldiers began to surrender en masse. They had seen enough of us. ■

Capt. Doug Fries is a B-52G radar navigator based at Loring AFB, Me. During the Persian Gulf War, he deployed overseas for seven months, logging 158 combat hours during ten missions.

The missile force of the future figures to be modified Minuteman IIIs, and the space-launch program is shifting direction.

The ICBM Era Ends

By David J. Lynch

After thirty years and billions of dollars' worth of improvements, the US strategic nuclear missile program appears to be over. No new ICBMs are in prospect. The end of the cold war has shifted attention from development of ever more powerful and accurate long-range weapons to the refinement of their technological twins—space-launch vehicles.

Not so long ago, the ICBM force would have expected to profit from such a robust booster program. No longer. Signs are that future launch vehicle programs will offer little benefit to missile-makers, even in the unlikely event that this country is forced into a crash effort to restart ICBM production.

"Ballistic missiles aren't much of a business anymore," said Steven Flank, formerly a physicist at Lawrence Livermore National Laboratory in California. "The launch vehicles are."

Since the dawn of the rocket age, ballistic missiles and rocket launchers have been closely linked, both in the public imagination and in technological reality. The Soviet Union's surprise 1957 launch of the satellite Sputnik caused grave worry in the United States. The same technology that put the diminutive satellite in orbit could almost as easily deliver a nuclear warhead over intercontinental distances.

Sputnik's success scared the US into pouring money into its own space program. It also spurred Washington into launching a huge program to develop a land-based nuclear missile force. In fact, the emergency ICBM plan that President Dwight D. Eisenhower approved on January 30, 1958, had been dramatically reshaped in the wake of Sputnik only three months earlier.

Thus, even from the earliest days, the two systems were inextricably linked. Said Sam Mihara, McDonnell Douglas's staff director for the Delta rocket program, "The history of every launch vehicle started with a missile. . . . Generally, 'missiles is missiles.' The original technology is basically the same."

McDonnell Douglas's workhorse Delta is a prime case. The rocket, which boasts a 97.9 percent success rate, evolved from the Air Force's Thor intermediate-range nuclear missile, deployed in Europe as part of NATO's theater nuclear deterrent in the 1950s and early 1960s.

The First True ICBM

The first intercontinental-range missile, the Atlas, was produced by General Dynamics' Convair division. The Atlas series got its start under an Army Air Forces contract awarded April 19, 1946. That early postwar program underlined the new US interest in missile technology that had been spurred by Nazi Germany's V-2 weapon. The first Atlas model was a one-and-a-half-stage system, powered by an engine rated at 360,000 pounds of thrust. If Atlas had ever been used in anger, it would have been steered along its 6,500-mile range by a radio-inertial guidance system.

The missile's links to space, however, never faded. Atlas boosters were used to speed Mercury astronauts into space in the early 1960s. In 1965, when the first Atlas strategic nuclear missiles were mothballed, they were shipped to Norton AFB, Calif., to be stored for later use as space launchers.

Two decades later, the Air Force converted thirteen of its remaining Titan II strategic nuclear missiles for use in the same role. More recently, the Department of Defense used militarily obsolete Minuteman I launchers to send vital Strategic Defense

Initiative experiments into space and to serve as targets in related antimissile defense system tests.

The Air Force's long and intense development of the intercontinental-range ballistic missile also paid off for space-launch vehicles, often in unappreciated ways. For example, techniques developed specifically to shield missile components from the effects of radiation during a nuclear war were employed on spacecraft on missions through the Van Allen radiation belt in the outer atmosphere.

The pioneer generation of missiles had numerous problems. The first-generation missiles proved "generally unreliable, very expensive to operate and maintain, and highly vulnerable to the effects of nuclear blast," said a 1990 Strategic Air Command history of the ballistic missile force.

Ever since those first Atlas weapons were fielded, the ballistic missile weapon force has been the subject of continuous improvement. At first, guidance was crude. Early ICBMs lacked integrated circuits and relied on rudimentary computers. Today, the guidance system in the most modern LGM-118A Peacekeeper missile is a sophisticated computer ball that contains 19,000 separate parts.

In some cases, the generational system improvements were incremental—for instance, production of more powerful engines that would provide slightly greater range. In others, the new model of a weapon represented an almost entirely fresh design. The Navy's Polaris A3 missile, test fired for the first time in 1963, was eighty-five percent new, according to a 1990 Navy report.

Throughout the three-decade history of the US missile program, successive models of ICBMs bettered their predecessors in each of the major component areas—propulsion, materials, fuel, and guidance systems. Second-generation ICBMs, such as the LGM-30 Minuteman series, offered improved reliability, lower operating costs, and greatly improved survivability.

The Problem Was Fuel

Specific improvements in the Titan II included more powerful engines, hypergolic fuel, and all-inertial guidance. The liquid-fueled Titan II stood alert from 1963 until 1987, when the last model was pulled from its silo and retired.

The military, however, had a major headache in handling the highly combustible liquid fuel for those early rockets. The Minuteman system that followed the gigantic Titan was a three-stage, solid-fuel rocket with about the same 5,500-mile range. By 1985, Air Force officials were eyeing ways to keep Minuteman viable well into the next century. Under the Rivet Mile program, they launched a joint SAC and Air Force Logistics Command initiative to refurbish the missile's internal components.

Today, 500 LGM-30G Minuteman III missiles deployed in the western United States constitute the backbone of the nation's remaining strategic deterrent. Upgrading these older but still potent weapons may be the only significant missile-related activity undertaken by the Pentagon in the next several years.

ICBM technology reached its apex with the ten-warhead Peacekeeper. The Carter Administration's original 200-missile Multiple Protective Shelter plan and the Reagan Administration's revised, 100-missile silo and mobility scheme became mired in political controversy, mostly because they did not provide a full solution to the problem of missile vulnerability.

However, the "MX" proved to be a remarkable technological achievement, with astonishing accuracy. According to Dunbar Lockwood, a specialist with the private Arms Control Association in Washington, the Peacekeeper has a circular error probable (CEP) of just 300 feet—meaning that, even at intercontinental ranges, fifty percent of all Peacekeeper shots would land within 300 feet of the target.

The Air Force does not dispute that figure. Gen. John T. Chain, USAF (Ret.), former commander in chief of SAC, reported not long ago that the missile's accuracy "makes your eyes water."

The four-stage Peacekeeper contained motor cases of Kevlar epoxy and employed an unusual, cold launch method. High-pressure steam would boost a Peacekeeper, housed in a metal container, from its underground silo. Once the entire package was at least 150 feet above the lip of the silo, the first-stage motor would ignite, propelling the Peacekeeper into ballistic flight.

Fifty of the ninety-ton Peacekeepers, packing 500 high-quality reentry vehicles, stand in steel and concrete silos sunk in the Great Plains of Wyoming. They may shortly become monuments to a passing era of weaponry. Because the threat posed by the old Soviet empire has collapsed, there is no political or military impetus to continue ballistic missile development.

Away With MIRVs

In his major arms-control initiative announced September 27, 1991, President Bush called for removing from alert SAC's 450 single-warhead Minuteman II ICBMs and 160 ten-warhead Navy Poseidon missiles. Moreover, the President has proposed banning all land-based ICBMs with multiple warheads. This step would remove the relatively new, state-of-the-art Peacekeeper from the force.

The President's proposal, coupled with the political transformation of the old Soviet Union, suggests that missiles may be deemphasized further. Said Richard Goetze, a retired Air Force major general and former SAC assistant chief of staff, "The Minuteman IIs are coming off alert. Eventually, we'll back down some of the others off alert."

The new sentiment has contributed to the demise of the controversial Small ICBM, or "Midgetman," program. President Bush, in his new Fiscal 1993 budget, canceled the single-warhead ICBM program, which, in nearly eight years of desultory, on-again, off-again work, had initiated the development of a road-mobile, single-warhead missile. So far, Midgetman, which originally was to have been deployed by the end of this year, has been test flown only twice. The projected $30 billion to $40 billion cost of a 500-missile Midgetman fleet proved intolerable in the current budget climate.

Veterans of missile development say that it is possible to design new-generation types yielding technical improvements over the Peacekeeper or Midgetman. In many areas, the available improvements would be slight; given the current international political climate, demand for them is slighter still.

Thomas Gunkel of Rockwell International Corp., who began his career as a young engineer on the Minuteman I program, agreed with this assessment. "The improvements [now available] I would characterize as incremental," said Mr. Gunkel. "The rate of change to technical strides isn't what it was twenty-five years ago."

Mr. Flank, the former Lawrence

Livermore scientist, said propulsion systems have more or less run through the readily available improvements. One possibility—widespread use of higher-energy propellants, such as those of the Trident D5 submarine-launched ballistic missile—is inherently dangerous to implement. It is also questionable whether the potential range improvements are worth the trouble, said Mr. Flank.

The greatest potential improvement would be the addition to ICBMs of "terminal guidance," meaning, essentially, the ability to acquire and assimilate a targeting update during the final stage of the warhead's flight. Such "zero CEP" weapons have been seen by the Air Force as potentially highly useful in attacking strategic relocatable targets.

The Minuteman III looks to be the basis of the land-based force for some time to come. For the past year, the Air Force has considered various plans to modernize the Minuteman III force with new guidance computers and onboard systems. Experts believe that, as a large portion of the strategic deterrent is taken off alert, the reliability of the remaining assets will become even more important.

"We ought to keep things safe and sure," Mr. Goetze said.

Space Launch Booming

Even as interest in new ballistic missiles wanes, there has been a boom in enthusiasm for developing new ways to get defense, scientific, and commercial cargo into space.

Research is going forward on a wide array of new and improved space-launch systems. McDonnell Douglas continues to upgrade its Delta rocket to meet commercial competition from GD's Atlas. The government is funding the National Aerospace Plane (NASP) and the National Launch System.

The emergence of actual, deployed systems from any of these programs is a long way off. A NASP prototype is not scheduled to fly until 1997 at the earliest, and many are skeptical that it will appear even then. The new heavy-lift NLS is even farther away.

Technologically, however, the programs have great promise, particularly in reducing the cost of placing payloads into space. Under the management of Air Force Systems Command's Space Systems Division (after July 1, Air Force Materiel Command's Space and Missile Systems Center) at Los Angeles AFB, Calif., the NLS program aims to field a launcher capable of placing ten-ton payloads into low-Earth orbit for a fraction of current costs. At present, six contractors are working with the Air Force and NASA on alternative concepts and system architecture studies.

"The goal of this launch program is to greatly improve national launch capability with reductions in operating costs and improvements in launch system reliability, responsiveness, and mission performance," said a July 24, 1991, policy statement by the National Space Council.

Under a $58.9 million Strategic Defense Initiative Organization contract, McDonnell Douglas is pursuing a single-stage-to-orbit (SSTO) vehicle that would lift off and land vertically. If things go as planned, the company would test fly a one-third-scale model in 1993.

"Space right now is very expensive to operate in. We need something to operate in space cheaply. We're trying to invent the DC-3 of the space age," said former astronaut Pete Conrad, now a McDonnell Douglas vice president.

Undoubtedly the most dramatic possibilities lie in the NASP, which President Reagan christened "The Orient Express" in a State of the Union address. While officials have shelved for now the goal of two-hour flights from the US to Tokyo, work is proceeding on a range of hypersonic technologies. Plans call for a late 1993 go-ahead on the program, with the first orbital test to take place in 1999.

The Ballistic Missile "Threat"

The demise of the ballistic missile poses danger to the commercial space-launch sector in at least one major respect. The retired missiles have become potential competitors for today's commercial space launchers.

In the 1980s, the Reagan Administration encouraged defense contractors to begin competing for commercial contracts to launch satellites into orbit. McDonnell Douglas, General Dynamics, and Martin Marietta responded with the Delta, Atlas, and Titan launchers, respectively.

Now there is a superabundance of ballistic missiles, rendered obsolete by unilateral arms-control steps. President Bush's September proposal idled 610 nuclear missiles and revived industry fears that excess rockets could swamp the commercial launch industry before it really gets off the ground.

The Pentagon is still considering how the government should dispose of these weapons, but officials in Washington already have signaled a willingness to use the obsolete missiles as space launchers. "Under certain conditions, we would allow for the use of excess ICBMs as commercial launchers," said Mark Albrecht, executive director of the National Space Council. "The question is how to bring them into the launch equation."

The Defense Department expects to produce answers this summer on the suitability of using retired missiles as space boosters.

The extent of the modification needed to make a Minuteman or Poseidon ready to launch satellites is unclear. One aim of the Pentagon's ongoing review is to answer that question. Industry officials emphasize the difficulties involved. One private expert said that reliability questions make it unlikely that companies would entrust valuable commercial cargo to an aging launcher.

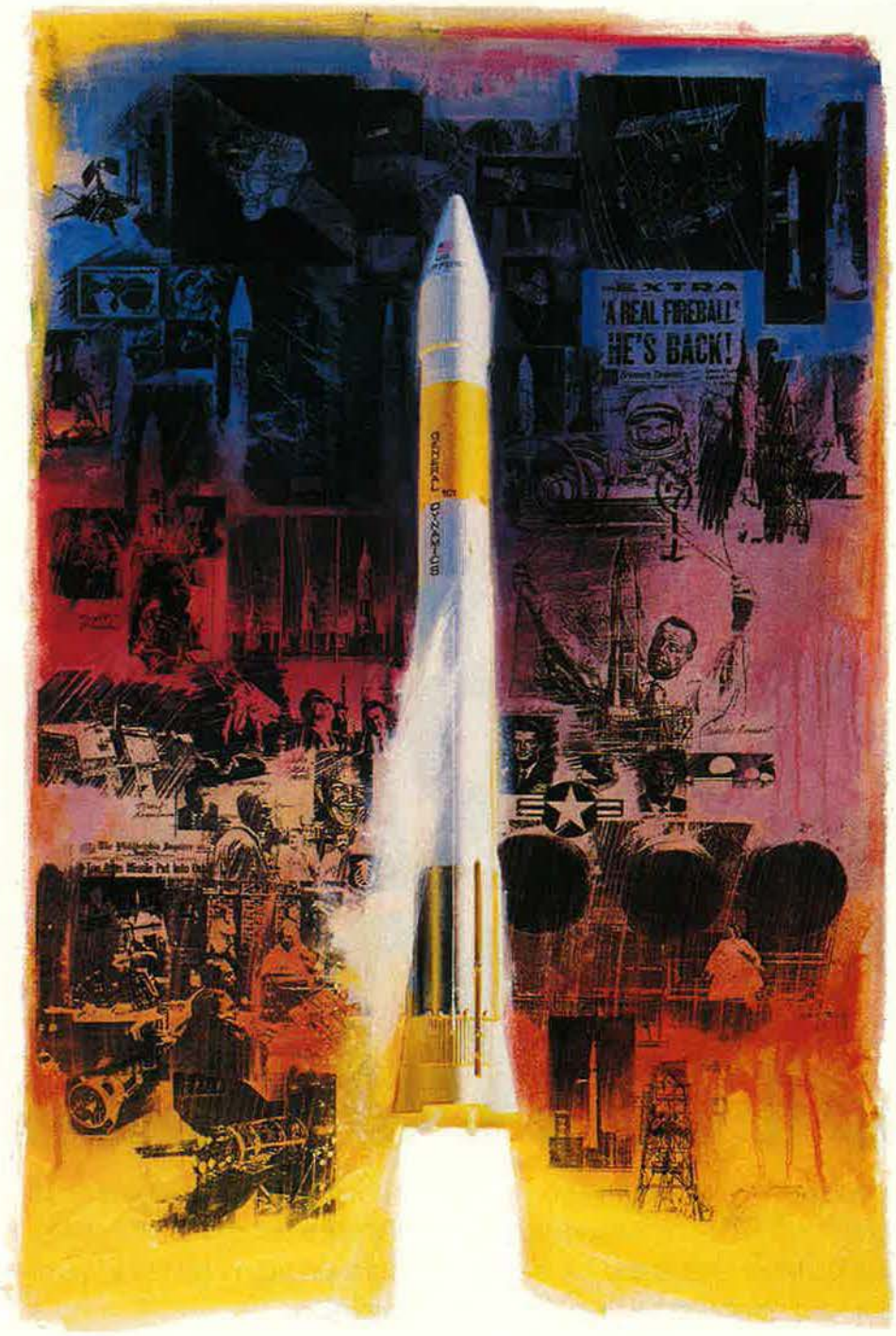
For the advocates of modernized launch systems, the big worry is too many programs chasing too few dollars. Cost estimates for the next phase of NASP, for example, are $5 billion to $10 billion. Several hundred million dollars are earmarked for early research into SSTO by McDonnell Douglas and into NLS by six other contractors. Something will have to give.

More broadly, NASP and SSTO, with their revolutionary approach to access to space, are the first, most visible signs that launch vehicle technology has begun to part company with its fraternal relation, the ballistic missile.

In the words of one rocket expert, "They've basically gone down a different technical path." ■

David J. Lynch covers the aerospace industry and national defense topics for the Orange County Register *in California. He is a former editor of* Defense Week *in Washington. His most recent article for* Air Force *Magazine was "Breakup of the Hive" in the January 1992 issue.*

ATLAS.



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Defense firms question whether the "fifth service" can gear up for the next crisis.

Rumbles From the Industrial Base

By Larry Grossman

LOCKHEED's chief executive, Daniel M. Tellep, seemed to capture the essence of post–cold war unease felt by the several hundred US Air Force acquisition officers and defense industry executives attending the second annual USAF-AFA acquisition conference, held recently near Washington, D. C.

"If someone asked me to describe the mood swings of the defense industry over the last decade," remarked Mr. Tellep, "I'd say 'euphoric, beleaguered, triumphant, apprehensive.' "

The US defense industry, explained the CEO of Lockheed, was frankly euphoric about the substantial increases in defense spending during the height of the Reagan military buildup of the early 1980s. When the press began to churn out hundreds of stories alleging massive cost overruns, spare parts "horror stories," and rampant waste, fraud, and abuse, the industry felt beleaguered. More recently, as the Persian Gulf War unfolded, the industry's mood turned triumphant as the US celebrated the armed forces' technological prowess.

Yet within months of the end of that war, noted Mr. Tellep, "this mood disappeared into the shadows of what one poignant headline called 'The War's Faded Triumph.' " As a result, the stark reality of change sweeping the industry has made its employees, leaders, and customers "distinctly apprehensive."

"Despite what many think," he went on, "it is not just downsizing, contraction, rightsizing—whatever you want to call it—that makes us apprehensive. We have been doing that for several years. Nor are we in industry concerned only about the fate of our programs or the size of our business. What we are deeply concerned about is a sense of lost equilibrium, the lack of shared national goals and the threat to our nation's technological vitality."

Mr. Tellep spoke for many at the late-February event, sponsored by

AFA's Central East Region. The theme was "Partnership, Competitiveness, and Rightsizing." Participants seemed convinced that, in the wake of the breakup of the Soviet Union, the nation's defense industrial complex, which has been churning out high-tech weapons and other advanced systems for nearly four decades, entered a period of radical change on a scale unprecedented in its history. To many, the uncertainty seems comparable in scope, if not magnitude, to that facing the new nations of eastern Europe and the former Soviet Union.

Life Support

Conference participants recognized that some in the Defense Department and Congress are trying to pull together a life-support system for the US defense industry to keep the industrial complex sufficiently strong to serve as a base for regeneration of US forces.

These experts fret that, unless the Pentagon comes up with the right "rightsizing" plan and moves to forge a partnership with defense industry, the so-called "fifth service" will not be able to gear up for the next crisis. The point was made by Defense Secretary Dick Cheney, who in a February report to Congress claimed that the defense industrial base "will not be able to respond in a timely fashion" if critical parts disappear.

One prime topic of conversation was the Pentagon's new approach to weapon acquisition. In an effort to prevent massive erosion of the base, the Pentagon's top weapons buyers announced in January that the government would pursue a new policy that emphasizes research and development and production of prototypes rather than production. Future funding for research and development will remain at steady if not increasing levels while overall defense spending declines.

The Defense Department maintains that this will ensure continuation of the technological advantage that the US armed forces enjoyed during Operation Desert Storm. Meanwhile, the Pentagon will push increased arms sales to friendly governments to stretch out current production and keep weapons suppliers in the defense business.

In addition, DoD wants to shore up industry balance sheets by phasing out the fixed-price contracting that resulted in big losses for many companies. It is urging defense contractors to adopt flexible and agile manufacturing systems so they can rapidly switch from making weapons to making commercial products and back again—a tall order in the best of times.

"Implementing this plan will not be easy, but it's the best way to go," Gen. Michael P. C. Carns, the Air Force Vice Chief of Staff, told conference attendees. "The alternative—conducting business as usual—will only postpone the hard choices."

"The new acquisition approach will require close partnership to be successful," Lt. Gen. John E. Jaquish, principal deputy to the assistant secretary of the Air Force for Acquisition, told the conference.

Opinion was divided on whether the Pentagon's plan is best, but few at the conference disagreed that there can be no going back to business as usual. The sentiment also was widespread on Capitol Hill. Said Rep. Les Aspin, the Wisconsin Democrat and defense expert who chairs the House Armed Services Committee, "If we continue with business as usual, we soon won't be doing much business at all. . . . We've got to plan now so that the defense industrial base we have left will provide us the defense we need for the future."

"Out of Business"

It is, rather, the specifics of the Pentagon's new roadmap for acquisition that draws criticism from Representative Aspin and acquisition experts. They said that the Cheney plan will not be enough. "If we follow [Cheney's] plan," argued Representative Aspin, "we will be out of business in several defense industries."

Industry executives at the conference strongly agreed with the House defense leader. "If we are going to be successful over the long haul, we cannot take the position of putting prototypes on the shelf," said Gordon L. Williams, president of Dallas-based LTV Aerospace & Defense Co.'s aircraft division. Industry must be able to build new designs "on hard tooling [and] must do it in an environment that is closely knit to production," said Mr. Williams, whose division builds major components for USAF's B-2 Stealth bomber.

While recognizing the fiscal and strategic realities that are forcing the change, industry—the Pentagon's partner in national defense—is anxious about the new acquisition rules. The changes sent shock waves through the defense industry, at least partly because senior Pentagon weapons buyers, from Deputy Secretary of Defense Donald Atwood on down, simply failed to consult industry counterparts, according to several executives.

At the conference, as in other venues, Pentagon officials were at pains to point out that, while tough times await the industry, there will still be significant purchases of military hardware. Because of falling budgets and rising weapons costs, a Defense Department fact sheet said, the military "must ensure that it produces only those weapon systems it absolutely needs," but this does not mean that the military is going to stop buying weapons for billions of dollars annually.

"We will still be producing things," said Secretary Cheney. Mr. Atwood added that "the Pentagon is going to spend $50 billion a year on acquisition," so the defense industry should not panic.

There was still unease among the conference participants about the course of the defense business. They noted that the Air Force will not be buying any more F-15 fighters from McDonnell Douglas after the final order placed in Fiscal 1991 and that only twenty-four General Dynamics–built USAF F-16 fighters have been requested for 1993, down from forty-eight this year and 108 in 1991. Army purchases of Gulf War–proven AH-64 Apache attack helicopters, built by McDonnell Douglas, and M1 tanks, built by General Dynamics, are scheduled to end this year. Under DoD plans, when General Dynamics' Electric Boat division completes the first *Seawolf*-class attack submarine for the Navy, the program will be terminated.

The Army's number one acquisition priority, the RAH-66 Comanche helicopter, was heading for production in late 1996, when the first of 1,292 aircraft for $34 billion was to roll off the line. Now, under the Pentagon's new acquisition plan, United Technologies' Sikorsky Aircraft and teammate Boeing Helicopters will build just three prototype Comanches.

The Pressure Is Off

The acquisition process can be changed because the Pentagon no

longer has to worry about "the Soviets right behind us, or just ahead of us," Secretary Atwood said. The pressure to get new equipment into the field has been alleviated, so time can be spent deciding exactly what is needed and seeking the best approach.

Industry executives at the conference nevertheless expressed dismay that the Pentagon would develop its industrial base policy in a vacuum.

"There is plenty of expertise in corporate boardrooms across the country," said one executive of a large US aerospace manufacturing firm. "You'd never know it, however, because no one from [the Office of the Secretary of Defense] ever asked anyone in the defense business for their advice." He added that the defense industry has been thrown into confusion because many of the Pentagon's new acquisition policies have not been put into final form.

In addition, the military has not decided the fate of several large programs in early stages of development. "We have no idea of what the future of those weapon systems is," the aerospace executive said.

The new strategy is "seriously flawed," said Don Fuqua, president of the Aerospace Industries Association. As the Defense Department works out the kinks, he added, industry hopes to help out. "I think our industry can help," said Mr. Fuqua. "We know what it takes to build this stuff."

Lockheed's Mr. Tellep took a singularly different approach from that of most major executives. He says that the Pentagon's new acquisition strategy—"if done right"—will provide a good way to continue the development of high technology in the new budget environment.

Mr. Tellep told the conference that early industry perception of the new acquisition strategy was unfavorable because it at first appeared to deemphasize development and production of systems after the prototype stage. "Industry's concern was that prototypes alone fail to maintain critical manufacturing skills and vital lower-tier supplier bases," he said, adding that he was relieved when Secretary Cheney clarified the plan during a news conference in late January.

In that appearance, the Secretary said, "We well understand that the process of developing a new weapon system not only involves developing the technology and engineering it into a weapon; it also involves developing the production process and building enough of a particular item to get operational experience with it, to be able to field it with the force in sufficient numbers so that we can develop the doctrine that goes with it."

Mr. Tellep lauded the Secretary's statement, claiming, "I can't imagine anyone in industry taking issue with it."

No Last Word

Even with industry in partnership, the Pentagon may not have the last word in shaping a new acquisition strategy. Several powerful Capitol Hill lawmakers have offered their own proposals. In an election year, with thousands of defense jobs at stake, many changes may yet be made in the new system.

Representative Aspin, for example, has proposed that the Defense Department sustain low-volume procurement for critical systems—even in excess of military needs. He singled out F-16s and naval nuclear reactors as good candidates.

Selective upgrading of existing systems, according to the Aspin proposal, would allow improvement of weaponry without the expense of new systems while helping maintain needed elements of the defense industrial base. Representative Aspin mentioned the conversion of M1A1 tanks into M1A2s, a move that would sustain armor, cannon, and propulsion elements of tank production.

The subject of much discussion at the acquisition conference, however, was Representative Aspin's plan for selective low-rate procurement. This would permit the purchase of current-generation systems and components as needed to keep vital, defense-unique suppliers alive to produce future systems.

In this context, Aspin would buy F-16s as a hedge against risks in development of the new F-22 Advanced Tactical Fighter, set to achieve initial operational capability in 2002. Selective low-rate procurement of F-16s would keep General Dynamics' Fort Worth production lines open until the Air Force can begin buying its new Multirole Fighter at the turn of the century.

Though Representative Aspin did not get the endorsement of industry executives attending the conference, the idea of continuing production—even at low rates—was embraced by several of those in attendance.

"If we allow our production facilities to atrophy, you're going to have to accept a strategy of a come-as-you-are force," said Oliver C. Boileau, president and general manager of the Northrop B-2 division. This, he said, is a "dangerous prospect," given the ease with which coalition forces overwhelmed the Iraqi air forces and Republican Guard.

"We won so easily that the American people believe we can do the same thing anywhere, anytime," said Mr. Boileau. "The Air Force and the rest of DoD must provide, from a national military strategy, the minimum required capabilities in numbers of equipment and kinds of equipment that we must have in the defense industrial base"—technologies not just for prototypes but also for the fighting force.

Representative Aspin's plan to keep weapons in low rates of production will not work, the Pentagon says. Sean O'Keefe, the Pentagon's comptroller and a close advisor to Secretary Cheney, contended that "it would be a mistake, and it would be very difficult to justify to the taxpayer the idea of going back to what we did in the late 1970s, which is build a very small number of weapon systems at very high unit costs and miserly rates."At the time, Mr. O'Keefe said, arsenal needs demanded this approach, but this is no longer true.

"To the extent that you make the decision to keep anything going that exceeds inventory demand for what you perceive to be the overall base force requirements," Mr. O'Keefe said, "in the end you make an industrial planning decision [that] we have demonstrated as a department that we are totally [incapable] of doing equitably. We've never done that right, and now is not the time to start, because invariably we're just not qualified to make decisions on where to draw the line." ■

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The Air Guard and Reserve were involved from the first hour on the first day.

TOTAL STORM

By James P. Coyne

OPERATION Desert Storm was the first major war of the Total Force era. When the US buildup began, there was no doubt that the Air National Guard and Air Force Reserve would take part. It was no surprise when they responded with effectiveness and style.

"The very first day, the first hour, I asked for all the C-5s and C-141s owned by the Guard and Reserve," noted Gen. H. T. Johnson, commander in chief of Military Airlift Command (now commander of Air Mobility Command). General Johnson recalled that, because the Guard and Reserve had not been formally mobilized, "I had no right to do that," but he got them anyway. "I also asked for all their crews," he added, "and we were oversubscribed in crews."

One day, the General made the offhand remark, "We need some C-130s, but we cannot call up individual crews in -130s. Why don't we set up a provisional unit?"

The General was just thinking out loud, but, within two hours, his Guard and Reserve advisors returned with news that they had assembled two lead units, one of Reservists from Dobbins AFB, Ga., and the other of Guardsmen from Charleston, W. Va. "When do you want them to move?" they asked.

The 926th Tactical Fighter Group, a Reserve A-10 unit from New Orleans, left a deep impression on the Iraqi foe. Overall, Reserve A-10s flew 1,300 combat sorties and logged more than 3,000 combat hours. One captured Iraqi captain described the experience:

"The single most recognizable and feared aircraft at low level was the [A-10] Thunderbolt II. This black jet was seen as deadly accurate. . . . The actual bomb run was terrifying, but the aircraft's loitering around the target area prior to hitting the target caused as much, if not more, anxiety, since the soldiers were unsure of the chosen target."

By war's end, 12,098 of the Air Force's 54,706 personnel in the Persian Gulf area—twenty-two percent—were Guardsmen or Reservists.

From Concept to Fact

Clearly, members of the Air Guard and Reserve are no "weekend warriors." In 1970, Secretary of Defense Melvin Laird directed that a "Total Force" concept be used in assumptions for planning, programming,

This A-10 and its pilot, Capt. Robert Swain of the 706th TFS, NAS New Orleans, scored the first-ever A-10 air-to-air victory, shooting down an Iraqi helicopter over Kuwait in Operation Desert Storm. Captain Swain's airplane,* Chopper Popper, *has a Cajun crawfish painted on its nose.

Photo © Randy G. Jolly/Arms Communications

An A-10 Victory

On February 6, Capt. Robert Swain of the 706th TFS, NAS New Orleans, La., shot down an Iraqi helicopter over central Kuwait in the first-ever A-10 air-to-air victory.

"As I was leaving the target area—after dropping six 500-lb. bombs and firing my two Maverick missiles at tanks—I noticed two black dots running across the desert. They weren't putting up any dust, and yet they were moving fast over the ground."

They were helicopters. On the radio, he told the forward air controller, flying nearby in an OA-10, about the two. The helicopters split up, one heading north, the other south. The OA-10 pilot moved in close to the helicopter flying south, established it was Iraqi, and began to fire marking rockets along its path.

Captain Swain was "cleared in, hot." Diving in, he lined up his target.

"On the first pass, I tried to shoot an AIM-9 heat-seeking missile, but I couldn't get it to lock on [the target]," he said. "So, on the second pass, I fired a long burst of 30-mm from the cannon, and the helicopter looked like it had been hit by a bomb. We tried to identify the type of [helicopter] after we were finished, but it was just a bunch of pieces."

manning, equipping, and employing the reserve units. They were no longer to be equipped with hand-me-down weapons. As Secretary Laird envisioned it, they were to be serious partners in national defense and take over missions previously assigned to active-duty forces.

Three years later, Secretary of Defense James R. Schlesinger announced that Total Force was no longer a concept but a fact.

The services took to the idea with varying degrees of enthusiasm and commitment. Sen. Sam Nunn (D-Ga.), Chairman of the Senate Armed Services Committee, said in 1990 that the Air Force was a clear leader in using reserve components effectively.

Indeed, the Air Force was soon relying on the Guard and Reserve for large portions of the airpower it put on the line. By the 1980s, the forces were flying modern aircraft. Their rosters were filled with experienced veterans. They frequently bested their active-duty counterparts in competitions.

Gen. Robert D. Russ, commander of Tactical Air Command, reported in early 1990 that, compared to active-duty counterparts, "the only difference in a Guard or Reserve tactical fighter unit today is twenty-four hours. We give the Guard and Reserve twenty-four hours to get started so they can recall their people."

In previous crises, Guard and Reserve units had responded. This was true in the 1973 Arab-Israeli War, the 1975 rescue of the *Mayaguez* off Cambodia, the 1983 conflict in Grenada, the 1986 Operation Eldorado Canyon against Libya, the 1987 and 1988 escort missions in the Persian Gulf, and the 1989 Operation Just Cause in Panama.

It was in the Gulf War, however, that the first massive test of the Total Force occurred. When Iraqi forces invaded Kuwait on August 2, 1990, Maj. Gen. Philip G. Killey, director of the Air National Guard, and Maj. Gen. Roger P. Scheer, chief of the Air Force Reserve, alerted their troops to get ready.

Flying and support units ran telephone checks to determine how many aircrews would be willing to volunteer. By the time the operational commands officially asked for help, volunteers were lined up in Guard and Reserve outfits across the country.

The initial call was for 6,000 volunteers. By the third week in August,

all 6,000 were on active duty, and more were standing by. In the first seventy-two hours after the call for volunteers, 15,000 Guardsmen and Reservists had stepped forward.

Hefty Work Loads

Most US strategic and tactical airlift capability is in USAF's Air Reserve Component. Fifty-five percent of the crews who operate strategic airlifters (C-5s and C-141s) are in the Guard and Reserve. Almost sixty percent of the tactical airlift (C-130s) capability is in the Guard and Reserve.

Furthermore, nineteen air refueling squadrons, about half of the Air Force's total capability, are in the reserve forces. These squadrons provide the country's wartime air refueling surge capability. Sixteen of them were ultimately activated.

Under the Total Force Policy, fifty-seven percent of the aerial port units, sixty-seven percent of aeromedical evacuation units, and forty-six percent of tactical reconnaissance assets were in the Air Reserve Component when Saddam invaded Kuwait.

Reservists and Guardsmen came from all walks of life. For example, 2d Lt. Becky Armendariz worked in the personnel office at the White House. She was also a member of the 60th Aeromedical Evacuation Squadron (AES) at Andrews AFB, Md., near Washington. "I arrived in Dhahran, Saudi Arabia, on November 7," she said. "I had, at first, expected to spend thirty days on active duty, but it turned out to be ninety days."

For Operation Desert Shield, Guardsmen and Reservists were called to active duty under two provisions of federal law.

For volunteer service, Title 10 of the US Code authorizes the Secretary of Defense to order individual members of the reserve components to active duty *with their consent* and (for National Guard personnel) that of their state governors. Another section of Title 10 authorized the President to call to active duty units of the Selected Reserve, up to a total of 200,000 for not more than ninety days, with one ninety-day extension.

With war a possibility in late 1990, however, Congress authorized the President to extend the Desert Shield call-up for combat units to 180 days, with a 180-day extension.

Mobilized or volunteer Reservists often faced special problems. For many, active service in the Gulf War meant large pay cuts, since military compensation did not match their civilian salaries. Others had to repay bonuses they had received from their employers. Some were even furloughed or released. Although the law provides protection, practically speaking, getting a job back often means lost time and money. Most employers supported their employees called to active duty, but some did not.

By August 3, however, the Air Reserve Component was prepared to augment the active-duty Air Force with complete units or small packages of people with individual, specialized skills. As General Johnson said, MAC put aircraft and aircrews into the airlift pipeline immediately.

The Air Guard, for example, provided six C-141s and fourteen augmented crews from the 172d Military Airlift Group from Jackson, Miss., and two C-5s and three crews from the 105th MAG, Stewart ANGB, N. Y. The Reserve responded with similar numbers.

Maximum Effort

MSgt. William R. Cary, a flight engineer with the 701st MAS, was one of the early C-141 crewmen to volunteer. The first flight left him in little doubt that this was to be a maximum effort. "We normally flew at a max weight of 275,000 pounds in the C-141," Sergeant Cary reported at the time. "Now we were operating at 375,000 pounds."

By August 6, when the US began to move a 250,000-strong war machine more than 8,000 miles, ANG KC-135 in-flight refueling outfits were assigned to tanker task force locations at Bangor ANGB, Me.; Pease ANGB, N. H.; Phoenix Sky Harbor IAP, Ariz.; and Forbes Field, Kan.

ANG and AFRES C-5 and C-141 aircraft and crews were incorporated into the MAC system on August 7. By then, aircraft maintenance and support volunteers from the Air Reserve Component were also working full-time.

Provisional reserve tactical airlift squadrons were formed from volunteers. The AFRES 94th Tactical Airlift Squadron (Provisional) was composed of eight C-130Hs and crews, four each from the 94th Tactical Airlift Wing, Dobbins AFB, Ga., and the 908th Tactical Airlift Group, Maxwell AFB, Ala. The Guard provided the 130th Tactical Airlift Squadron (Provisional) with eight C-130Hs, four from the 130th Tactical Airlift Group, Charleston, W. Va., and four from the 136th Tactical Airlift Wing, Dallas, Tex.

The two provisional squadrons were destined to operate out of Al Kharj airfield, Saudi Arabia. In the beginning, however, no facilities existed for transport aircrews and ground personnel, so the squadrons operated out of the UK, flying between Al Kharj and Britain for several weeks while temporary facilities were constructed.

These F/A-16s of the ANG's 174th TFW, Hancock Field, N. Y., deployed to the Gulf area. Armed with 30-mm gun pods, the wing's Fighting Falcons are the only ones in the Total Force currently dedicated to the mission of close air support.

On August 7, when the first air and ground elements began to arrive in Saudi Arabia, the Guard activated its contingency support staff at Andrews AFB. The Reserve manned a CSS at its headquarters at Robins AFB, Ga. The Air Force activated a central contingency support staff at the Pentagon on August 8.

The 172d MAG provided the first Guard airlift sortie in support of Operation Desert Shield, airlifting troops and equipment of the Army's 82d Airborne Division.

By the end of August, the Guard and Reserve were flying forty-two percent of the strategic airlift and thirty-three percent of the aerial refueling missions. Concurrently, the Guard deployed sixteen C-130H tactical airlifters to the Gulf. The C-130H, the newest version of the Lockheed Hercules, has powerful T56-A-15 turboprop engines, a redesigned and strengthened outer wing, updated avionics, and improved cargo-handling capabilities.

By September 20, 1990, wartime sortie rates, made possible by the addition of activated Guard and Reserve aircraft and aircrews, resulted in a huge surge in flying hours. This created an increased need for aircraft maintenance capabilities. MAC issued a call for more maintenance people from the Guard and Reserve. Individual maintenance personnel from ANG and AFRES began to be recalled and put into MAC's infrastructure.

By October 1990, the White House came to the conclusion that only offensive military action would force Saddam to withdraw forces from Kuwait. The President wanted to know what it would take to do the job. Gen. H. Norman Schwarzkopf, through Gen. Colin Powell, Chairman of the Joint Chiefs of Staff, informed President Bush that he needed an additional 200,000 troops.

Some would come from bases and reserve components in the US, but with the cold war in Europe ending, the Army could move its crack VII Corps from the continent without significant risk. In November 1990, President Bush ordered 200,000 more troops for the Gulf.

"If we were to get a second Army corps," recalled Lt. Gen. Charles Horner, the commander of Central Command's air forces and the air boss of the campaign, "that meant we had doubled the requirement for full-service support. I looked at each of our airfields to see what additional forces we could accommodate, so we built our air force support up about half again as much." More reserve and active-duty units were ordered up.

Photo by Robert F. Dorr

Capt. Karen Morgan, a Reserve instructor pilot with the 459th AW, Andrews AFB, Md., pilots a C-141 to the Gulf. AFRES and ANG crews flew a high percentage of USAF's strategic airlift and aerial refueling missions before and during the war.

The President issued another executive order, extending active duty for those originally called up for an additional ninety days. It was clear by now that the crisis would not be over quickly.

Open Twenty-Four Hours

In December, more Guardsmen and Reservists were called up. Among them were fire fighters from Reserve civil engineering squadrons, medical personnel, an aeromedical patient staging squadron, an aerial port squadron, refueling aircrews, and maintenance and support personnel.

The 439th MAW, Westover AFB, Mass., was activated December 3 to augment airlift operations from the US to the war area. The 439th kept Westover AFB open twenty-four hours a day. Later, ANG KC-135E tanker outfits were alerted for activation. The call-up finally included twelve of the thirteen ANG tanker units. The units, with a total strength of sixty-two tankers, were quickly deployed with maintenance support to Saudi Arabia, where the tempo of training operations was revving up.

Then, on December 3, the US began to call up Guard and Reserve fighters. Modern F-16s of the 169th TFG, McEntire ANGB, S. C., were alerted. So were the F/A-16s of the 174th TFW, Hancock Field, N. Y. Reconnaissance aircrews and support personnel from the 152d TRG, Reno, Nev., replaced the 117th TRW, Birmingham, Ala., which had been in the initial call-up. From the Air Force Reserve, the 926th TFG, NAS New Orleans, La., with A-10 close support fighters, was alerted.

These units were carefully selected. The 169th TFG had won the 1989 Gunsmoke competition, which pits the best Air Force fighter teams from commands around the world. The 174th TFW has TAC's only F/A-16A fighters. The F/A-16, an enhanced variant of the basic multirole fighter, is a prime asset in air-to-ground operations. The 926th TFG, equipped with A-10s, was ideal for helping to fill the increased ground support requirements that went with the new influx of ground troops.

The 152d Tactical Reconnaissance Group deployed RF-4Cs to Saudi Arabia on December 5. The RF-4C was a vital reconnaissance asset during the Gulf War. It was difficult to get tactical intelligence, General Schwarzkopf reported, because cloudy weather and oil smoke interfered with bomb-damage assessment and new target intelligence. The flexibility and responsiveness of the RF-4C helped reduce the scarcity of real-time intelligence.

A KC-135E Stratotanker from ANG's 190th Aerial Refueling Group, Topeka, Kan., refuels a Navy carrier-based A-6E Intruder on a Gulf War sortie. The four AFRES refueling squadrons dispensed more than eighteen million gallons of fuel.

Between Christmas and New Year's Day, the flow of Guard and Reserve people toward the Gulf continued. Security police and medical personnel were placed on active duty, as were tactical transport crews and combat logistics personnel.

On December 29, the 169th TFG, first Guard fighter unit to deploy, sent twenty-four F-16As to Al Kharj airfield. More than 700 support people deployed in transports.

On January 2, 1991, the 174th TFW deployed eighteen F/A-16 aircraft to Al Kharj and, along with the 169th TFG, was incorporated into the 4th Tactical Fighter Wing (Provisional). Together, the 169th and the 174th flew more than 3,000 sorties during the war.

Capt. Grich Goodwin, an F-16 pilot with the 174th, had spent ten years flying A-10s in the active force before joining the New York ANG in 1990.

"I finally got a job with American Airlines, and two days into training, I got the call," Captain Goodwin said. "It was December 29, and they called me at lunch." The captain would fly thirty-eight combat missions in the Gulf. Today, he notes wryly that his former active-duty A-10 colleagues had not deployed.

"Last Out" Hardships

Guardsmen and Reservists served on all fronts. Back at the 174th's home station, Hancock Field, the workday for CMSgt. Marshall B. Carter, chief enlisted maintenance superintendent, started at 4 a.m. and often went into the night. "I asked to go to Saudi Arabia, but they needed me here," he said.

Four AFRES refueling squadrons were mobilized for Desert Storm. One squadron was equipped with the KC-10 Extender and the other three with the KC-135 Stratotanker. In the course of the war, reserve force tankers refueled more than 8,000 warplanes, dispensing more than eighteen million gallons of fuel.

The 100-hour ground war began February 24, 1991. A Reserve C-130E from the 1650th TAW (Provisional), composed of the 914th and 927th TAGs, flew the first aeromedical evacuation flight of the ground campaign. The 1650th evacuated wounded US Marines from the southern Kuwait battlefield to hospitals in Saudi Arabia.

Four days after the start of the ground war, Washington declared a cease-fire and dictated terms to Baghdad. On July 31, Congress mandated that all reservists called to active duty be demobilized. Many Air Reserve Component people volunteered for active duty, returning equipment and people to home bases.

Reservists took pride in serving their country in wartime, but the Air Force policy of first in, first out, which sounded fair on the surface, in reality caused problems. Many Reservists came on board late in Desert Shield. They had to wait to be demobilized. Many felt that, with financial and professional woes mounting back home, they should have been released sooner.

Capt. Buddy Young, a South Carolina F-16 fighter pilot, had built up an ambulance and tour bus business that employed fifty people. It was family-owned, and, without his management, it almost went under during the months that he was gone. SSgt. Lanty Mimnaugh, a loadmaster with the 701st MAS, lost his construction business while on active duty. Both Captain Young and Sergeant Mimnaugh say they would go again if called, but they feel that the first in, first out policy is a tough burden that Reservists and employers should not have to bear.

Most employers kept the reservists' jobs open for them. Some made up the difference between military and civilian pay. Many gave special aid and support to the families of Guardsmen and Reservists. One Wilmington, Del., employer gave $40,000 to families hard pressed financially.

The Total Force image suffered somewhat in the early going when a few of the Army's National Guard roundout brigades were judged not in shape to deploy when they were called up. Secretary of Defense Dick Cheney said that the problem was confined to three Army Guard units and that those who read it as a broader indictment of Guard and Reserve forces were wrong.

Overall, the reserve components performed with distinction in the Gulf War. If anyone was surprised by the effectiveness of the Air Guard and Reserve, it certainly was not the Air Force, which had known the caliber of these units all along. ■

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Gallery of Commonwealth Missiles

By John W. R. Taylor

Intercontinental Ballistic Missiles

In the last weeks of 1991, the State Council, made up of the republic presidents of the Commonwealth of Independent States (CIS), decided to maintain unitary command of the strategic armed forces of the former USSR. The Strategic Deterrent Forces (SDF) came into being, with responsibility for the former Strategic Rocket Forces (RVSN), early warning defense systems, antiballistic missile defenses, space observation, and space troops units. Strategic bombers and missile submarines did not become part of the SDF, but they are under its control. The stated intention was to adhere to US-Soviet Treaty commitments already agreed.

Under the terms of the Strategic Arms Reduction Talks (START) Treaty, agreed last year, intended limits for each nation were to include 154 heavy intercontinental ballistic missiles (ICBMs), a total of 4,900 ICBM and submarine-launched ballistic missile (SLBM) warheads, and 1,100 mobile ICBM warheads. The aggregate throw-weight of deployed ICBMs and SLBMs was to be cut to 50 percent of the then-existing Soviet level. Production in the USSR had declined slightly to 125 ICBMs and 65 SLBMs in 1990, but modernization of the ICBM force has continued, with deployment of additional SS-24 and SS-25 missiles, upgrading of the SS-18, and corresponding removal of older and less effective weapons. Similarly, production and deployment of SS-N-20 and SS-N-23 SLBMs have continued.

SS-11 (CIS **RS-10**; NATO "Sego")

About 20 ICBM sites in Russia, located in European Russia, in the Urals, and along the route of the trans-Siberian railway, house mainly older systems, plus rail-mobile SS-24s and road-mobile SS-25s. In its 1991 publication *Military Forces in Transition*, DoD reported a further reduction of 39 SS-11s to a total of 296 deployed, all in Russia. Although considerably less capable than the missiles that are replacing them, the SS-11s retain significant destructive potential against softer area targets in the US and Eurasia. There are two current versions, classified as "light" ICBMs:

SS-11 Mod 2. Single reentry vehicle (1 megaton), with added penetration aids. Deployment began in 1973.

SS-11 Mod 3. First operational Soviet missile with MRVs (three 200 kiloton). Deployment began in 1975.

Launch Mode: silo based (not upgraded in hardness); hot launched.
Power Plant: two-stage storable liquid-propellant.
Guidance: inertial.
Warhead: single nuclear (Mod 2); three MRVs (Mod 3).
Dimensions: length 62 ft 4 in, max diameter 7 ft 10½ in.
Launch Weight: 105,820 lb.
Performance: max range 8,075 miles (Mod 2), 6,585 miles (Mod 3). CEP 1.1 km (0.7 miles).

SS-13 (CIS **RS-12/SS-12**; NATO "Savage")

When the Nadiradze OKB began development of the SS-13, in 1957, the choice of solid propulsion was unique among the larger Soviet missiles. Only 60 were deployed, in Mod 2 configuration from 1971. Of these, 40 remained in silos in Russia 20 years later. Each is in approximately the same category as the US Minuteman.
Launch Mode: silo based; hot launched.
Power Plant: three-stage solid-propellant, each with four nozzles and separated by truss structures.
Guidance: inertial.
Warhead: single nuclear (750 kilotons).
Dimensions: length 65 ft 7½ in, max diameter 5 ft 7 in (first stage base).
Launch Weight: 72,750 lb.
Performance: range 5,840 miles. CEP 1.8 km (1.1 miles).

SS-17 (CIS **RS-16**; NATO "Spanker")

Of 150 SS-17 "light" ICBMs originally emplaced, only 44 remained operational by September 1991. In addition to complying with Treaty force limitations, the progressive elimination from Russian silos of SS-17s, SS-11s, and SS-13s will create a more consolidated force by the late 1990s, with only four ICBM types deployed instead of the present seven. Survivability will also be much improved by the mobility of the SS-24s and SS-25s. In their time, the SS-17s introduced innovative features. They were loaded in modified SS-11 silos inside their transportation canisters. A cold launch technique enabled them to be "popped" out of the launchers by a gas generator before the main booster motors were fired. As a result, the silos would not have been heavily damaged in operational use and could have been reloaded, although this would have been a slow process. The SS-17 Mod 1 had multiple independently targetable reentry vehicles, like the other fourth-generation Soviet ICBMs, the SS-18 and SS-19. All three missile types were test-fired with a single reentry vehicle for a multimegaton warhead, in case it might be needed for use against future very hard targets; but all SS-17s were eventually upgraded to Mod 3 standard with four MIRVs, as described below.
Launch Mode: silo based; cold launched.
Power Plant: two-stage storable liquid-propellant.
Guidance: inertial.
Warhead: four MIRVs (each 200 kilotons).
Dimensions: length 78 ft 9 in, max diameter 8 ft 2½ in.
Launch Weight: 143,300 lb.
Performance: max range 6,200 miles. CEP 1,300 ft.

SS-13 "Savage" (Novosti)

SS-18 (CIS **RS-20**; NATO "Satan")

The SS-18 is the only CIS missile classified as a "heavy" ICBM in START terms. The current total of 308 deployed in converted SS-9 silos has to be reduced to 154. This is expected to be achieved by removing the 104 SS-18s that constitute Kazakhstan's entire ICBM force, at Derzhavinsk and Zhangiztobe, plus 50 of those based in Russian Siberia, between the Urals and the River Enisey. Production of the missiles, by the Yuzhnoe Machine Building enterprise in Dnepropetrovsk, Ukraine, has already been terminated. Their warheads were produced only in Russia, and the missiles will not fit in Ukrainian silos.

In *Military Forces in Transition*, DoD states, "Silo conversion is under way to replace older variants of the SS-18 . . . with substantially more capable versions (the SS-18 Mod 5, equipped with 10 MIRVs, and the single-warhead Mod 6). The improved lethality of the SS-18 Mod 5 offsets the START requirement to reduce heavy ICBMs by 50 percent. Assessed improvements in the Mod 5's accuracy and warhead yield give each reentry vehicle almost double the capability of those of the Mod 4 against US ICBM silos, which the United States will substantially reduce under START." DoD believed formerly that the SS-18 force, by itself, had the capability to destroy 65–80 percent of US ICBM silos and command facilities, using two warheads against each silo, and that, after doing so, 1,000 SS-18 warheads would still have been available for further attacks on US targets.
Launch Mode: silo based; cold launched.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: Mod 5 ten or more MIRVs (each 750 kilotons), Mod 6 one RV (20 megatons).
Dimensions: length 114 ft 10 in, max diameter 9 ft 10 in.
Launch Weight: 440,920 lb.
Performance: max range 6,835 miles. CEP 820 ft.

SS-19 (CIS **RS-18**; NATO "Stiletto")

Of 300 SS-19s currently deployed, about 60 percent are in Russia, with the largest base at Tatishchevo; the remainder constitute the largest component of Ukraine's 176-strong ICBM force, at Pervomaysk. More than 50 of the SS-19 silos originally activated in 1974–82 have already been converted to take the newer SS-24 Mod 2; the remainder are expected to be destroyed under the terms of the START Treaty.

The hot-launched SS-19 Mod 3, now deployed, is a light ICBM, comparable in size to USAF's Peacekeeper, with the flexibility to attack targets in Eurasia as well as in the US. Although less accurate than the SS-18, it is reckoned to have significant capability against all but hardened silos.
Launch Mode: silo based; hot launched.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: six MIRVs (each 500 kilotons).
Dimensions: length 88 ft 7 in, max diameter 8 ft 2½ in.
Launch Weight: 198,400 lb.
Performance: range 6,200 miles. CEP 985 ft.

SS-24 (CIS **RS-22**; NATO "Scalpel")

Operational since 1987, the SS-24 is a Peacekeeper-sized, solid-propellant system, intended for use against soft or semihardened targets. The Mod 1 version, regarded in the US as the first CIS fifth-generation ICBM, reflects the 1970s emphasis on survivability through weapon system mobility. DoD's *Military Forces in Transition* reports, "Deployment of the rail-mobile SS-24 Mod 1 is complete. The Soviets [CIS] currently have three garrisons for this system that has the capability to roam over 145,000 km (90,100 miles) of track."

Only 36 SS-24 Mod Is were operational by September 1991, all in Russia, and production has ended. This underlines the importance of the road-mobile SS-25s, with which the SS-24s are expected eventually to constitute about two-thirds of the CIS strategic rocket force. The other 56 SS-24s deployed since 1989 are Mod 2s, based at Khmelnitskiy in Ukraine in converted SS-19 silos. Their accuracy is believed to be better than that of the SS-18 and SS-19.
Launch Mode: rail-mobile (Mod 1) or silo based (Mod 2); cold launched.
Power Plant: three-stage solid-propellant.
Guidance: inertial.
Warhead: up to ten MIRVs (each 300–500 kilotons).
Dimensions: length 72 ft 2 in, max diameter 7 ft 6½ in.
Launch Weight: 198,400 lb.
Performance: max range 6,200 miles. CEP 660 ft.

SS-25 (CIS **RS-12M**; NATO "Sickle")

Now the most numerous type of CIS ICBM, a total of 315 road-mobile SS-25s were operational in the summer of 1991, with production continuing at the

Votkinsk Machine Building factory, Udmurt. About 75 percent are based in seven regions of Russia, each with 27 to 45 missiles. Sites identified to date are at Bershet, Nizhniy Tagil, and Novosibirsk in the Urals, and Yuriya in the Kirov region. The other SS-25s are centered on Lida and Mozyr in Belarus.

As the CIS designation RS-12M implies, Moscow regards this Minuteman-sized ICBM as a direct modernization of the SS-13 (CIS RS-12). This enables it to conform with the restraints embodied in the SALT Treaty terms. Most operational SS-25 deployments are to former SS-20 IRBM bases eliminated under the INF Treaty. At each base, a number of garages with sliding roofs house the system's massive off-road, wheeled transporter-erector-launchers; other buildings shelter the mobile support equipment. Advances claimed for the SS-25 include a greater throw-weight and nine times the accuracy of the SS-13, as well as greater survivability (because it is mobile) and an inherent refire capability. SS-11 silos are being deactivated in compensation for SS-25 deployments, which are expected to total 350 this year.

Launch Mode: road-mobile, with optional launch from inside garage; cold launched.
Power Plant: three-stage solid-propellant.
Guidance: inertial.
Warhead: single RV (550 kilotons).
Dimensions: length 62 ft 4 in, max diameter 5 ft 7 in.
Launch Weight: 72,750 lb.
Performance: range 6,525 miles, CEP 660 ft.

Submarine-Launched Ballistic Missiles

All CIS SLBMs and the submarines from which they are launched (SSBNs) are built in Russia. The submarines' home bases are also in Russia, on the Kola Peninsula for those with the Northern Fleet, and in Kamchatka for vessels of the Pacific Fleet. Production of a total 65 SS-N-20 and SS-N-23 SLBMs in 1990 represented a decline of around 15 percent, but improved versions are reported to be under development. In September 1991, 912 SLBMs were deployed in 59 submarines. Under the terms of the SALT I arms agreement, permitted totals were 950 SLBMs and 62 SSBNs.

SS-N-6 (CIS **R-21**; NATO "Serb")

The oldest class of Russian SSBN still operational is known to NATO as "Yankee I." Thirty-four were built in 1963–74, each with two rows of launchtubes in its hull for 16 SS-N-6 intermediate-range ballistic missiles. One sank; eleven remain in service with the Pacific Fleet, based at Navaga in Kamchatka. The others have been replaced by "Typhoons" and "Deltas" and have had their launchtubes removed. The missiles are of two types:

Mod 1: entered service 1967. Range from patrol areas adequate to cover the US eastern seaboard as far as the Mississippi and western seaboard to the east side of the Rockies.

Mod 2: as Mod 1, but range increased.

Launch Mode: submarine-launched; intermediate range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial.
Warhead: single RV (one megaton).
Dimensions: length 31 ft 8 in, body diameter 5 ft 5 in.
Launch Weight: 50,700 lb.
Performance: max range (Mod 1) 1,500 miles, (Mod 2) 1,865 miles. CEP 4,265 ft.

SS-N-8 (NATO "Sawfly")

Increased size and the addition of stellar sensing techniques to the guidance system gave this SLBM intercontinental range and greatly improved accuracy compared with the SS-N-6. It was deployed from 1971 on 18 "Delta I" submarines, developed from the "Yankee," with a deeper housing for the longer SS-N-8s above the rear casing. To compensate for added top-weight, the number of missiles was restricted to 12. This was restored to 16 in the four Delta IIs, which have a lengthened hull at the expense of a small speed reduction to 24 knots. The total of 280 SS-N-8s still operational are all of Mod 2 type, as described. Delta Is and IIs are based at Murena in Kamchatka.

Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: one RV (one megaton), according to DoD; other sources 2 MRVs (each 800 kilotons).
Dimensions: length 42 ft 6 in, body diameter 5 ft 10⅞ in.
Launch Weight: 56,135 lb.
Performance: max range 5,655 miles. CEP 1,315 ft.

SS-N-17 (NATO "Snipe")

The single "Yankee II" SSBN, armed with SS-N-17 missiles (see last year's "Gallery of Soviet Missiles"), is being dismantled.

SS-N-18 (CIS **RSM-50**; NATO "Stingray")

Like the SS-N-8, this SLBM was designed by the Makeyev OKB, and the two missiles have many similarities. The major advance was the first use of MIRVed warheads on a Russian submarine-launched ballistic missile. Increased length required an even higher housing above the ship's casing. Testing at sea began toward the end of 1976, following proving tests ashore, and the SS-N-18 was deployed on 14 "Delta III" SSBNs in 1976–82. Each ship carries 16 missiles, in two rows, making a total of 224 currently deployed from the Pacific Fleet's base of Kalmar in Kamchatka. It is expected that some may be replaced eventually with Makeyev's newer SS-N-23 "Skiff" SLBMs in a modernization program. Versions now operational:

Mod 1: armed with three MIRVs.
Mod 3: with seven MIRVs.

The Mod 2, with a single higher-yield reentry vehicle and longer range, is not in service.

Launch Mode: submarine-launched; intercontinental range.
Power Plant: two-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: Mod 1 three MIRVs (each 200 kilotons), Mod 3 seven MIRVs (each 100 kilotons).
Dimensions: length 46 ft 3 in, body diameter 5 ft 10⅞ in.
Launch Weight: 74,955 lb.
Performance: max range 4,040 miles. CEP 2,950 ft.

SS-N-20 (CIS **RSM-52**; NATO "Sturgeon")

Largest and heaviest of Russian SLBMs, the Makeyev-designed SS-N-20 is carried by the formidable Typhoon SSBNs. The ships of this class are by far the biggest submarines ever put into service, with a length of 562 ft and displacement of 21,500 tons surfaced, 26,500 tons submerged. Six entered service in 1982–89, and the final edition of DoD's *Soviet Military Power* referred to the Typhoons and Delta IVs as "thirteen of the most modern, capable platforms carry[ing] MIRVed, long-range SLBMs that eventually may have a hard-target-kill potential against targets in the continental United States." Circumstances have changed, and no more Typhoons will be completed. Those in service are based in the Kola Peninsula and are intended to launch their missiles from protected waters near the CIS to ensure survivability.

First test firing of the SS-N-20 took place in January 1980 after an eight-year development period. What was intended to be the first Russian series-production, solid-propellant SLBM incurred repeated failures before two successful tests were reported in 1981. Four missiles were launched simultaneously in October 1982, and 20 SS-N-20s were eventually loaded in each Typhoon in a unique configuration with the launchtubes forward of the sail. There are Mod 1 and Mod 2 versions, as follows:

Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage solid propellant.
Guidance: inertial, with stellar reference update.
Warhead: Mod 1 eight MIRVs, Mod 2 ten MIRVs (each 100 kilotons).
Dimensions: length 49 ft 2½ in, body diameter 7 ft 2½ in.
Launch Weight: 132,275 lb.
Performance: max range 5,150 miles. CEP 1,640 ft.

SS-N-23 (CIS **RSM-54**; NATO "Skiff")

The fact that this latest known Russian SLBM, first tested in 1983, has liquid propulsion suggests that this is still preferred by that state's submariners. To carry the SS-N-23, seven new Delphin-class (NATO "Delta IV") submarines have been constructed at Severodvinsk, at the rate of about one a year, with another five planned. Each carries 16 SS-N-23s inside the conventional type of raised housing aft of the sail. These were designed to carry ten MIRVs, but the START agreement allocates only four reentry vehicles to each missile in what is known as Mod 2 form. The Delphin SSBNs are based with the other newer (Typhoon) class in the Kola Peninsula as part of the Northern Fleet.

Launch Mode: submarine-launched; intercontinental range.
Power Plant: three-stage liquid-propellant.
Guidance: inertial, with stellar reference update.
Warhead: Mod 1 ten MIRVs, Mod 2 four MIRVs (each 100 kilotons).
Dimensions: length 45 ft 11 in, body diameter 5 ft 10⅞ in.
Launch Weight: 88,185 lb.
Performance: max range 5,600 miles. CEP 1,640 ft.

SS-N-6 "Serb" (Novosti)

SS-N-8 "Sawfly"

AS-4 "Kitchen" on Tu-22M3 (Piotr Butowski)

Airborne Nuclear Attack and Cruise Missiles

AS-4 (NATO "Kitchen")

The large air-to-surface missile known to NATO as Kitchen was first observed on a Tu-22 (Blinder) bomber during an Aviation Day flyby over Moscow more than thirty years ago. It remains one of the most important weapons available to CIS air and naval air forces, and it is the primary armament of two of the three major types of current strategic bombers. The original version had inertial guidance and a 350 kiloton nuclear warhead, needing no terminal homing. When an alternative version, with a 2,200 lb high-explosive warhead for antishipping use, was developed in the early 1970s, active radar terminal homing was added. A defense-suppression version, with passive radar homing, has also been reported.

Type: short-range, air-to-surface missile.
Power Plant: liquid-propellant rocket.
Guidance: inertial, or inertial plus active radar homing, or inertial plus passive radar homing.
Warhead: alternative nuclear (350 kilotons) or high-explosive (2,200 lb).
Dimensions: span 9 ft 10 in, length 37 ft 1 in, body diameter 3 ft 3½ in.
Launch Weight: 13,000 lb.
Performance: max speed Mach 4.6, range 185 miles at low altitude, 285 miles at high altitude.
Carried by: Tu-22 Blinder-B (one), Tu-22M Backfire (one or two), Tu-95 Bear-G (two).

AS-6 (NATO "Kingfish")

The AS-6 Kingfish has an airplane configuration similar to that of the AS-4 Kitchen but is powered by a solid-propellant rocket motor. It was first seen under the port wing of a Tu-16K, replacing the bomber's underbelly 1961-vintage K-10 (AS-2 Kipper) antishipping missile. In first-line service, the Badger-C Mod version of the Tu-16K carried a Kingfish under each wing, as do Badger-G Mod conversions of the Tu-16KS-1 Badger-B. The AS-6 began, like Kitchen, with a 350

kiloton nuclear warhead and inertial guidance, requiring no terminal homing. To optimize its accuracy in an antiship role, a second version was developed with an active radar terminal seeker and alternative nuclear or high-explosive warhead. The third variant has a defense-suppression role, with a passive radar seeker that homes on ship- or land-based radars. Deployment is believed to have started in 1973, with about 300 missiles now operationally available.
Type: short-range, air-to-surface missile.
Power Plant: solid-propellant rocket.
Guidance: inertial, or inertial plus active radar homing, or inertial plus passive radar homing.
Warhead: alternative nuclear (350 kilotons) or high-explosive (2,200 lb).
Dimensions: span 8 ft 2½ in, length 36 ft 1 in, body diameter 2 ft 11½ in.
Launch Weight: 12,125 lb.
Performance: max speed Mach 3, range 250 miles.
Carried by: Tu-16K Badger-G Mod.

AS-15 (CIS RK-55; NATO "Kent")

When the START Treaty becomes fully effective, some three-fourths of the CIS strategic bomber force will consist of Tu-95MS Bear-Hs and Tu-160 Blackjacks armed with AS-15 air-launched cruise missiles (ALCMs) unless stated intentions change. DoD has believed for years that the AS-15 is generally similar to the submarine-launched SS-N-21 (NATO Sampson), and to the ground-launched SS-CX-4 (Slingshot), which had to be destroyed under the INF Treaty. The exchange of data that accompanied the INF negotiations provided some of the information given below for the AS-15. It would appear to be similar in configuration to the smaller US BGM-109 Tomahawk that was fired with outstanding success from Navy ships during the 1991 Persian Gulf War. Both missiles are turbofan powered, and the AS-15 has a terrain-comparison/inertial guidance system like Tomahawk's Tercom. Development rounds were launched from Tu-22M Backfire bombers in the late 1970s and early 1980s, but this aircraft is not an operational ALCM carrier. Deployment on Tu-95MS Bear-H began in 1984, with six missiles on an internal rotary launcher in each aircraft and pylons for up to ten more in four underwing clusters. The Tu-160 has two rotary launchers for a total of 12 AS-15s or 24 AS-16s (see below). In a global sense, the AS-15s provide CIS attack forces with greatly improved capabilities for low-level and standoff attack in both theater and intercontinental operations.
Type: long-range, air-to-surface missile.
Power Plant: turbofan.
Guidance: inertial with terrain comparison.
Warhead: nuclear (200 kilotons).
Dimensions: span approx 10 ft 10 in, length 26 ft 6½ in, body diameter 1 ft 8 in.
Launch Weight: 3,750 lb.
Performance: speed subsonic, range 2,175 miles. CEP 500 ft.
Carried by: Tu-95MS Bear-H, Tu-160 Blackjack.

AS-16 (CIS RKV-500B; NATO "Kickback")

In addition to two underwing AS-4 Kitchens, a Tu-22M-3 Backfire-C bomber exhibited at Machulische AB, near Minsk, in February, had a rotary launcher carrying six AS-16 Kickbacks in its weapons bay. DoD believes that it can carry four more underwing, instead of two AS-4s. Designated RKV-500B in the CIS, Kickback is a short-range attack missile in the same class as USAF's AGM-69 SRAM. Development is assumed to have begun in the early 1970s, with IOC in about 1978. It became known that 12 are carried as an alternative to six AS-15 ALCMs on each of the Tu-160 Blackjack's rotary launchers when former US Defense Secretary Frank Carlucci was shown a Tu-160 at Kubinka AB in 1988. This suggests that it could also be carried on the rotary launcher of the Tu-95MS Bear-H. The following data are estimated.
Type: short-range, air-to-surface missile.
Power Plant: solid-propellant.
Guidance: inertial.
Warhead: nuclear (200 kilotons), or high-explosive.
Dimensions: span 2 ft 11½ in, length 16 ft 5 in, body diameter 1 ft 5¾ in.
Launch Weight: 2,650 lb.
Performance: max speed Mach 3, range 125 miles.
Carried by: Tu-95MS Bear-H, Tu-22M-3 Backfire-C, Tu-160 Blackjack.

AS-X-19 (NATO "Koala")

This supersonic ALCM, and the similar submarine-launched SS-NX-24 Scorpion, both still in the research and development phase, represent CIS attempts to further refine cruise missile technology. A diagram in DoD's *Military Forces in Transition* suggests that the AS-X-19 is a sweptwing/swept tail missile, with an overall length of about 40 ft. This would make it much too large to be carried on the standard CIS rotary launcher, implying an underwing mounting of the kind used for the AS-6 Kingfish or AS-4 Kitchen. The Tu-160 would be capable of carrying such a missile, but the AS-X-19 has been associated officially with only the Tu-95MS Bear-H. The fact that only two of the missiles could be loaded on each aircraft makes their future role in the bomber force uncertain.
Type: long-range, air-to-surface missile.
Power Plant: turbofan.
Warhead: nuclear or high-explosive.
Dimensions: span 20 ft, length 40 ft.
Performance: speed Mach 2.5 to 3 at 70,000 ft, range 1,865 miles.

SA-2 "Guideline" (TASS)

SA-3 "Goa"

Surface-to-Air Missiles

SH-11 (NATO "Gorgon")

The world's only operational ABM (antiballistic missile) system is emplaced around Moscow. Comprising the full 100 launchers permitted by the 1972 ABM Treaty, it is considered capable of engaging small numbers of reentry vehicles approaching from any direction during an accidental or unauthorized launch against the city. In its newly modernized form, it offers a dual-layered defense against ballistic missiles and some use against satellites in low-Earth orbit. A multifunctional "Pill Box" radar located at Pushkino, north of Moscow, has the task of identifying and tracking incoming reentry vehicles. These would then be intercepted at high altitude and over long ranges by Gorgon ABMs. Any that penetrated this layer of defense would be engaged by Gazelle ABMs within the atmosphere.

It is believed that 36 silo-based Gorgons are replacing the original SH-01 Galosh exoatmospheric intercept missiles, which were launched from above ground. Little is known about them, but they were identified initially as Modified Galosh, and the following details of the original SH-01 provide an indication of their likely characteristics:
Type: silo-launched, exoatmospheric, antiballistic missile.
Power Plant: three-stage liquid-propellant.
Guidance: command.
Warhead: nuclear (one megaton).
Dimensions: length 65 ft, base diameter 8 ft 5 in.
Launch Weight: 72,750 lb.
Performance: range more than 200 miles.

SH-08 (NATO "Gazelle")

This quick-reaction, high-acceleration interceptor missile is designed to destroy in the atmosphere reentry vehicles that penetrate the outer layer of ABM defense. Up to 64 are thought to be silo-based around Moscow, as the second stage of the capital's antiballistic missile defenses. Gazelle is described as being similar in general configuration to the long-abandoned US Sprint, with a low-yield nuclear warhead. Like the exoatmospheric Gorgons, it is command-guided from the ground via the Pill Box phased-array radar at Pushkino. The following data are estimated:
Type: silo-launched, endoatmospheric, antiballistic missile.
Power Plant: solid-propellant.
Guidance: command.
Warhead: nuclear (10 kilotons or less).
Dimensions: length 32 ft 10 in, max diameter 3 ft 3 in.
Launch Weight: 22,000 lb.
Performance: range 50 miles.

SA-2 (CIS V-750 Dvina; NATO "Guideline")

The number of SA-2s in the CIS strategic air defense force has declined from a peak of more than 4,600 in the late 1960s to fewer than 2,400. By the time the last has been replaced with SA-10s, this veteran surface-to-air missile will have served for 40 years, with the armed forces of 28 nations, in many forms. All are land-transportable on a semitrailer and can be transferred to the standard single-round launcher in 12 minutes. Only the SA-2E version has alternative high-explosive (650 lb) or command-detonated nuclear (15 kiloton) warheads in a more bulbous nose.

First of many known operational successes for the SA-2 was the destruction of Gary Powers's U-2 on May 1, 1960, near Sverdlovsk. More recent firings were made by Iraq in the 1991 Persian Gulf War, but the missile's effectiveness has been reduced dramatically by modern airborne countermeasures. Its "Fan Song" radar, with a crew of four to six, operates in target acquisition and automatic tracking modes. It can track up to six targets simultaneously before switching to automatic tracking and missile guidance against the selected target. Unless the SA-2 picks up its narrow UHF line-of-sight guidance beam within six seconds of launch, it will go ballistic. It reaches its maximum velocity at 25,000 ft and has only limited maneuverability against modern tactical aircraft.
Type: medium-altitude, transportable, surface-to-air missile.
Power Plant: liquid-propellant sustainer, burning nitric acid–kerosene mix; solid-propellant booster.
Guidance: radio command.
Warhead: high-explosive (430 lb; except on SA-2E), with proximity and/or command fuzing.
Dimensions (SA-2F): length 35 ft 1 in, body diameter (second stage) 1 ft 8 in, wingspan (second stage) 5 ft 7 in.
Launch Weight (SA-2F): 5,040 lb.
Performance: max speed Mach 3.5, slant range 21.75 miles, effective ceiling 300–90,000 ft.

SA-3 (CIS S-125 Neva; NATO "Goa")

The latest available data suggest that more than 300 battalion sites with SA-3 missiles are operational in the CIS, each equipped with four semimobile twin or fixed quadruple rail launchers. Exports have been made to 25 nations, including Iraq. The SA-3 entered service in 1961, as a counterpart to the US Hawk, and was still in production at the beginning of the 1990s. **SA-3A** and **SA-3B** (from 1964) versions differ in the B's improved command guidance. The SA-3 was first used in action by a joint Egyptian-Soviet defense network covering the Suez Canal during the closing stages of the 1968–70 Egyptian-Israeli War of Attrition, shooting down five F-4E Phantoms. Like the SA-2, it has since been used in many campaigns and is road-transportable. Reload time on four rails is 50 minutes. The export version is named Pechora, in the Soviet tradition of naming its static and towed surface-to-air missiles after national rivers.

The system's P-15M "Squat Eye" early warning and target acquisition radar has a range of 130 miles; the "Low Blow" radar used for target monitoring and missile control has an acquisition range of 68 miles and a tracking range of 25–52 miles. Six targets can be tracked simultaneously and one or two missiles guided. During operations in a dense ECM environment, 15-mile-range TV cameras on the latest Low Blow systems provide the fire-control team with the same information as that from the radar without affecting the command guidance function. (See also Naval SA-N-1.)
(Data for SA-3B.)
Type: low/medium-altitude, transportable, surface-to-air missile.
Power Plant: two-stage solid-propellant.
Guidance: radio command.
Warhead: high-explosive (132 lb), with Doppler radar proximity and contact fuzing. Lethal burst radius 41 ft.
Dimensions: length 20 ft 0 in, body diameter (second stage, max) 1 ft 2½ in, wingspan (second stage) 4 ft 0 in.
Launch Weight: 2,095 lb.
Performance: max speed Mach 3.5, slant range 1.5–11.4 miles, effective ceiling 150–60,000 ft.

SA-4 (CIS 9M8 Krug; NATO "Ganef")

Full deployment of the SA-4 began in 1969 and totaled some 1,300 twin-round launchers in armies of the former USSR in the 1980s. Replacement with SA-11s and SA-12As has been under way through the past decade, but many SA-4s remain as air defense elements of CIS armies, with a peacetime strength of three batteries in each brigade. They are deployed normally six to 15 miles behind the FEBA, as elements of an integrated defense system embodying every type of surface-to-air missile and antiaircraft gun. Each battery has three SPU tracked mobile launchers, four

Ural 375 TZM transport/reload vehicles each carrying one missile, and one SSNR "Pat Hand" mobile missile guidance radar. Acquisition range of Pat Hand is 75–80 miles, and tracking range, at which a single missile can be launched, is 50–56 miles. The radar can guide two missiles to a single target, if required. Reload time for the SPU is 10–15 minutes.

All elements of the SA-4 system are air-transportable in An-22 and An-124 military freighters. At least four variants of the missile were built. Major current versions, often mixed in a battery:

9M8MI (SA-4A): 1967 version, with overall length of 28 ft 10½ in; slant range 5–34 miles; effective ceiling 330–88,600 ft.

9M8M2 (SA-4B): 1973 version, with shorter nose; improved close-range performance at expense of max range and effective ceiling. *(Data for SA-4B follow.)*

Type: medium/high-altitude, air-transportable, surface-to-air missile system.

Power Plant: ramjet sustainer, burning kerosene; four wraparound solid-propellant boosters.

Guidance: radio command, with semiactive radar terminal homing.

Warhead: high-explosive (300 lb), with proximity fuzing.

Dimensions: length 27 ft 3 in, body diameter 2 ft 10 in, wingspan 7 ft 6½ in.

Launch Weight: approx 5,500 lb.

Performance: max speed Mach 2.5, slant range 0.7–28 miles; effective ceiling 330–78,750 ft.

SA-5 (CIS S-200 Volga; NATO "Gammon")

Of the estimated 6,700 home defense missile launchers operational in the CIS, about 1,930 are believed to carry SA-5s, at 130 sites. They are the last known surface-to-air missiles developed in the former USSR for deployment from static launchers and were intended to counter such high-performance aircraft as USAF's then-planned B-70 strategic bomber. Production continued after the B-70 cancellation, and there have been three versions:

SA-5A: initial production version, operational from 1966.

SA-5B: as SA-5A, but with nuclear warhead. Entered service 1969–70.

SA-5C: as SA-5B, but with improved terminal guidance and alternative nuclear or conventional warhead. Standard version from 1975–76.

The CIS missiles are deployed in Air Defense Rocket Brigades, made up of battalions of SA-3 and SA-5 launchers, plus 23-mm or 57-mm antiaircraft guns. Each SA-5 battalion has a 200 mile range P-35M "Barlock-B" target search and acquisition radar with integral IFF, a 165 mile range "Square Pair" missile guidance radar, and six single-rail missile launchers. SA-5s were launched against USAF SR-71s, without success. No better results were achieved by Libya (one of nine export customers) against US aircraft equipped with ECM and armed with AGM-88 HARMs (high-speed antiradiation missiles) in March–April 1986.

Type: medium/high-altitude, surface-to-air missile, fired from single-rail static launcher.

Power Plant: storable liquid-propellant sustainer; four wraparound solid-propellant boosters.

Guidance: command, with active radar terminal homing.

Warhead (SA-5C): nuclear (25 kilotons) or high-explosive, with proximity and command fuzing.

Dimensions: length 35 ft 2 in, body diameter 2 ft 9½ in, wingspan 9 ft 4 in.

Launch Weight: 6,400 lb.

Performance: max speed above Mach 4, slant range 155 miles, effective ceiling 1,000–100,000 ft.

SA-6 (CIS 9M9 Kub; NATO "Gainful")

This self-propelled tactical weapon system caused considerable dismay in NATO when the Egyptians and Syrians used it to destroy about 20 Israeli aircraft during the 1973 war in the Middle East. It had first been seen on its three-round tracked transporter-erector-launcher (TEL) in the annual military parade through Red Square in November 1967. Not until the war brought an opportunity to study a complete SA-6 system in detail was it realized that the missile's unique integral solid rocket/ramjet propulsion system was a decade ahead of comparable Western technology. Even more disturbing was that US-supplied ECM that enabled Israeli aircraft to survive attack by other missiles proved ineffective against the SA-6. Today the armies of the CIS have about 850 SA-6 TELs, deployed in antiaircraft regiments at divisional level. Each regiment consists of an Hq. with EW, IFF, and height-finding radars, and five SA-6 batteries. Each battery has an SSNR "Straight Flush" fire-control radar, mounted on the same kind of tracked chassis as the TEL; four SA-6 TELs; and four ZIL 131 TZM reload vehicles, each carrying three missiles. Straight Flush has a detection/acquisition range of 34–46 miles and 32,800 ft altitude capability. It performs IFF interrogation, target tracking and illumination, and missile radar command guidance functions. The missile is capable of sustained 15*g* maneuvers. Reloading of the TEL takes ten minutes. All elements of the SA-6 system are air-transportable in An-22, An-124, and Il-76 freighters.

SA-4 "Ganef" (Daniel Simon-Gamma)

SA-6 "Gainful"

SA-7 "Grail"

SA-9 "Gaskin" (TASS)

Pending availability of the SA-11 Gadfly weapon system, one of the original **SA-6A** TELs in some batteries was replaced with a TELAR (transporter-erector-launcher and radar) with added SA-11 "Fire Dome" engagement radar. This overcame an earlier shortcoming by enabling two targets to be engaged simultaneously by such a battery. The TELAR carries modified **SA-6B** missiles. Export SA-6 systems are known as **Kvadrat** (Quadrant) and are used by 19 foreign armed forces.

Type: low/medium-altitude, mobile, surface-to-air missile system.

Power Plant: solid-propellant booster; after burnout, its empty casing becomes a ramjet combustion chamber for ram air mixed with the exhaust from a solid-propellant gas generator.

Guidance: radar command; semiactive radar terminal homing.

Warhead: high-explosive (123 lb), with proximity and contact fuzing. Lethal burst radius 16 ft.

Dimensions: length 18 ft 9 in, body diameter 1 ft 1⅓ in, wingspan 4 ft 1 in.

Launch Weight: 1,320 lb.

Performance: max speed Mach 2.8, slant range, 1.8–15 miles, effective ceiling 330–36,000 ft.

SA-7 (CIS 9M32 Strela-2; NATO "Grail")

This shoulder-fired, tube-launched, passive infrared homing missile was first used by Egyptian forces during the 1968–70 War of Attrition, when it caused damage in the jetpipe area of several Israeli aircraft. It proved more troublesome in Vietnam, where 528 SA-7s were fired by the North Vietnamese, destroying 45 US and South Vietnamese aircraft, most of them relatively slow battlefield support airplanes and helicopters. Since then, huge numbers have been acquired by the armed services of 57 nations and more than 25 guerrilla/terrorist groups worldwide. As well as destroying many targets, they have forced pilots to fly above the minimum effective range of defensive radars, making them more vulnerable and degrading their ground attack accuracy and ability to support friendly troops.

Shortcomings of the initial **SA-7A** Grail were that it could be fired only from behind a target at a very hot exhaust area, over a narrow field of fire, and tended to home on the sun if pointed within 20° of that heat source. Solar reflection from clouds or heat from sun-exposed rocks could guide it astray, limiting its usefulness against low-flying aircraft. In 1971, the improved **SA-7B** Grail Mod 1 (Soviet **9M32M Strela-2M)** entered service, with an extended field of fire of 30° each side of the target's tail, a seeker able to filter out spurious heat sources, including early IR decoys and flares, and an improved warhead. The operator could also have a small passive RF antenna fixed to his helmet, to provide audible warning of an approaching aircraft by picking up emissions from its radar and radar altimeter. Major version since the mid-1970s has been the **SA-7C** Grail Mod 2, with improved launcher and more effective RF detector mounted forward of the gripstock. The second member of a CIS army SA-7 team carries a reload missile. Reload time is six seconds.

The SA-7 is also carried by vehicles, including ships, in batteries of four, six, and eight, for both offensive and defensive employment. Some are deployed on helicopters for air-to-air combat use.

Type: low-altitude, man-portable, surface-to-air missile system.

Power Plant: solid-propellant booster/sustainer.

Guidance: infrared passive homing.

Warhead: high-explosive (2.5 lb), with contact and graze fuzing.

Dimensions: length 4 ft 8¾ in, body diameter 2⅞ in.

Launch Weight: 21.7 lb. Launcher: 10.9 lb.

Performance: max speed Mach 1.7, slant range 0.5–2.6 miles, effective ceiling 165–7,550 ft.

SA-8 (CIS 9M33 Romb; NATO "Gecko")

This all-weather, low-altitude surface-to-air missile was one of the most effective elements of Iraq's air defense forces during the 1991 Persian Gulf War, claiming a number of Tomahawk cruise missiles. Developed to fill the gap between the SA-7/SA-9 and the SA-6, it is categorized as a ZRK-SD integrated missile system, able to self-deploy over medium ranges, and was the first tactical air defense weapon system of the former USSR in which all components necessary to conduct a target engagement are carried by a single vehicle. In the original **SA-8A** Gecko Mod 0 **(9M33)**, two pairs of exposed single-stage missiles were carried, ready to fire. The later **SA-8B** Gecko Mod 1 (typically **9M33M3**) system has six two-stage, increased-performance missiles in launcher/containers. Fire-control equipment and launcher are mounted on a rotating turret, carried by a BAZ-5937 six-wheel, fully amphibious, all-terrain vehicle. The "Land Role" fire-control radar, to the rear of the one-man gunner/radar operator's position, has a 360° scan over a 22-mile range. It folds down behind the launcher, enabling the weapon system to be airlifted in An-22, An-124, and Il-76 transport aircraft. Range of the monopulse tracking radar is 15.5 miles. An LLLTV/optical system assists target tracking in low visibility and dense ECM. Reload time is five minutes.

The SA-8A was first displayed in a 1975 military parade through Moscow. Together with the SA-6, it largely replaced S-60 57-mm towed antiaircraft guns in CIS service, and has itself replaced some SA-6s. Five batteries are deployed with each divisional antiaircraft regiment. A battery comprises, in peacetime, four BAZ-5937 launch vehicles and two TZM reload vehicles, supported by 24 ZIL 131 trucks to serve as missile transporters. More than 1,000 systems are operational in the CIS; others have been exported to ten countries. (See also SA-N-4.) *(Data for SA-8A.)*

Type: low-altitude, self-contained, mobile surface-to-air missile system.

Power Plant: single-stage solid-propellant.

Guidance: radar command, permitting two missiles to be guided simultaneously against a single target, on different frequencies to complicate ECM.

Warhead: high-explosive (42 lb), with proximity and contact fuzing. Lethal burst radius 16 ft.

Dimensions: length 10 ft 4 in, body diameter 8¼ in, fin span 2 ft 1¼ in.

Launch Weight: 286 lb.

Performance: max speed Mach 2.4, slant range SA-8A 0.9–7.5 miles, SA-8B 0.9–9.3 miles, effective ceiling 82–16,400 ft.

SA-9 (CIS 9M31 Strela-1; NATO "Gaskin")

The SA-9 mobile amphibious weapon system has been largely replaced in CIS armies with the SA-13, but continues to equip 22 foreign armies and two guerrilla forces. Operational since 1968, it comprises a BRDM-2 four-wheel vehicle carrying a box launcher for two pairs of infrared homing solid-propellant missiles in place of the normal turret. The launcher rests flat on the rear of the vehicle when not required to be ready for

action. Four reload rounds are stowed in the BRDM-2. Sixteen SA-9 transporter-erector-launchers (TELs) formerly equipped each CIS division, in four batteries, together with ZSU-23-4 tracked self-propelled antiaircraft gun systems, with four 23-mm guns. Surveillance is provided by a "Dog Ear" radar vehicle, supplemented by "Flat Box" passive radar antennas on one TEL in each battery. Early **SA-9A** Gaskin Mod 0 **(9M31)** missiles were followed by **SA-9B** Gaskin Mod 1 **(9M31M)** with improved cooled seeker and longer range. *(Data for SA-9B).*

Type: low-altitude, mobile, surface-to-air missile system.
Power Plant: dual-thrust solid-propellant.
Guidance: infrared passive homing.
Warhead: high-explosive (5.75 lb), with proximity fuzing. Lethal burst radius 16 ft.
Dimensions: length 5 ft 11 in, body diameter 4¾ in, wingspan 1 ft 2¾ in.
Launch Weight: 66 lb.
Performance: max speed Mach 1.5, slant range 0.35–5 miles, effective ceiling 32–20,000 ft. Range is reduced considerably in head-on engagement and extended to a possible 6.8 miles in tail-chase.

SA-10 (CIS S-300; NATO "Grumble")

Approximately one-quarter of CIS strategic surface-to-air missile launchers carry this all-altitude weapon, a version of which also arms nuclear-powered battle cruisers. It replaces SA-2s and SA-3s and is effective against targets at heights up to 98,500 ft, out to a range of 62 miles, including low-flying aircraft, cruise missiles, and reentry vehicles from ballistic missiles in the class of the Scuds used by Iraq in the Persian Gulf War. Deployment of the initial fixed-base **SA-10A** (Grumble Mod 0) began in 1980. An SA-10A regiment is reported to comprise three batteries and an F-band 3-D surveillance and tracking radar ("Big Bird") at the comand post for long-range target detection. Each battery has an engagement control center, a 3-D CW pulse-Doppler target acquisition radar ("Clam Shell"), an I-band phased-array engagement radar ("Flap Lid A"), and up to 12 four-rail container erector/launchers on semitrailers. These are positioned on concrete pads, and the missiles are launched vertically. The track-via-missile (TVM) system guidance, like that of the US Patriot, enables up to six targets to be engaged simultaneously, with two missiles per target. A battery can fire three missiles per second, against targets traveling at up to 2,610 mph.

For improved mobility, the land-mobile **SA-10B** (Grumble Mod 1) version was developed in the mid-1980s, with four-axle, four-round TELs based on the MAZ-7910 vehicle. Reload missiles and a "Flap Lid B" planar array target-tracking and fire-control radar are carried on basically similar trucks. Readiness to fire is five minutes after the vehicles come to a halt. First export customers are Bulgaria (SA-10A) and Czechoslovakia (SA-10B). (See also SA-N-6.)

Type: all-altitude, fixed site and mobile surface-to-air missile system.
Power Plant: single-stage solid-propellant.
Guidance: radar command, with semiactive radar terminal homing and proximity fuzing.
Warhead: high-explosive (200–285 lb) or low-yield nuclear.
Dimensions: length 23 ft 0 in, body diameter 1 ft 5¾ in, wingspan 3 ft 3½ in.
Launch Weight: 3,300 lb.
Performance: max speed Mach 6, range 1.85–62 miles, effective ceiling 80–98,500 ft.

SA-11 (NATO "Gadfly")

Since 1979, this weapon system has progressively replaced SA-4s in army-level missile brigades and some SA-6s at divisional level, for defense against high-performance aircraft and cruise missiles at low to medium altitudes. The SA-11 system is self-contained on a GM-569 tracked vehicle, which carries a 360° traversing four-rail launcher and "Fire Dome" monopulse guidance and tracking radar. The missile resembles the US Navy's Standard MR1 RIM-66 in general appearance and can sustain 23*g* maneuvers.

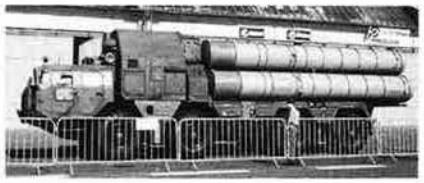
An SA-11 regiment is made up of five batteries, each with four TELs, and similar GM-569 vehicles carrying early warning and acquisition radars and reload missiles. The same chassis is also used to carry the regiment's long-range early warning radar. If this is not available, the SA-11 TELs can be integrated into an SA-6 battery, using the latter's "Straight Flush" fire-control radar. Other operators of this system include India, Poland, Syria, and Yugoslavia.

Type: low/medium-altitude, mobile, surface-to-air missile system.
Power Plant: solid-propellant.
Guidance: semiactive monopulse radar command.
Warhead: high-explosive (198 lb).
Dimensions: length 18 ft 4½ in, body diameter 1 ft 3¾ in, wingspan 3 ft 11¼ in.
Launch Weight: 1,433 lb.
Performance: max speed Mach 3, slant range 1.85–17.5 miles, effective ceiling 100–46,000 ft.

SA-12A (NATO "Gladiator")

DoD states in *Military Forces in Transition* that the SA-12 system has been tested successfully against tactical ballistic missiles and that concern exists in Washington about the capability of both the SA-12 and SA-10 to intercept strategic warheads. Deployment of the land-mobile tactical SA-12A began in 1986, to augment the aging SA-4. The total number currently operational is unknown, but several dozen launchers were stationed with Soviet Army units in East Germany before reunification. They appear to exist in two slightly different forms, to engage aircraft and tactical ballistic missiles in the class of the US Lance, respectively. All components of the SA-12A system are based on the tracked MT-T chassis, a derivative of the T-64 main battle tank. The three batteries of an SA-12A battalion each have three transporter-erector-launchers (TELs), a "Grill Pan" fire-control vehicle, and a reload transporter. The main "Bill Board" long-range target search and acquisition radar vehicle and additional reload transporters are held at battalion Hq. level. Three battalions make up a brigade, with further Bill Boards assigned to Hq.

Launch of SA-9 (TASS)



SA-10B "Grumble" Mod 1

SA-13 "Gopher" (Martin Mamula)

Each TEL carries two missile container/launchers that can be raised independently to a vertical position for launch and a telescopic missile guidance radar. The latter is believed to control the missile in flight after its target has been tracked and handed on by Grill Pan.

Type: all-altitude, mobile, surface-to-air missile system.
Power Plant: two-stage solid-propellant.
Guidance: semiactive radar command.
Warhead: high-explosive fragmentation (330 lb).
Dimensions: length 23 ft 7½ in, body diameter 1 ft 7¾ in, wingspan 4 ft 5 in.
Launch Weight: approx 4,400 lb.
Performance: max speed Mach 3, slant range, 3.4–50 miles, effective ceiling 2,950–98,400 ft.

SA-12B (NATO "Giant")

This considerably scaled-up derivative of the SA-12A was conceived as part of the rail-mobile SS-24 Mod 1 Scalpel ICBM system. Its MT-T two-round tracked TELs were to be carried on low-loader railcars. After the ICBM train emerged from its tunnel concealment to move to its launch area, the SA-12Bs were intended to disperse into the surrounding area to defend the Scalpel launchers from attacking enemy aircraft and strategic missile reentry vehicles. Such a use, capable of nationwide deployment, would contravene the terms of the ABM Treaty, and the present status of the SA-12B program is not known. DoD reported that it had reached flight test status by 1987.

Type: all-altitude, mobile, surface-to-air missile system.
Power Plant: two-stage solid-propellant.
Guidance: radar command, with active homing.
Warhead: unknown.
Dimensions: length 34 ft 5½ in, body diameter 3 ft 3½ in.
Performance: max slant range 125 miles.

SA-13 (CIS 9M37 Strela-10; NATO "Gopher")

Since this tracked mobile weapon system entered service in 1977, at least two improved versions have appeared. More than 1,200 four-missile launchers are operational with CIS army and naval infantry units; others have been supplied to twelve foreign countries and have seen combat use in Chad, Angola, and Iraq. The basic **9M37** missile was followed by the **9M37M Strela-10M2,** offering choice of an uncooled lead sulphide, near-IR homing seeker, or cooled indium altimonide mid-IR homing type, in each case with all-aspects and IRCCM capabilities. The missiles are carried in two twin-box launchers on transporter-erector-launcher and radar (TELAR) vehicles of two types. The only apparent difference is that TELAR-1 has four "Flat Box B" passive radar detection antennas on its upper surface; TELAR-2 has none. It is suggested that TELAR-1 is used only by the battery commander. High-readiness tank and motorized rifle divisions of the army have four air defense battalions, each with six SA-13 TELARs and six ZSU-23-4 antiaircraft gun systems, the SA-13s having replaced SA-9s one for one. Most normal air defense battalions have four SA-13s and four ZSU-23-4s. Eight reload missiles are normally carried by each of the vehicles, which are fully amphibious. The associated "Dog Ear" acquisition/tracking radar vehicle of the SA-9 is retained, with range-only radar on each TELAR.

The latest known version of the missile is the **9M333 Strela-10M3,** intended for use in the mobile battle and to defend troops in movement from attack by low-level aircraft, helicopters, and precision guided weapons, as well as from observation by UAVs. It has a dual-mode optical photocontrast/infrared seeker to improve adverse weather operation. Production continues. *(Data for 9M37M; 9M333 in parentheses.)*

Type: low-altitude, mobile, surface-to-air missile system.
Power Plant: solid-propellant.
Guidance: infrared passive homing in two frequency bands (optical photocontrast/IR).
Warhead: high-explosive fragmentation rod; 6 lb and 100 rods. Lethal burst radius 16 ft. Contact and active xenon lamp proximity fuzing (contact and active laser proximity fuzing).
Dimensions: length 7 ft 2½ in, body diameter 4¾ in, wingspan 1 ft 3¾ in.
Launch Weight: 87 lb (93 lb).
Performance: max speed Mach 2, slant range 0.3–3.1 miles, effective ceiling 33–11,500 ft.

SA-14 (CIS Strela-3; NATO "Gremlin")

This development of the SA-7 shoulder-fired SAM, with much-improved effective altitude capability, began to replace the earlier weapon one for one in the army of the former USSR in 1978. It is also used by naval infantry and in 13 other nations. Compared with the SA-7, it has an uprated rocket motor, a more powerful warhead, and a cryogenically cooled IR seeker with proportional guidance that is effective in head-on as well as tail-chase firings and against targets maneuvering at up to 8*g*. Effectiveness against targets equipped with flare dispensers and IR jammers is claimed to be much enhanced. A passive RF direction-finder antenna system is optional. *(See also SA-N-8.)*

Type: low-altitude, man-portable, surface-to-air missile system.
Power Plant: solid-propellant booster/sustainer.
Guidance: infrared passive homing.
Warhead: high-explosive fragmentation (4.4 lb), with contact and graze fuzing.
Dimensions: length 4 ft 7¼ in, body diameter 3 in.
Launch Weight: 21.8 lb. Launcher: 13.4 lb.
Performance: max speed Mach 1.76, slant range 0.37–3.7 miles, effective ceiling 33–18,000 ft.

SA-15 (CIS ZRK Tor)

Although this large, highly automated, mobile SAM has attained only limited deployment so far, it is immensely more formidable than the SA-6 and SA-8 that it is designed to replace. Its modified GM-569 tracked vehicle is air-transportable but not amphibious. A box-like turret on top of the hull houses eight vertically mounted missiles in two rows and carries the engagement radars. Above the rear of the box is a 3-D pulse-Doppler E/F-band surveillance radar able to detect up to 48 targets over a range of at least 15 miles. It then assesses in order of priority, and tracks, the ten most threatening targets. The pulse-Doppler phased-array G/H-band target tracking and missile guidance radar at the front is able to track two targets traveling at up to 435 mph simultaneously, by day or night in all weather and in dense ECM environments. It is supplemented by an autonomous automatic TV tracking system that enhances the SA-15's capability in battlefield clutter and dense ECM. Reaction time is five to eight seconds from target detection. The missiles are cold-launched

and able to maneuver at 30*g* against fixed-wing aircraft, helicopters, UAVs, precision guided weapons, and some types of guided missiles. Long-range surveillance for the SA-15 is provided by the "Dog Ear" type of radar vehicle. The SA-15 vehicle carries a crew of three. The missile is thought to be similar to that used in the naval SA-N-9 system.

Type: low/medium-altitude, mobile, surface-to-air missile system.
Power Plant: single-stage solid-propellant.
Guidance: radar command, supplemented by TV/IR trackers.
Warhead: high-explosive fragmentation (33 lb), with proximity fuzing.
Dimensions: length 11 ft 6 in, body diameter 7⅞ in, wingspan 2 ft 0 in.
Launch Weight: 375 lb.
Performance: max speed Mach 2.5, slant range 1–7.5 miles, effective ceiling 33–19,700 ft.

SA-16 (CIS **Igla-1**; NATO "Gimlet")

The third-generation SA-16 destroyed more Coalition aircraft than any other shoulder-fired SAM used in the 1991 Persian Gulf War, including four Marine Corps AV-8B Harrier IIs. Together with the self-propelled 2S6 antiaircraft weapon system (see SA-19), it has been replacing the SA-7, SA-14, and ZSU-23-4 gun system for the past decade and was used earlier in combat by Angola. Other customers include Finland and Nicaragua. Its configuration is similar to that of the SA-7 and SA-14, but it is an entirely new weapon, with a conical nose like that of the French Mistral. Deployment time is 13 seconds, and launch time from target acquisition is five seconds. Guidance is by proportional navigation, and the cooled IR seeker improves resistance to countermeasures. Maximum target-bearing angle for launch is ±40°.

Type: low-altitude, man-portable, surface-to-air weapon system.
Power Plant: dual-thrust solid-propellant.
Guidance: infrared passive homing.
Warhead: high-explosive fragmentation (4.4 lb), with contact and graze fuzing.
Dimensions: length 5 ft 1 in, body diameter 3⅛ in.
Launch Weight: 23.8 lb. Launcher: 9.25 lb.
Performance: average speed Mach 1.68, slant range 0.37–3.1 miles, effective ceiling 33–11,500 ft.

SA-17

Intended to supersede the SA-11 "Gadfly," this new low/medium-altitude SAM was identified by NATO in 1986–87 and is expected to achieve initial operational status during the coming year. It has a similar configuration to the SA-11 and is based on the same GM-569 tracked vehicle. A major innovation is a new surveillance radar known to NATO as "Snow Drift," also carried on a modified GM-569, which replaces the SA-11's "Tube Arm."

SA-18

First mentioned in the 1990 edition of DoD's *Soviet Military Power,* this fourth-generation, shoulder-fired, surface-to-air missile is described as "highly capable." It is said to be in service in small quantities for field testing.

SA-19

This tube-launched hypersonic missile (possible Soviet designation 9M311) was developed as one element of the 2S6 gun/missile tracked regimental air defense vehicle. It entered service in 1986, primarily in an antihelicopter role. Eight SA-19s are mounted in clusters of four on each side of a turret that also carries four 30-mm guns. The CADS-1 combined air defense system fitted to the aircraft carrier *Admiral Kuznetsov,* the battle cruiser *Kalinin,* and the new *Neustrashimyy*-class frigate is similar to the 2S6 (see SA-N-11 entry.)

Type: tube-launched, low/medium-altitude, surface-to-air missile.
Power Plant: two-stage solid-propellant.
Guidance: semiautomatic command to line-of-sight (SACLOS) with infrared and possibly laser terminal homing.
Warhead: high-explosive (17.6 lb).
Dimensions: length 6 ft 6¾ in, body diameter 5⅞ in.
Launch Weight: 66 lb.
Performance: speed hypersonic, max range 4.3–6.2 miles.

Naval Surface-to-Air Missiles

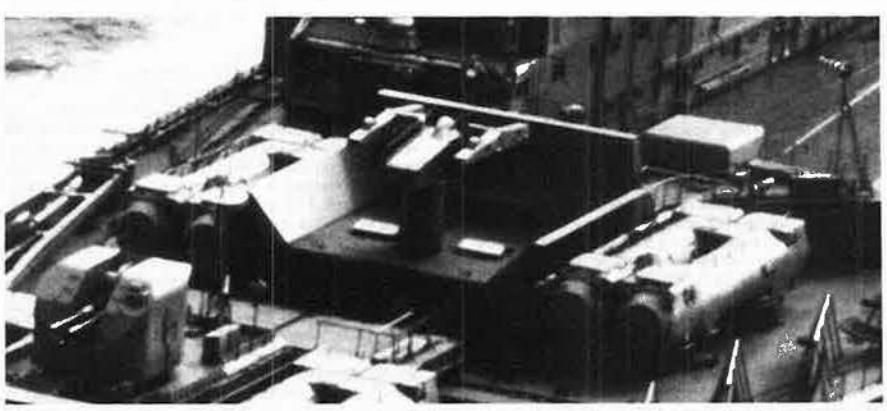
SA-N-1 (CIS **M1 Volga-M**; NATO "Goa")

The SA-N-1 was the first SAM installed in ships of the former Soviet Navy, from 1961. After thirty years, it remains on 19 cruisers and destroyers, but many are due for retirement. Data for the current SA-N-1B (Goa Mod 1) are similar to those given for the landbased SA–3, with which it was developed. It is carried on a roll-stabilized twin launcher.

SA-N-3 (NATO "Goblet")

Goblet is the only surface-to-air missile known to have been developed exclusively for use by the Navy of the former USSR. More effective than the SA-N-1, it is carried by larger vessels, including the *Kiev*-class carrier/cruisers, helicopter cruisers *Moskva* and *Leningrad,* and *Kara* and *Kresta II* cruisers. Compared with the original **SA-N-3A** Goblet Mod 0 version, the **SA-N-3B** Goblet Mod 1 has internal improvements and greater range but is otherwise similar. Both versions are fired from a twin launcher and have a secondary antiship capability.

SA-N-1 "Goa" (TASS)



SA-N-3 "Goblet"

Type: short-range, shipborne, theater defense missile.
Power Plant: dual-thrust solid-propellant.
Guidance: radar command, with semiactive homing.
Warhead: high-explosive (176 lb).
Dimensions: length 20 ft 0 in, body diameter 1 ft 11½ in.
Launch Weight: 1,863 lb.
Performance: speed approx Mach 2.5, slant range 1.85–18.5 miles (SA-N-3A), 1.85–34 miles (SA-N-3B), effective ceiling 300–75,000 ft.

SA-N-4 (CIS **Osa-M**; NATO "Gecko")

This close-range ship-to-air missile system preceded the landbased mobile SA-8B system, which embodies the same missile. It equips more than 160 ships of 12 classes in the CIS navies, giving them also a limited antiship capability. The retractable twin-round "pop-up" launcher is housed in a drum below deck.

SA-N-5 (NATO "Grail") and SA-N-8 (NATO "Gremlin")

Both the original SA-7 (Grail) and SA-14 (Gremlin) shoulder-fired infrared homing SAMs have been adapted for ship defense, under the designations SA-N-5 and SA-N-8, respectively. Four of the missiles, in their launchtubes, are normally mounted on a framework that can be slewed for aiming. A few installations have only two missiles. They provide simple antiaircraft protection for well over 200 small ships of the CIS navies.

SA-N-6 (NATO "Grumble")

Developed simultaneously with the landbased SA-10 and using the same basic missile, this system has been operational for more than a decade. It superseded the SA-N-1 and SA-N-3 in major warships and is assumed to deal with the same multiple threats as the US Navy's AEGIS area defense system. However, it is doubtful the SA-N-6 could intercept sea-skimming cruise missiles of low radar cross section. This may explain why it is partnered by the smaller SA-N-9 system in later ships of the *Kirov* class. Standard *Kirov* installation comprises 12 eight-round rotary magazines below the foredeck, from which the missiles are launched vertically. *Slava*-class cruisers have eight magazines, with a total of 64 missiles. The *Kara*-class *Azov,* the original trials ship for the SA-N-6 system, has six launchers and 24 missiles. *(Data as for the SA-10.)*

SA-N-7 (NATO "Gadfly")

The SA-N-7 system was developed in parallel with its landbased counterpart, the SA-11, and uses the same basic missile. Sea trials began in 1981, in the *Kashin*-class destroyer *Provornyy,* which remains operational with 20 of the missiles. Subsequently, the SA-N-7 became standard armament on the *Sovremennyy* class of guided missile destroyers, with two single-rail launchers and 44 missiles in each ship. The sophistication and rapid-fire potential of the weapon system are indicated by the requirement for six associated "Front Dome" fire-control/target illuminating radars on each ship. *(Missile data as for the SA-11.)*

SA-N-9

This advanced, vertically launched, short-range missile is similar to the landbased SA-15 and is capable of both antiaircraft and antimissile defense. The carrier *Admiral Kuznetsov* has four six-round launchers and a total of 192 missiles. Sister ships of the battle cruiser *Kirov* each have 128 SA-N-9s, in addition to the SA-N-4 and SA-N-6 SAMs in the *Kirov* itself. They are distributed between two rows of four vertical launchers, on each side of the stern helicopter pad, and two rectangular groups of four launchers on the forecastle. The same system is carried by *Udaloy*-class antisubmarine ships (each eight launchers, 64 missiles), the carrier/cruisers *Novorossiysk* and *Admiral Gorshkov* (formerly *Baku*) (each 24 launchers, 96 and 192 missiles, respectively), and the new frigate *Neustrashimyy* (four six-round launchers).

SA-N-10

This close-range surface-to-air missile system is installed in the naval missile range ship *Kapusta.* The four quadruple launchers differ from those used for the SA-N-5 and SA-N-8 by being reloaded automatically instead of by hand. The missile is reported to be similar to the Army's SA-16 "Gimlet."

SA-N-11 (CADS-1)

Naval counterpart of the landbased 2S6 combined air defense system is the CADS-1, mounting eight SA-N-11 surface-to-air missiles and two 30-mm Gatling-type guns, together with a "Hot Flash" fire-control radar. Eight CADS-1 systems are installed in the carrier *Admiral Kuznetsov,* two on each side of the fore and aft decks. The battle cruiser *Kalinin* has six CADS-1s; the new *Neustrashimyy* frigate has two. The missile is similar to the SA-19 (which see). ■

AFA President O. R. Crawford has appointed these advisors and councils for 1992.

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Daly


Farage


Schittulli


Turner


Willard

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Hearon


Kornreich


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Glenn


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Haney


Hartburg


Huneycutt


Martens


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Sallee


Szalasny


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Pfingston

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Hiss Beck Cammarano


Caton Chestnutt Chumley Cox Day Hansen


Mauldin McCoy McDaniels Pope


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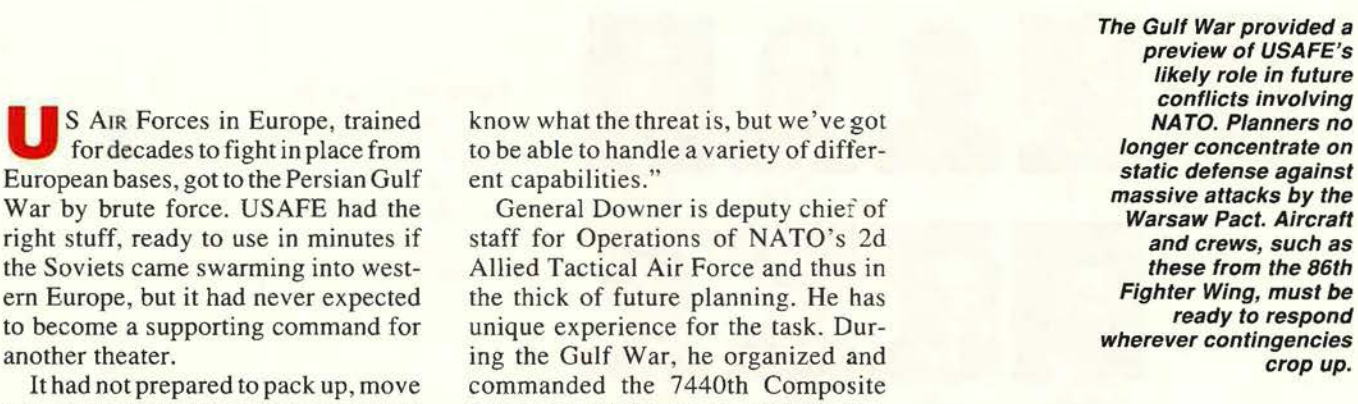
The USAFE "Proven Force" in Operation Desert Storm may have a strong influence on Allied air planning in Europe.

NATO's New Model

By Charles W. Corddry



USAF photo by TSgt. Fernando Serna

The Gulf War provided a preview of USAFE's likely role in future conflicts involving NATO. Planners no longer concentrate on static defense against massive attacks by the Warsaw Pact. Aircraft and crews, such as these from the 86th Fighter Wing, must be ready to respond wherever contingencies crop up.

US Air Forces in Europe, trained for decades to fight in place from European bases, got to the Persian Gulf War by brute force. USAFE had the right stuff, ready to use in minutes if the Soviets came swarming into western Europe, but it had never expected to become a supporting command for another theater.

It had not prepared to pack up, move out, and fight somewhere else almost from a standing start in the way that Tactical Air Command squadrons at home had and did. It sent more than half its aircraft to the conflict nonetheless, building up its support structures overnight. What it did there has now become a model for USAFE and Allied air forces as they are refashioned for the rapid mobility and multinational operations prescribed in the North Atlantic Treaty Organization's new strategy.

Describing the major changes in NATO's plans and forces, Brig. Gen. Lee A. Downer said during a talk at USAFE headquarters at Ramstein AB, Germany, that they "take us away from this linear, massive, defensive wall that we had built in Europe into a much more dynamic, flexible, fluid, multifaceted sort of ability. We don't know what the threat is, but we've got to be able to handle a variety of different capabilities."

General Downer is deputy chief of staff for Operations of NATO's 2d Allied Tactical Air Force and thus in the thick of future planning. He has unique experience for the task. During the Gulf War, he organized and commanded the 7440th Composite Wing (Provisional) at Incirlik AB, Turkey, the first such formation ever authorized, he said, to conduct its own campaign against a large target base. This set of targets, said the General, had been assigned by Lt. Gen. Charles A. Horner, the Saudi Arabia–based air commander of Desert Storm.

The wing was the air component of Joint Task Force Proven Force, set up in Turkey to open a second air front that denied Saddam Hussein's forces any prospect of a sanctuary in northern Iraq and contributed to forcing Iraqi aircraft to flee to Iran. In its little-publicized campaign, the composite outfit employed ten different types of aircraft, flew 4,600 combat sorties, and had zero combat losses.

From USAFE units, it had F-111E long-range interdiction aircraft, F-16C multirole fighters, F-4G Wild Weasel defense suppression planes, F-15 air-superiority fighters, EF-111 area jammers, EC-130 electronic warfare planes, and RF-4C reconnaissance aircraft. It had KC-135 tankers and E-3 Airborne Warning and Control System (AWACS) aircraft from US bases, plus six F-4E laser-designator-equipped fighters rescued in the Philippines from a trip to the boneyard but put in place at Incirlik only on the last night of the war.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Tailoring the NATO Force

"NATO is looking now at tailoring its operations similar to the way we tailored them in Proven Force," General Downer said.

As NATO "builds on what we learned in the Gulf" from the command and control, organizational, and composite operations standpoints, it also confronts possibly major investment problems in switching from static, "fight-from-the-base" concepts to mobility concepts. Mobility did not loom very large in cold war planning in Europe.

"Now they [the Allies] have to think about how much investment we are going to have to make to support this concept," General Downer said. "They're going to be very careful and cautious about this commitment."

The United States proved in the Gulf War, said General Downer, that "with brute force" it could move swiftly to crisis areas, but it will be much more efficient if the entire Alliance trains its squadrons to the high standards and marshals the resources required for rapid mobility.

In General Downer's view, this issue will have to be resolved as the Alliance pushes forward with its new strategy for deterrence, crisis management, and potential combat in regional conflicts or small wars on NATO's periphery. From the USAFE logistician's vantage point, there are similar issues to be resolved.

Germany is an important part of the revamped NATO. All component commanders of Allied Forces Central Europe report to Gen. Henning von Ondarza, whose role is analogous to that of Gen. H. Norman Schwarzkopf during the Gulf War.

However the new strategy shapes up, it will have to be implemented with greatly reduced forces functioning under reorganized and streamlined commands. USAFE is briskly slimming down, dropping to about 3.5 fighter wing equivalents from the long-maintained 8.5 wing equivalents, closing out more than half of its main operating bases in Europe, and eliminating about 25,000 personnel spaces to get down to 44,200. These are the USAFE statistics for the projected US force level of 150,000 troops to which Gen. John R. Galvin, NATO and US European commander, wants to reduce by 1995. Most of the USAFE drawdown is scheduled to be completed by the end of 1993.

"That is not business as usual," said Gen. Robert C. Oaks, commander in chief of USAFE and Allied Air Forces Central Europe, as he describes the cuts in combat units and the reduced infrastructure. "That is big-deal reductions."

The keynote as he builds down the force and plans its future, General Oaks said, is balance—balance in the geographic distribution of his squadrons and in mission capabilities.

Though all NATO nations are reducing their forces numerically, widespread use of precision guided munitions, such as these being loaded by crews from the 48th Fighter Wing, will ensure that effectiveness remains high.

Goodbye to Torrejon

From the geographic standpoint, General Oaks and General Galvin have been frustrated thus far in their long-running effort to base a unit on the NATO southern flank to compensate for the loss of Torrejon AB, Spain, where USAFE's 401st Fighter Wing had long been stationed. Control of Torrejon reverted to Spanish authorities on May 4, 1992, and all US Air Force units either are out or shortly will be.

General Galvin told the House Armed Services Committee in late March that, if he had just two fighter wings in Europe, "I would want one in the southern region, and it should be in Italy." His reason was that the region has been one of repeated US deployments in crises. The Mediterranean, he said, "is the most likely place historically, in terms of the United States' responses, for something to happen."

Congress, looking at the cost of a new base as the cold war subsided and then ended, has been unmoved, and the proposed construction at Crotone in Italy has gone by the board. "But we are still committed to retain that fighter presence in the southern region," General Oaks said. Working with the Italian government, NATO is trying to find an economical and acceptable solution. Meanwhile, the General has held some of the 401st Fighter Wing's F-16s at Ramstein, USAFE's headquarters base, ready to deploy south if such a solution is found.

In the major restructuring of USAFE, the command is giving up more than 400 of its approximately 700 fighter aircraft. However, as explained by Col. Kenneth R. Reynolds, USAFE's assistant deputy chief of staff for Plans and Programs, it is acquiring its own refueling tankers and airlift aircraft. The former once were part of Strategic Air Command, which has deactivated, and the latter were part of Military Airlift Command, which also has passed from existence. The Air Force thus is better preparing itself under the new mobility concept, with all its forces in the theater under a single commander.

When the slimming and reorganization are completed, according to present plans, USAFE's force structure will look like this:

- At the 86th Fighter Wing, Ramstein AB, Germany, two F-16 multirole fighter squadrons.
- At the 36th Fighter Wing, Bitburg AB, Germany, two F-15 air-superiority fighter squadrons.
- At the 52d Fighter Wing, Spangdahlem AB, Germany, one F-16 multirole fighter squadron, one A-10 close air support aircraft squadron, and one OA-10 forward air controller squadron.
- At the 48th Fighter Wing, RAF Lakenheath, UK, two F-15E dual-mission strike fighter squadrons.
- At the 32d Fighter Group, Soesterberg AB, the Netherlands, one F-15 air-superiority fighter squadron.

In addition, USAFE would control three squadrons of special operations aircraft based at RAF Alconbury, UK, the 435th Airlift Wing's C-130s based at Rhein-Main AB, Germany, and the 100th Air Refueling Wing's KC-135 tankers based at RAF Mildenhall, UK.

General Oaks says he will maintain, within this structure, capabilities for reconnaissance—which may be of first importance in rapid reaction operations—and for electronic warfare.

USAFE is eliminating some organizational layers and streamlining others. Two numbered air forces, 3d Air Force at Mildenhall and 17th Air Force at Sembach AB, Germany, are to cut back to fewer than 100 persons from a previous 185 to 190, Colonel Reynolds said, and will focus on the flying mission and preparations to receive reinforcements when and if required. Air Divisions, hardly needed in a much smaller force, are being eliminated. Base commanders are being eliminated, so that now there will be just one boss—the wing commander—at each base, with clean lines running to his subordinates in charge of operations, logistics, and support functions.

The Alliance, said General Oaks, has adopted "a new strategy, new concept of operations, new force structure, and new command-and-control structure—and that's the guts of any military organization."

General Oaks said that NATO has returned to a principle of warfare—maneuver—that had been more or less abandoned during the long cold war with its "layer cake, static defense" at the Iron Curtain. This, he said, was especially apparent in the US Army's performance during its four-day Gulf War appearance. "Maneuver really reemerged as a major principle of war in just those few short days" of ground combat in the desert and is firmly established in NATO's new concept of operations, General Oaks said.

Withal, the USAFE commander sees his forces performing traditional air missions in a future conflict. "You say, 'Where's the battle going to be?' " he commented. "I don't know where the battle's going to be, but I do know if I'm going to have a capable military force, I've got to be able to do all the elements of airpower—air defense, close air support, battlefield interdiction, deeper interdiction.

"The new missions are really the same things we've always done—basic airpower missions," said General Oaks, and USAFE's training in Europe follows that course.

Joint Precision Interdiction

This discussion got General Oaks into explaining a new NATO concept—Joint Precision Interdiction (JPI). In the cold war days of static ground defenses (and acute political sensitivity about any crossing of the intra-German border by land forces), strategists devised a plan for locating and attacking the second and third echelons of attacking Warsaw Pact forces. Follow-On Forces Attack (FOFA) was primarily an Air Force task, in view of the limited reach of Army weapons.

With the reemergence of maneuver and no static defense lines, enemy forces now would be attacked on their lines of approach—"to keep forces out of the battle before they can form in battle lines." As far as General Oaks is concerned, this could be called either FOFA or JPI because, in his view, "they're kind of blood brothers."

What is "joint" about it? The Army now has the ATACMS (Army's Tactical Missile System), an interdiction weapon, so there has to be integrated air and land operation, just as the air defense fighter and antiaircraft missile operations must be coordinated.

Military restructuring was put in motion in NATO shortly before August 2, 1990, when Iraq invaded Kuwait, but the performance of US and Allied forces in the Gulf War has come to serve as a model for USAFE and other NATO air forces planning mobile and multinational operations.

For example, General Galvin said he is cutting the number and size of headquarters by twenty-five percent. In the central European part of his command, the headquarters of two Allied Tactical Air Forces and two Army Groups will disappear. The commander of Allied Forces Central Europe, German Gen. Henning von Ondarza, who reports to General Galvin, will now command the much-reduced air, land, and maritime components in the region, and their commanders report to him. By coincidence or not, this structure resembles that in the Gulf War, where Gen. H. Norman Schwarzkopf had air, land, and sea component commanders under his command.

From the airpower standpoint, the key organization—again, as in Operation Desert Storm—will be a central tasking agency. Here, planners examine threats, lay out the targets, and plot the courses for a composite force of fighters, electronic warfare aircraft, tankers, etc., as allocated by the air commander. In the present structure, this agency is the Allied Tactical Operations Center. In the new setup,

as described by General Downer, it will be the Combined Air Operations Center, dealing directly with the combat units. This builds on the experience of General Downer's composite wing in the Gulf War, but it could be much more complicated as the air operations center packages forces from a number of countries spread over several bases, requiring complex communications.

USAFE will not have composite wings stationed at European bases. As explained by Col. Rudolf E. Peksens, USAFE's assistant deputy chief of staff for Operations, an exercise becomes composite with "wheels up." Aircraft depart their bases, form up, and train in the air. Colonel Peksens, who was General Downer's vice commander in the Gulf War, said that training would be constant so that staffs and crews do not forget the lessons. From Bitburg and Spangdahlem, just five miles apart, a composite outfit can be quickly formed in the air with F-15s, F-16s, and A-10s.

Staying Loose

NATO's cutting edge for crisis management under the new strategy will be the Rapid Reaction Corps, a multinational organization being formed under the command of a British general, and the "Reaction Force Air." The concept, developed by staff officers, has been awaiting NATO approval.

Given airpower's innate ability to get somewhere fast, the Reaction Force Air will be a much looser organization than its ground counterpart, consisting of a menu of various national squadrons from which a required force can be put together. As now envisioned, the force would have no commanding officer but rather would be assembled and handed over to whatever NATO air commander sought it—for example, General Oaks in the central region. A German three-star general will be designated "Director of the Reaction Force Air Staff," which will do the planning, coordinating, and readiness monitoring.

Under the concept worked out so far, the force would have on call an as-yet-undetermined number of fighter squadrons from various nations, surface-to-air missile units, and a command-and-control element. Eventually a mobile combined air operations center may be added.

General Oaks gave an example of how the Reaction Force Air might be employed in a crisis. For a start, there would be reconnaissance aircraft. "You would probably start out sending AWACS, and then you would send some protection for AWACS, so you'd send F-15s, and then as Army got in there . . . you would send some close air support aircraft. [Then] offensive counterair, interdiction forces, F-16s. You would mold the force to meet the need."

World events have forced USAFE and NATO to abandon the business-as-usual approach. The emphasis is now on balance and flexibility, with a special premium on planning and close cooperation with Allies and other US services.

Molding the shrinking force to meet expanding needs for flexibility and mobility is imposing new burdens and strains on USAFE's logistics system. Extensive reorganization is under way to ensure that the force's "beans and bullets" are ready to use and ready to go.

Maj. Gen. Philip L. Metzler, Jr., USAFE's deputy chief of staff for Logistics, recalled that USAFE was able to go to the Gulf only via the "brute force" technique. As USAFE takes on new mobility missions, he said, it will need money for training and preparing to move the whole array of people and equipment—jacks, stands, oil, starters, consumables, sustainment items, the lot—as the tactical forces at home have long stayed ready to do.

The General is making major changes in the way USAFE stores munitions and other war reserve materiel, having learned in the Gulf War that the stuff was "not easy to move or near transport." The WRM is now being containerized and made ready for swift movement on rail and through ports. Regional logistics centers are to be set up—tentatively, at Mildenhall, Sembach, Incirlik, and Aviano in Italy—for centralized management of the command's vast, widespread stocks of war reserves and prepositioned equipment for reinforcing units. General Metzler recognizes, too, on the strength of Gulf War experience, that USAFE must be prepared to serve as the rear support base for forces engaged in conflict outside its area.

He sees the future logistics mission as calling for three critical capabilities: sustaining the capabilities of in-place forces in Europe in peacetime and, if necessary, in war; being prepared for contingency missions within and out of theater; and being ready to bed down incoming reinforcements, just as under the old war plans.

The third item has a high priority with General Oaks. He finds it hard to envision any operation that would not involve US interests.

"Maintaining a reinforcement capability is a very important and continuing part of the USAFE mission," the General said. ■

Charles W. Corddry, a defense correspondent in Washington for the Baltimore Sun, has covered military and foreign policy issues for nearly fifty years. His most recent article for Air Force Magazine *was "The Powell Perspective" in the March 1991 issue.*

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When improved maintenance is the goal, it pays to consult the troops.

Fast Fix

By Debra K. Tanzi and SSgt. Rick Burnham

TSgt. Edwin Munar was a jet engine mechanic at USAF's 4th Wing, Seymour Johnson AFB, N. C. At a special conference at Eglin AFB, Fla., he pitched an idea to improve F-15E maintenance. Sergeant Munar argued it would be more cost-effective and efficient simply to replace F-15E hinge assemblies on the engine exhaust nozzles than to send them to a logistics depot for repair.

Senior maintenance officials approved the idea on the spot.

Thus did Sergeant Munar become a part of a new process the Air Force has developed to streamline its operations. The concept is called "fast fix" by some and "job fair" by others, but the point is the same: Bring together, under one roof, key weapon system managers and maintainers to discuss faster, cheaper ways to maintain military aircraft.

"Our objective was to speed up the system, to allow the technician to effect change," said Col. Roy Duhon, logistics group commander at the 33d Fighter Wing, Eglin AFB, Fla. "When we began this," he said, "some were skeptical and thought there would be much resistance to approving change at the unit level. To the contrary, depot representatives and engineers have repeatedly come in with their guns loaded, ready to approve."

Colonel Duhon adds that the sessions are "fast-paced, action-packed, . . . with all key players present to make decisions on the spot."

In June 1990, a General Accounting Office study found that numerous maintenance tasks could be done at the unit level rather than at depots and that the Air Force could save money by doing so. The Air Force was willing but needed to find out from the units what could, in fact, be done.

In October 1990, Tactical Air Command began to put the concept into practice. In that month, the command held its first "job fair." The event concentrated on the A-10 Thunderbolt II close air support aircraft. Since then, TAC has held annual job fairs for the F-15, F-16, and F-111 fighters. The most recent job fair, which featured the E-3 Airborne Warning and Control System plane, was the first to focus on a TAC "heavy."

As a complement to the TAC job fairs, Military Airlift Command started a spin-off, known as "fast fix." Each of the programs includes participants from the Air Force Reserve,

At a fast fix conference at Eglin AFB, Fla., TSgt. Edwin Munar of the 4th Wing, Seymour Johnson AFB, N. C., convinced maintenance managers that it would be more efficient to replace the hinge assemblies (opposite) on F-15s' engine exhaust nozzles on site than to send them to a logistics depot for repair.

USAF photo by SSgt. Rich Covington

Air National Guard, Air Staff, US Air Forces in Europe, Pacific Air Forces, Air Force Logistics Command, and Air Force Systems Command.

Initial Skepticism

Colonel Duhon reported that a flightline technician came to a conference with some definite ideas on how to fix an F-15 hydraulics problem. The senior hydraulics engineer was deeply skeptical and disputed the maintainer's ideas.

"However, after an initial round of disagreement, they sat side-by-side hashing over the problem," said Colonel Duhon. "The beauty of the program is, before they left, they came up with a solution."

This kind of face-to-face interchange is a big dividend of the job fair, says the Air Force. During one recent twelve-month period, F-15 maintainers proposed eleven new ideas for fixing the F-15 more efficiently. All were initially disapproved. At the next F-15 job fair, the technicians who had submitted the suggestions came armed with detailed explanations and demonstrations of their proposed solutions. Once they were able to communicate with the maintainers, face-to-face, the engineers agreed to take a second look. They did—and approved all eleven recommendations.

The goal, said Col. Raymond Davies, logistics group commander for the 4th Wing, is to avoid all the red tape associated with submitting ideas through higher echelons of command. "It takes months to get any feedback [through normal channels] for a simple repair procedure," asserted Colonel Davies. "This method gets rid of all the cumbersome paperwork involved with submitting them up the chain of command."

Colonel Davies should know. At the recent Eglin job fair, the 4th Wing submitted eighteen maintenance initiatives, each of which was approved on the spot.

Lt. Col. A. B. Decker, chief of the F-15 logistics management division, Langley AFB, Va., is the job fair organizer. "In the field," said Colonel Decker, "we find that many of our failure modes are small leaks, minor repairs, and adjustments that can effectively be made at the unit level. While we know the aircraft must go to depot periodically, this process can and does improve mission capability by authorizing the unit to do more fixes."

The Five-Minute Fix

The usual routine is for unit technicians to demonstrate a problem and proposed solution, using as many visual props as they can.

CMSgt. Horst Walter, chief of quality assurance with the 1st Fighter Wing, Langley AFB, Va., showed a videotape demonstrating a procedure he devised to "make safe" an F-15 ejection seat quickly and effectively for public static display. According to Technical Orders, maintainers were required to remove the seat, remove ejection explosive initiators, then reinstall the seat, a procedure that takes about three hours.

"We locally manufacture special tools that can be installed into the F-15 cockpit using three padlocks that are keyed for one key," said Chief Walter. "These locks secure the seat, canopy handle, and canopy initiator. Using this system, I can totally secure the seat and canopy in less than five minutes."

His briefing to the job fair board included facts about the number of static displays requested at Langley and how this locking system, which does not compromise safety, could save some $20,000 annually. The

change was approved by the job fair board and sent to the item manager at Robins AFB, Ga., for final incorporation into the Technical Order system.

Attendance is increasing as word spreads about the job fairs. More than 100 maintenance workers and officials attended the F/EF-111 job fair held at Cannon AFB, N. M., in March. The job fair board received thirty-nine major new initiatives. According to MSgt. Michael Harp, who was assigned to Hq. TAC, the maintainers got twenty-five out of thirty-nine action items approved on the spot.

"Our biggest items have to do with the engine," said Sergeant Harp. "This year, our big-ticket item was approval for base-level repair on the F-111 main fuel control throttle seal," which he said would save thousands of dollars.

The architect of MAC's fast fix program was Col. Thomas Thompson, MAC's director of Maintenance Engineering. He heard about the process while attending a TAC conference last year. His interest and work resulted in a conference on C-5 maintenance, held in late February at Travis AFB, Calif. This meeting brought together more than ninety managers and technicians from throughout the Air Force who were experienced with the workhorse airlifter. Next, the fast fix operation will travel to Charleston AFB, S. C., to focus on the C-141 StarLifter.

TAC and MAC officials found that much more than new maintenance procedures are shared at these meetings. Another by-product is that various organizations get a chance to talk about their ideas to better execute routine jobs.

USAF photo by Debra K. Tanzi

At Travis AFB, Calif., last February, more than ninety C-5 managers and technicians attended a C-5 conference. Attendance is increasing at such conferences, where maintainers at all levels discuss new procedures and solve old problems.

Members of the 60th Aircraft Generation Squadron at Travis came across a tool to reflange a plane's bleed air ducts. The current tool used by the Air Force comes in fifty pieces, which fill two large boxes. The new tool, which is in wide use in the commercial airline industry, comes in one piece and is adjustable to the size of the duct.

A Turn of the Wrist

"It's like the difference between a typewriter and a computer," said SMSgt. Mark Putzer, a C-5 aircraft maintenance supervisor. "The tool we have now is the one that came with the C-5 in 1968. With the turn of your wrist, this new flanging tool allows repair of five to six ducts in the time it takes to assemble our current tool."

The job fair process seems to save money. Case in point: SSgt. Byron Lebreche's idea for a built-in test set for the C-5's air pressurization control box. The test set allows an electro-environmental systems specialist to test the box's thermostat, eliminating the need to send the entire box to a depot for repair. Total savings: an estimated $5,000 per box.

Another on-the-spot approval was given to SMSgt. Michael S. Vekasy. Sergeant Vekasy had an idea how base maintainers could change the C-5's flight spoiler actuator forward and rear gland seals. The Technical Order restricted repair to depot level. "It's an easy repair and can be accurately tested to verify installation and correct operation of the unit," said Maj. Marcelo Paz, a C-5 maintenance manager for MAC at Scott AFB, Ill. "This item stands out as a true success story from fast fix. Big savings come into play by not having to ship the item." MAC estimated that it would save $390,000 a year, fleet-wide, by adopting this idea.

USAF photo by Debra K. Tanzi

At the C-5 conference, Sgt. Christopher Smith of Altus AFB, Okla., demonstrated a more efficient way to change the airlifter's 300-foot winch cable. Conference attendees requested videotapes of his demo to use as training aids for their units.

Another by-product of these meetings is the valuable sharing of how-to information. Changing the cable in the C-5 winch is something often left to the depot. The winch, used for loading cargo, has about 300 feet of cable.

"We have figured out an efficient way to fix it ourselves" when it gets frayed, said Sgt. Christopher Smith of Altus AFB, Okla. "It takes two people about four hours to change the cable, and it's done."

Documenting this on video proved the old saying that a picture is worth a thousand words. "When a video is as well done as this one from Altus, you don't need much else," commented Major Paz. "It's all right there." Fast fix attendees requested copies of the video to use as training aids for their units.

The Center for Supportability and Technology Insertion from Wright-Patterson AFB, Ohio, presents a video at job fair and fast fix forums to update conferees on the latest technology insertion efforts. During these presentations, Lt. Col. H. Duane Murphy, CSTI's director of business relations, highlights information of interest to maintainers.

USAF photo by Debra K. Tanzi

At Travis's C-5 conference, members of the 60th Aircraft Generation Squadron demonstrated a new tool (below) used on commercial airliners to reflange bleed air ducts. The old tool comes in fifty pieces (above, right); the new one (above, left) comes in one piece and adjusts to the size of the duct.

USAF photo by Debra K. Tanzi

A Welcome Change

Col. Hal Lawrence, deputy commander for Maintenance for the 439th Airlift Wing (AFRES) at Westover AFB, Mass., said the experience levels in Reserve units are very high because their people have worked on the same systems for several years. Thus, he said, the idea of doing more maintenance at base level is welcomed by the Air Force Reserve.

"It's frustrating for maintainers to have to tag a part and ship it off," Colonel Lawrence said. "They know they can fix it themselves faster and cheaper. The idea can benefit the whole Air Force."

TAC's job fair program starts at the squadron level. During the year, the squadrons are asked to look for ways to improve job efficiency and increase aircraft mission capable rates. The ideas produced are submitted as suggestions. As TAC prepares the job fair agenda, it looks at all the submitted ideas and decides which ones are best suited to a particular event.

TAC compiles these suggestions in an agenda book and provides preview copies to the System Program Managers and Air Logistics Centers. During the job fair, technicians present their suggestions, sometimes with a demonstration using the actual parts.

At one session, TSgt. Samuel Ware, a weapons mechanic from the 325th Training Wing at Tyndall AFB, Fla., brought a tool for reflaring the pitot static probe, which measures the air pressure and gives airspeed readings. The tool repairs the probe, which has a tendency to bend and cause erroneous readings. Each replacement probe costs $2,650. Savings at Tyndall AFB alone are estimated at more than $88,000 per year.

"I thought we could do better than to just remove and replace it," said Sergeant Ware. "The job fair program has given us an avenue to work the problem ourselves." ■

Debra K. Tanzi is a logistics management specialist for the Air Force Center for Supportability and Technology Insertion, part of Air Force Logistics Command at Wright-Patterson AFB, Ohio. SSgt. Rick Burnham currently edits the base newspaper at Lajes Field, Azores.

It took both determination and daring to prove what could be done in the air.

Beginnings

By Bruce D. Callander

Maj. Carl "Tooey" Spaatz (fully clothed) reaches from **Question Mark** *to grab a refueling hose. His 1929 flight was a pioneering experiment in air-to-air refueling, but within the year, his time-aloft record had been beaten nine times.*

In January 1929, a future chief of staff of the Air Force reached through the top hatch of an airborne Fokker C-2 trimotor aircraft and groped for a hose dangling from an airplane above him. He was stark naked. Maj. Carl Spaatz had been drenched with gasoline during an earlier contact and had stripped to avoid being burned. He would be soaked by aircraft fuel twice more during the week-long flight of *Question Mark*.

The exploit of Major (later General) Spaatz was one of the pioneering experiments in air-to-air refueling, but it was not the very first. More than a decade earlier, other flyers explored the idea. Even earlier than that, they experimented with techniques that, along with aerial refueling, were to become crucial to modern aviation: airborne radio communication, night flying, instrument navigation, and automatic flight control.

World War I was still on when Navy Lt. Godfrey Cabot began to practice flying over and then snatching weights from a moving sea sled. Later he replaced the weights with five-gallon cans of gasoline, which he used to refuel his plane.

In 1923, two Army lieutenants flying in a de Havilland carried out the first plane-to-plane transfer of fuel. Lt. Lowell Smith flew the two-seat plane while Lt. John Richter filled a fifty-gallon tank in the rear cockpit. A second, "mother" ship supplied fuel through a hose hanging down to the plane. With this system, Lieutenants Smith and Richter managed to stay aloft for thirty-seven hours, breaking all endurance and distance records.

On New Year's Day 1929, Major Spaatz and his fellow crew members began their flight. They remained airborne for 150 hours and took on 5,600 gallons of gasoline. Mother ships delivered food and spare parts. Mechanic Roy Hooe serviced the engines from catwalks on the wings. To communicate with stations on the ground, the crew of *Question Mark* fired flares and dropped notes. They signaled to the tankers by jerking on the fuel hose. The crew suffered from cold nights, noxious gasoline fumes, and general exhaustion, but it was engine failure that finally brought them down.

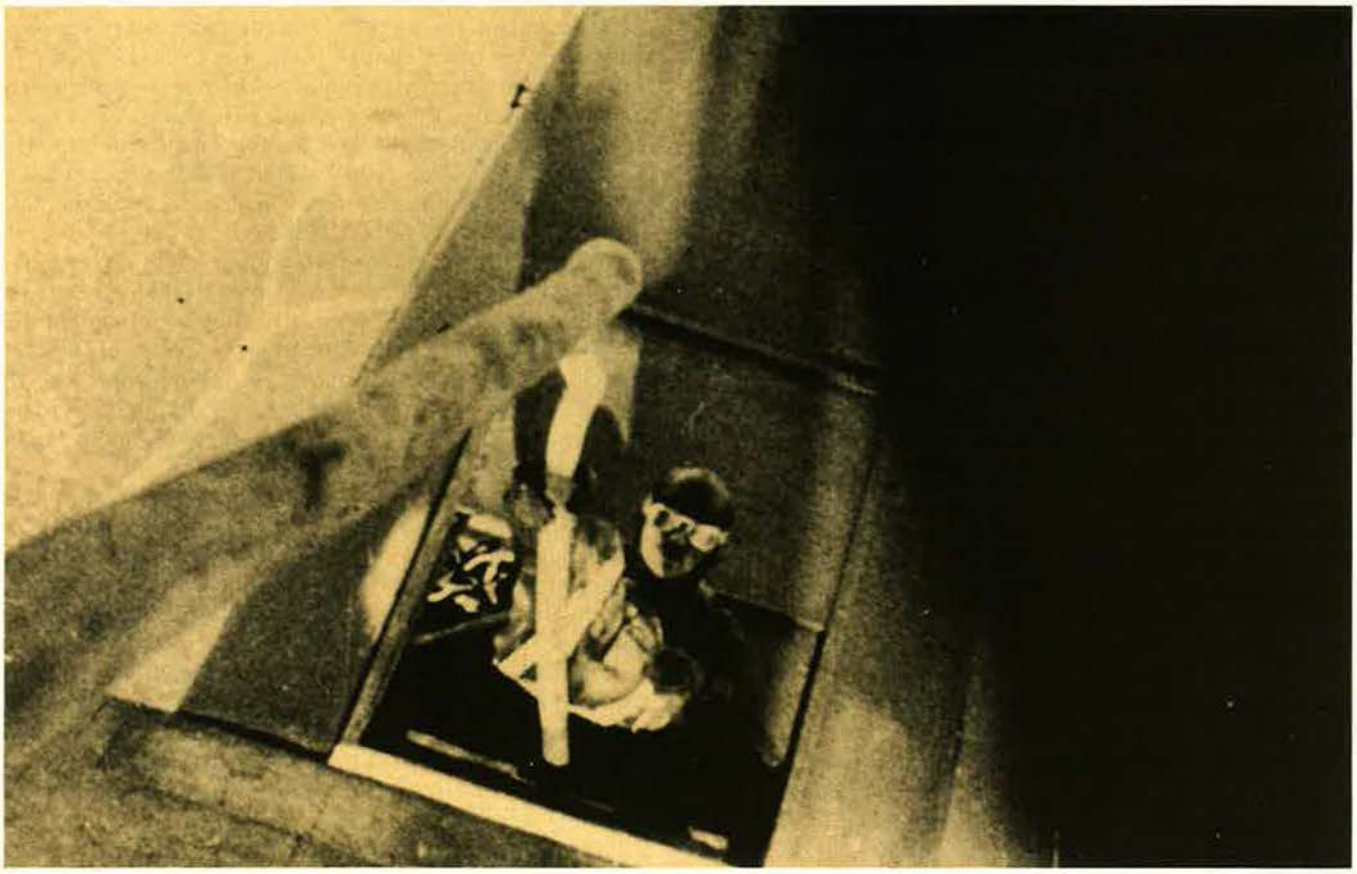
The media promptly predicted that aerial refueling would revolutionize commercial aviation, introduce intercontinental bombing to warfare, and make navies obsolete. The only immediate effect, however, was to inspire longer flights.

In August 1929, Lt. Nicolas Mamer and Arthur Walker flew *Spokane Sun God* nonstop from the state of Washington to the East Coast and back, refueling eleven times. Within the year, *Question Mark*'s time-aloft record had been beaten nine times.

Militarily, however, the technique had little obvious practical application. Through World War II, aircraft builders concentrated on extending the unrefueled range of planes.

Then, in 1947, Boeing converted a B-29 bomber into a trailing-hose tanker to refuel fighters. The next year, it experimented with a telescoping pipe that could be used for refueling bombers. By 1949, Capt. James Gallagher's crew was carrying out the first nonstop, round-the-world flight, refueling their B-50, *Lucky Lady II*, four times.

Use of the jet engine led to routine aerial refueling. Boeing added jet pods to KB-50s to permit them to keep up with fighters. In 1956, the company developed the all-jet KC-135 Stratotanker and a winged fuel pipe that could be



"flown" by a crewman in the mother ship. A year later, Maj. Gen. Archie Old, Jr., led three B-52 bombers around the world in forty-five hours, making four refueling contacts. Today's KC-10 flies further and faster, refuels both bombers and fighters, and doubles as a cargo hauler.

Radio Transforms Aviation

Early aerial refueling suffered from a lack of instantaneous radio communication, which was eventually to transform aviation.

Aviators had been searching for fast, sophisticated ways to conduct airborne communications. As early as 1861, Thaddeus Lowe had telegraphed the White House from a balloon as it floated over Washington. Later, Lowe used the wire to direct artillery fire and report Confederate troop movements. By 1909, when the Army bought its first plane, balloons were using radio telegraph.

Two years later, Lt. Benjamin Foulois carried in his Wright flyer a wireless radio, which he used to send signals along the 106-mile route between the Texas towns of Laredo and Eagle Pass.

Early radio transmission was iffy, however, and the Army continued to explore other communication systems. James Means offered a novel idea: to inject lamp black intermittently into the plane's exhaust system and so produce visible "dots" and "dashes" in the sky. The Army did not buy the idea, but commercial flyers later refined it for skywriting.

Meanwhile, flyers kept tinkering with the radio. In 1914, Lts. Herbert Dargue and Joseph Mauborgne, who were stationed in the Philippines, began to send and receive a wireless signal over a distance of ten miles. Flyers in San Diego extended the range by putting a 180-watt transmitter in a Martin trainer. The power came from a wing-mounted generator run by a small propeller.

By the time the US entered World War I, radio voice transmission had arrived, but the equipment remained bulky and unreliable. Engine vibrations destroyed tubes and wrecked generators. Pilots fell back on shooting flares and signaling with Klaxon horns and machine-gun bursts.

Toward the end of the war, the RAF exploited the homing ability of radio to send its pursuit pilots after enemy planes. The US Army sent officers to train on the equipment, but the war ended before they finished.

American air leaders came out of the war sold on radio, but many pilots continued to have little faith in it. For many, radio raised a question of priorities. Radio sets were heavy and fickle and took up space. As he prepared for his nonstop transatlantic flight in 1927, Charles Lindbergh decided additional fuel would be more useful than a radio.

Things changed abruptly in 1934. President Roosevelt ordered the Air Corps to haul the mail, and that meant flying at night and in poor weather. The Army added radios and trained pilots to use them. The experience made believers of many.

By World War II, all combat planes had two-way radios, and bombers carried their own radio operators. Even then, much of the message traffic was by radio telegraph, not by voice. Wartime radio still relied on fat vacuum tubes and bulky transmitters that could be knocked out by flak. It was not until 1947 that transistors opened the way for miniaturized, solid-state electronics and made the new Air Force radios worth more than their weight in fuel.

Night Flying

The same factor that made airborne radios practical—the rapid improvement of electronics—also made around-the-clock flying routine.

Pilots had long been challenging the darkness. In 1910, Britain's Claude Grahame-White raced France's Louis Paulhan the 165 miles from London to Manchester. When Grahame-White ran out of daylight, automobile headlights helped him find the railroad lines he used as a guide, but Paulhan, having a head start, won the race.

That fall, US Capt. Charles Chandler fared better flying home at night from the Army-Navy game in Annapolis. He followed the B&O Railroad signal lights back to College Park, Md. His mechanics lit fires on the airfield to guide him in.

Soon acetylene lights were set up along the College Park runway, and pilots practiced night landings routinely, but night cross-country flights were still an adventure in those days before rural electrification.

In World War I, pilots found that darkness offered benefits that offset the risks. Night bombing was effective in the St.-Mihiel offensive, and the Air Service planned to create a thirty-squadron bombardment section. The new units never saw action, but the Air Service continued to build its night-flying capability.

The main problem was equipment. Instruments had to be equipped with internal lighting. Altimeters, airspeed indicators, and compasses had to be more accurate. Exhaust systems had to be shielded to reduce cockpit glare.

In the early 1920s, the Army laid out a model airway from Washington, D. C., to Dayton, Ohio, and asked towns en route to set up beacon lights. Next, the Army had to convince pilots to use the system. In August 1922, Lt. Clayton Bissell made the first night flight over the Washington-Dayton airway. He questioned whether the equipment was worth the money.

Despite the skepticism, the Air Service extended the airway to fields in Virginia, New York, Michigan, Illinois, and Texas. It added night flying to pilot training and fitted planes with colored navigation lights. Wingtip flares were replaced with electric landing lights, and runways were illuminated.

Flying the mail was what convinced many pilots that guts alone were not enough. One was 2d Lt. Charles P. Hollstein, who began flying the Cleveland-Washington run barely six months after earning his wings. On a night flight, his compass light went out and his radio quit. He crashed in a snowstorm. Hollstein hiked to the nearest town to report the mishap, then went back to recover his mail sacks. Several pilots were less lucky.

The Air Corps gave more attention to night flying, and, by the time the US entered World War II, it had become a standard part of training. Ironically, however, many of the crews that trained to fly in the dark never did so in combat. The US Army Air Forces opted for daylight bombing in Europe. It was late in the war before P-61 night fighters saw action and the US gave up daylight bombing of Japan for low-level night raids.

Navigating by Instrument

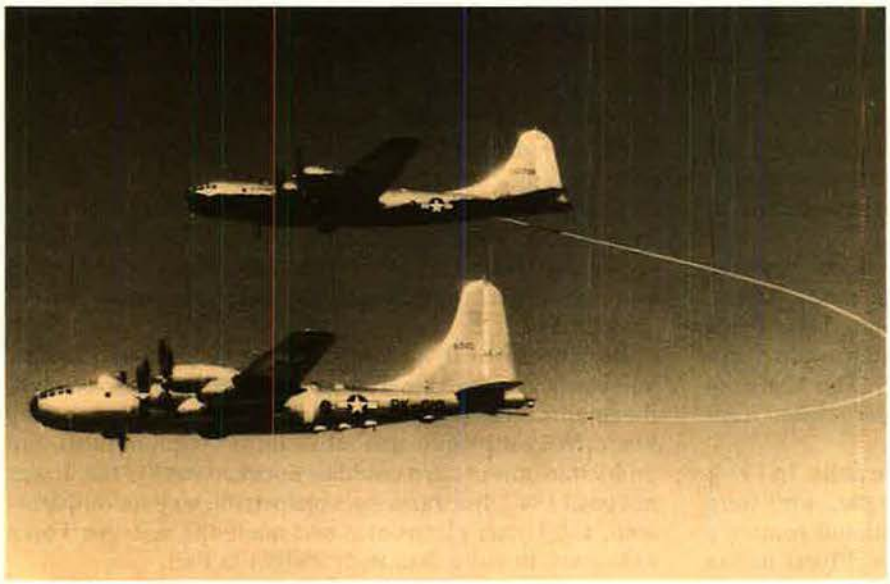
New devices, such as radar, took the terror out of night flying, but long before such electronic wonders arrived, pilots were getting lots of mileage out of primitive instruments.

James Means came up with an "aeronautical clinometer." Like a carpenter's level, it held a ball of mercury in a glass bowl. Means patented this forerunner of the turn-and-bank indicator in 1911, but it had one flaw: The pilot had to look down to read it and, in the process, could lose his visual orientation.

The pre–World War I Aviation Section was not much interested in such gadgetry anyway. However, by the early 1920s, flights were longer and the old, basic instruments were not enough.

Even magnetic compasses proved unreliable in planes filled with metal parts. Elmer Sperry came up with a ship's compass using a gyroscope not affected by its environment. The Army's Engineering Division tested a system that used radio homing and Morse code signals to give direction.

As cockpits became more cluttered with instruments, seat-of-the-pants pilots faced a dilemma. The dials told them one thing and their instincts another. Capt. David A. Myers, flight surgeon at Crissy Field, Calif., set out to show them which was right.



In 1949, Capt. James Gallagher's crew made the first nonstop, round-the-world flight, refueling their B-50,* Lucky Lady II *(bottom aircraft), four times from KB-29s. These were bombers converted by Boeing in 1947 into trailing-hose tankers that could refuel fighters; in 1948, the company added a telescoping pipe to refuel bombers.

The Air Corps put Lt. James Doolittle in charge of its Full Flight Laboratory to test the "Vertigo-Stopper Box" and other flight instruments. In September 1929 Lieutenant Doolittle made the first completely blind flight, following a radio beacon with a hood (shown here folded down) over his cockpit.

Flight physicals entailed spinning pilots in a revolving chair, but subjects were allowed to keep their eyes open. Captain Myers asked them to close their eyes and tell him which way they were turning. Most could not. Then Captain Myers let Capt. William Oker undergo the test while looking into a box that contained one of Sperry's gyroscopic turn-and-bank indicators. Reading the instruments, Oker could tell where he was at any given moment.

Captains Myers and Oker went on to perfect this "Vertigo-Stopper Box" and convince other pilots to trust it. One early convert was Lt. James Doolittle, a race flyer with a doctorate in aeronautics. When the Air Corps set up a Full Flight Laboratory at Mitchel Field, N. Y., it put Lieutenant Doolittle in charge.

On September 24, 1929, Doolittle put the instruments to the ultimate test. He climbed into his plane, pulled a hood over the cockpit, and took off on the radio beam. At 1,000 feet, he made a 180-degree turn, flew another ten minutes, and made another 180-degree turn. He came down on the beam and, when the marker beacon told him he was over the field, cut the power and dropped in. Doolittle had made the first blind flight.

Instrument flying remained hazardous, however. When Lt. Otto Wienecke crashed during a snowstorm, investigators concluded he had been relying on his artificial horizon and had flown into the ground. The instrument, designed to be read at eye level, had been installed low on the panel and gave a false reading.

The crash caused the Air Corps to rethink the whole system of cockpit layout. By World War II, planes had a full array of flight and navigation instruments and flight students spent hours learning to use them.

The Automatic Pilot

Another technological development also was available to relieve pilots on long flights and increase bombing accuracy. Like night flying, the automatic pilot had roots deep in the early days of aviation.

For the epochal 1903 flights at Kitty Hawk, the Wright brothers built an unstable machine and learned to fly it. Less than two years later, they began work on an automatic stabilizer.

Their system included a pendulum to sense the machine's roll and yaw and a horizontal vane to detect pitch. The sensors sent signals to a compressed-air system that activated the plane's wing-warping and elevator controls. The Wrights worked several years on the device. By late 1913, Orville Wright was ready to demonstrate it on a specially built plane. He made a normal takeoff, then flew several times around the field with his hands held above his head.

Another inventor already had come up with a better idea. Lawrence Sperry (son of Elmer) was taking flying lessons from Glenn Curtiss. Lawrence was convinced his father's gyroscopic stabilizer for ships would work on aircraft. In 1914, he produced such a device. Sperry showed it off by standing in the seat of his Curtiss flying boat and having his mechanic crawl out onto one wing, with the aircraft cruising placidly all the while.

The automatic pilot grew increasingly useful as planes increased their range and pilots needed relief from the strain of flying. In time, however, it was to serve a more deadly purpose.

In 1911, former artillery officer Riley Scott developed a bomb-aiming device. It worked in the slow-moving, low-flying machines of the day. The Air Service and its predecessors used something similar through World War I and into the 1920s. In 1931, Air Corps officers were impressed by Navy demonstrations of a bombsight designed by Carl Norden. It used gyroscopes for stability.

Although Norden's sight was accurate, it required a lot of conversation between bombardier and pilot, which took time. To eliminate the time lag, Norden tied his sight into an autopilot. This let the bombardier steer the plane by turning his knobs and activating the flight controls via servomotors. The automatic stabilizer envisioned by the Wrights had become a lethal weapon system. ■

Between tours of active duty during World War II and the Korean War, Bruce D. Callander earned a B.A. in journalism at the University of Michigan. In 1952, he joined Air Force Times, *becoming editor in 1972. His most recent article for* Air Force *Magazine, "The Mission," appeared in the February 1992 issue.*

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AFA/AEF Report

By Daniel M. Sheehan, Assistant Managing Editor

Honors at Edwards

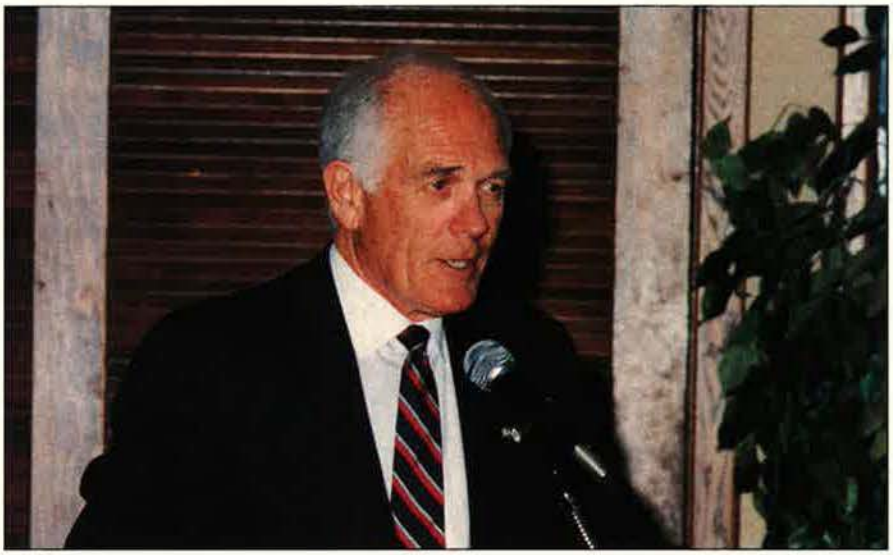
With a pledge and a challenge, National President O. R. Crawford helped the Air Force Flight Test Center and its associate unit at Edwards AFB, Calif., honor their twelve outstanding performers for 1991. The **Antelope Valley (Calif.) Chapter** and the Lancaster and Palmdale chambers of commerce cohosted the twenty-second annual Honors and Awards Banquet.

Mr. Crawford pledged continued Association support for Air Force programs in Washington and challenged members of the audience to participate in the political process by writing their elected representatives "to make sure they know how important national security is to you."

AFFTC Commander Brig. Gen. Roy D. Bridges, Jr., had words of praise for the honorees: "Because of your commitment to excellence, we continued to deliver quality systems to the best air force in the world."

The AFFTC honorees were Maj. Paul L. Sampson, Outstanding Reservist; Capt. Tim B. Freeman, Outstanding Officer; MSgt. Travis D. Wright, Jr., Outstanding Senior NCO; MSgt. James L. Jones, Outstanding Career NCO; SrA. Gregory Lee Munson, Outstanding First-Term Airman; Robert E. Lee, Outstanding Civilian (exempt); and Lisa Sigman, Outstanding Civilian (nonexempt).

The associate unit honorees were Maj. Mark A. Peterson, Outstanding Officer; SMSgt. Willie E. Yates, Jr., Outstanding Senior NCO; SSgt. Joseph W. Knallay, Outstanding Career NCO; Dr. Wesley Hoffman, Outstanding Civilian (exempt); and Emogene Stephens, Outstanding Civilian (nonexempt).



"Of the five wars in the past seventy years, only in Operation Desert Storm was America prepared," National President O. R. Crawford told the audience at Edwards AFB. He exhorted them to "write your elected representatives . . . make sure they know how important national security is to you."

Pennsylvania AFA members get together with Rep. John Murtha (D-Pa.), chairman of the Appropriations Committee's Defense Subcommittee. From left are John Everhard, Joe Walker–Mon Valley Chapter vice president; Chairman Murtha; Gene Goldenberg, state president; and Robert Rutledge, state vice president.

Walker Retires

Former National Vice President (New England Region) and current National Director Joseph A. Zaranka joined more than 1,000 others at a black-tie banquet at Westover AFB, Mass., honoring outgoing 439th Military Airlift Wing Commander Brig. Gen. Frederick "Mike" Walker.

Under General Walker's command, the 439th MAW received an Outstanding Unit Award for its yeoman service during Operations Desert Shield, Desert Storm, and Provide Comfort, including transport of more than 33,000 troops and 63,000 tons of cargo during the Persian Gulf War. On General Walker's final mission, he piloted a C-5 loaded with supplies on a flight to Russia.

Air Force Reserve Chief Maj. Gen. John J. Closner III and new Wing Commander Col. James P. Czekanski praised General Walker's five years of command of the wing.

Coming Events

June 5–6, **Tennessee State Convention,** Memphis, Tenn.; June 9–10, **Utah State Convention,** Ogden, Utah; June12–14, **Virginia State Convention,** Hampton, Va.; June 13, **Ohio State Convention,** Columbus, Ohio; June 13–14, **South Dakota State Convention,** Pierre, S. D.; June 19–20, **Minnesota State Convention,** Hinckley, Minn.; June 26–27, **Mississippi State Convention,** Columbus, Miss.; June 26–27, **Missouri State Convention,** Whiteman AFB, Mo.; July 10–11, **Kansas State Convention,** Wichita, Kan.; July 17–18, **Arkansas State Convention,** Little Rock, Ark.; July 17–18, **Colorado State Convention,** Lowry AFB, Colo.; July 17–19, **Georgia State Convention,** Savannah, Ga.; July 17–19, **Michigan State Convention,** Marquette, Mich.; July 17–19, **Pennsylvania State Convention,** Harrisburg, Pa.; July 17–19, **Texas State Convention,** San Angelo, Tex.; July 24–25, **Florida State Convention,** Panama City, Fla.; July 24–26, **Washington State Convention,** Tacoma, Wash.; July 31–August 1, **Arizona-Nevada (Combined) State Convention,** Las Vegas, Nev.; August 7–9, **California State Convention,** San Bernardino, Calif.; August 14–15, **Louisiana State Convention,** Bossier City, La.; August 15, **Illinois State Convention,** St. Louis, Mo.; August 22–23, **Indiana State Convention,** Kokomo, Ind.; August 28–29, **New Mexico State Convention,** Alamogordo, N. M.; September 14–16, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.

NCO Graduation

Chairman of the Board Jack C. Price traveled to Maxwell AFB's Gunter Annex, Ala., for the graduation ceremony of the USAF Senior NCO Academy. While there, he presented AFA's Military Studies Award to SMSgt. Monte E. Tahvonen of Class 92-B. Academy Commandant CMSgt. Glenn R. White appreciated Mr. Price's support, saying, "Friends like you make the difference between success and failure of any program."

Chapter News

The **Fort Worth (Tex.) Chapter** had an extraordinarily successful Community Appreciation Banquet in February. More than 400 members and guests attended the event, which honored Lt. Gen. Charles A. Horner, Desert Storm's air boss. General Horner joined President Crawford in presenting an Exceptional Service Award to Texas State President Buck Webber. Also at the banquet were AEF Chairman of the Board James M. Keck, National Director Bryan L. Murphy, Jr., Fort Worth Mayor Kay Granger, and 7th Wing Commander Col. Dick Szafranski.

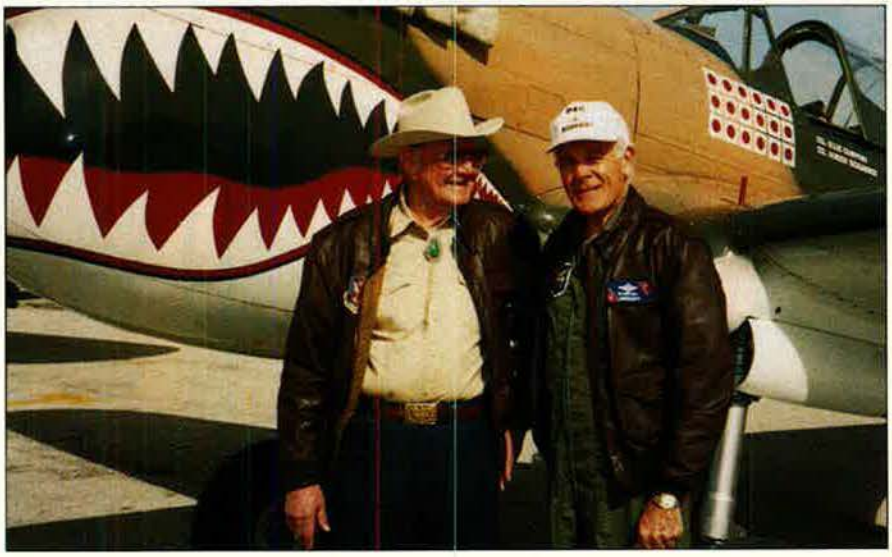
The Fort Worth Chapter is also heavily involved in keeping area residents informed about the closure of Carswell AFB. Its newsletter has instituted a regular column by the chief of the Base Closure Transition Team to detail the month-by-month status of the base and its services.

The chapter has also taken an active role in two programs in conjunction with AEF. Sgt. Muriel B. Brooks, a target intelligence specialist with the 7th Operational Support Squadron, received the chapter's first $250 grant under AEF's Eagle Plan, which honors top graduates from the Community College of the Air Force. Under AEF's "Visions of Exploration" program, ten local elementary and middle schools will receive interdisciplinary instruction with an emphasis on space exploration. *USA Today* has teamed with AEF for this program.

Vice Commander of Military Airlift Command Lt. Gen. Robert L. Rutherford spoke to a meeting of the **Altus (Okla.) Chapter** at the Altus AFB Officers Club. A crowd of almost 300 heard the General's speech. The meeting also marked the enlistment of the chapter's 100th Community partner, and the chapter presented an appreciation plaque to 443d Airlift Wing Commander Col. (Brig. Gen. selectee) Walter S. Hogle, Jr. National Vice President (Southwest Region) Aaron Burleson, Oklahoma State President Bennie Drake, State Secretary Glenda Drake, and Altus Chapter President Gary L. Thompson attended the meeting.

The **Westchester Falcon (N. Y.) Chapter** convened a quarterly meeting at the West Point Officers Club and welcomed guest speaker Lou Loevsky, a navigator with the 466th Bomb Group, 8th Air Force, during World War II. Mr. Loevsky described his combat experiences, including his being shot down over Berlin and his subsequent trials as a POW until his liberation by General Patton's Third Army. Chapter President Herbert S. Leopold deemed the meeting a success and termed the presentation "moving."

The **Carl Vinson Memorial (Ga.) Chapter,** despite enlisting some 200 Community Partners, refuses to rest on its laurels. Former Chapter and State President Dr. Dan Callahan has taken a leading role in informing the Warner Robins area of the contributions of Robins AFB. He has urged the maintenance of close base-community ties and underscored the benefits that the base provides to the Warner Robins area's social structure and educational system as well as its economy. He urges local businesses to "give something back" by supporting the Community Partner program in an effort to demonstrate the good community relations that can mean the difference between an open base and a closed one in this era of cutbacks and streamlining.



David Lee "Tex" Hill, Flying Tigers ace, commander of USAAF's first jet unit, and retired ANG brigadier general, and President Crawford pose before the latter's immaculately restored P-40 Warhawk at a fiftieth anniversary of World War II reception at Brcoks AFB, Tex. Mr. Hill gave the keynote address.

The **Total Force (Pa.) Chapter** recently added another Community Partner to its list. Chapter President Lee Niehaus welcomed Frank Shea, general manager of the Airport Howard Johnson's Motel, during ceremonies attended by Total Force Chapter officers Vice President Fran Soczik, Secretary Pat Accetta, and Treasurer Doug May.

Have AFA/AEF News?

Contributions to "AFA/AEF Report" should be sent to Dave Noerr, AFA National Headquarters, 1501 Lee Highway, Arlington, VA 22209-1198. ■

Unit Reunions

Air Commando Ass'n
Air Commandos who served in World War II (2d and 3d Air Commando Groups) will hold a reunion on September 10–13, 1992, in Colorado Springs, Colo. **Contact:** W. Robert Eason, 10031 Barnetts Ford Rd., Orange, VA 22960. Phone: (703) 672-4074.

Air Rescue Ass'n
The Air Rescue Association will hold a reunion October 14–17, 1992, in Tucson, Ariz. **Contact:** Roy E. Jacobsen, P. O. Box 14225, Scottsdale, AZ 85267-4225. Phone: (602) 948-6660.

Deming Army Airfield
Personnel who served at Deming Army Airfield, N. M., will hold a reunion September 18–20, 1992, in Deming, N. M. **Contact:** Reunion Committee, 402 S. Tin, Deming, NM 88030.

La Junta Army Airfield
Veterans who served at La Junta Army Airfield, Colo., will hold a fiftieth-anniversary reunion September 11–13, 1992. **Contact:** Doyle L. Davidson, P. O. Box 408, La Junta, CO 81050. Phone: (719) 384-7411.

RAF Burtonwood
Personnel who were stationed at RAF Burtonwood, England, will hold a reunion October 7–11, 1992, at the Marriott Hotel in Romulus, Mich. **Contact:** Al Roberts, 11983 Twelve Mile Rd., Shelbyville, MI 49344. Phone: (616) 672-5247.

Women's Overseas Service League
The Women's Overseas Service League will hold its annual reunion convention June 28–July 1, 1992, in San Antonio, Tex. **Contacts:** Jean Schiffman, 414 Windcrest Dr., San Antonio, TX 78239. Phone: (317) 255-2854 (Jane Ford).

Wurtsmith AFB
A reunion will be held July 16–18, 1992, at Wurtsmith AFB, Mich., to celebrate the base's heritage. **Contact:** Maj. Gary Seifert, USAF, 379th Transportation Squadron, Wurtsmith AFB, MI 48753-5000. Phone: (517) 747-6351. DSN: 623-6351.

1st Strategic Air Depot
Veterans who served with the 1st Strategic Air Depot (Honington-Troston, England) between 1942 and 1946 will hold a reunion October 1–4, 1992, in Orlando, Fla. **Contact:** James M. Wiggins, 15285 Brookridge Blvd., Brooksville, FL 34613.

8th Tactical Fighter Wing
The 8th Tactical Fighter Wing will hold a reunion October 15–18, 1992, at the Ramada Classic Hotel in Albuquerque, N. M. **Contact:** Col. James D. Covington, USAF (Ret.), 10211 Montgomery Blvd., N. E., Albuquerque, NM 87111. Phone: (800) 675-6226 or (505) 293-3118.

9th Air Force "Gangway"
Personnel assigned to 9th Air Force Advance Headquarters "Gangway" between October 1943 and December 1945 will hold a reunion September 23–26, 1992, in Colorado Springs, Colo. **Contact:** Jerry Stover, 4025 Druid Ln., Dallas, TX 75205. Phone: (214) 522-0227.

10th Fighter Squadron
Veterans of the 10th Fighter Squadron, 50th Fighter Group, will hold a reunion September 24–27, 1992, in St. Louis, Mo. **Contact:** B. B. Morrison, P. O. Box 1258, Riverdale, GA 30274. Phone: (404) 996-7253.

11th Air Force
Veterans of 11th Air Force will hold a reunion October 1–4, 1992, at the Marriott Hotel in Colorado Springs, Colo. **Contact:** Ralph M. Bartholomew, 313 Madison St., Ketchikan, AK 99901-5835. Phone: (907) 225-2121. Fax: (907) 225-9727.

20th Combat Mapping Squadron
Veterans of the 20th Combat Mapping Squadron, 6th Photo Group (World War II), will hold a reunion September 16–19, 1992, in Colorado Springs, Colo. **Contact:** Lt. Col. David W. Ecoff, Sr., USAF (Ret.), 13850 Tulane St., Brookfield, WI 53005-7146. Phone: (414) 784-3946.

20th Tactical Recon Squadron
Veterans of the 20th Tactical Reconnaissance Squadron (World War II) will hold a reunion September 17–20, 1992, in Fairborn, Ohio. **Contact:** Stanley Gawlik, 661 Woodland Dr., Tallmadge, OH 44278. Phone: (216) 633-5750.

27th Air Transport Group
Veterans of the 27th Air Transport Group, which included the 86th, 87th, 320th, and 321st Transport Squadrons and the 310th, 311th, 312th, and 325th Ferrying Squadrons, will hold a reunion September 24–26, 1992, in Rapid City, S. D. **Contact:** Richard H. Seebers, 707 Baxter Ave., Orlando, FL 32806. Phone: (407) 851-6368.

27th Troop Carrier Squadron
The 27th Troop Carrier Squadron will hold a reunion October 8–11, 1992, in Fresno, Calif. **Contact:** Robert L. Major, P. O. Box 1042, Murphy, NC 28906-1042. Phone: (704) 644-5376.

34th Bomb Group
Veterans of the 34th Bomb Group will hold a reunion September 14–17, 1992, at the Gold Coast Hotel in Las Vegas, Nev. **Contact:** Ray L. Summa, 2910 Bittersweet Ln., Anderson, IN 46011. Phone: (317) 644-6027.

40th Air Refueling Squadron
The 40th Air Refueling Squadron will hold a reunion September 24–27, 1992, in Salina, Kan. **Contact:** Col. John Frazeur, USAF (Ret.), 3417 N. Washington, Tacoma, WA 98407.

Readers wishing to submit reunion notices to "Unit Reunions" should mail their notices well in advance of the event to "Unit Reunions," AIR FORCE Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information.

Class 43-A-1
Veterans of Pilot Class 43-A-1, Mather Field, Calif., will hold a reunion September 30–October 4, 1992, in Washington, D. C. **Contact:** Mike Achter, 417 5th St., S. E., Washington, DC 20003. Phone: (202) 546-0365.

Class 44-E
Class 44-E (Pilot Squadron 64), Western Flying Training Command, Santa Ana, Calif., will hold a reunion October 1–3, 1992, in Dayton, Ohio. **Contact:** James E. Driscoll, 9323 Brambly Ln., Alexandria, VA 22309. Phone: (703) 780-8436.

Class 47-C
Pilot Class 47-C will hold a reunion October 15–17, 1992, in Omaha, Neb. **Contact:** Bob Campion, P. O. Box 1712, Fulton, TX 78358.

49th Fighter-Interceptor Squadron
Veterans of the 49th Pursuit/Fighter/Fighter-Interceptor Squadron will hold a reunion September 27–30, 1992, in Fort Worth, Tex. **Contact:** Sheril D. Huff, 3200 Chetwood Dr., Del City, OK 73115-1933. Phone: (405) 677-2683.

51st Fighter Group
Veterans of the 51st Fighter Group and attached squadrons will hold a reunion September 17–20, 1992, at the Hilton Hotel in Sacramento, Calif. **Contact:** Robert G. Haines, 1720 13th Ave., Belle Fourche, SD 57717. Phone: (605) 892-4623.

Class 52-H
Pilot Class 52-H will hold a reunion October 23–24, 1992, in Kinston, N. C. **Contact:** Gil Woolard, 1607 Carnbridge Dr., Kinston, NC 28501. Phone: (919) 527-0425.

55th Weather Recon Squadron
Veterans of the 55th Weather Reconnaissance Squadron (Long-Range Weather) who served with 20th Air Force in World War II will hold a reunion September 3–5, 1992, at the Marriott Hotel and Marina in San Diego, Calif. **Contact:** Lt. Col. Carlo Arrobio, USAF (Ret.), 2612 Hollister Terrace, Glendale, CA 91206. Phone: (818) 243-9516.

57th Bomb Wing
Veterans of the 57th Bomb Wing, along with units that organized and trained during 1942 at Columbia Army Airfield, S. C., will hold a fiftieth-anniversary reunion September 22–27, 1992, in Columbia, S. C. **Contact:** Robert E. Evans, 1950 Cunningham Rd., Indianapolis, IN 46224-5341. Phone: (317) 247-7507.

61st Troop Carrier Squadron
The 61st Troop Carrier Squadron will hold a reunion September 24–26, 1992, at the Monteleone Hotel in New Orleans, La. **Contact:** Lew Johnston, 2665 Chestnut St., San Francisco, CA 94123. Phone: (415) 567-4717.

71st Liaison Squadron
The 71st Liaison Squadron will hold a reunion

September 24–27, 1992, in Panama City Beach, Fla. **Contact:** Maj. Robert M. Smith, USAF (Ret.), 119 Christopher Dr., Panama City Beach, FL 32413.

75th Fighter Squadron
Veterans of the 75th Fighter Squadron, 23d Fighter Group, 14th Air Force, will hold a reunion September 4–7, 1992, in San Francisco, Calif. **Contact:** Maj. Myron D. Levy, USAF (Ret.), 11933 Claychester Dr., Des Peres, MO 63131.

78th Troop Carrier Squadron
Veterans of the 78th Troop Carrier Squadron, 435th Troop Carrier Group, will hold a reunion October 8–11, 1992, in New Orleans, La. **Contact:** Fred J. Kopatz, Jr., 4315 Naneen Dr., Louisville, KY 40216. Phone: (502) 367-8106.

81st Troop Carrier Squadron
Veterans of the 81st Troop Carrier Squadron, 436th Troop Carrier Group (World War II), will hold a reunion September 29–October 1, 1992, in San Antonio, Tex. **Contact:** G. R. Ammerman, 210 Quail Trail, Aliceville, AL 35442. Phone: (205) 373-6820.

86th/72d Air Service Squadrons
Veterans of the 86th and 72d Air Service Squadrons, 52d Air Service Group, who served in the China-Burma-India (CBI) theater during World War II will hold a reunion October 8–10, 1992, at the Acadiana Hotel in Lafayette, La. **Contact:** Ann Sonnier, Rte. 2, Box 308, Church Point, LA 70525. Phone: (318) 896-4237.

86th Fighter-Bomber Group
Veterans of the 86th Fighter-Bomber Group and headquarters squadrons who served in World War II (European Theater) will hold a reunion September 24–26, 1992, in Myrtle Beach, S. C. **Contact:** Gil Hurt, 4920 Montcrest Dr., Chattanooga, TN 37416. Phone: (615) 344-6077.

90th Bomb Group
The 90th Bomb Group "Jolly Rogers" will hold a reunion September 16–19, 1992, in Norfolk, Va. **Contact:** Bill Baker, 7079 Kirby Crescent, Norfolk, VA 23505. Phone: (804) 587-2324.

100th Bomb Wing
Veterans of the 100th Bomb Wing who served at Pease AFB, N. H., will hold a reunion October 30–November 1, 1992, in Colorado Springs, Colo. **Contacts:** Lt. Col. Arthur W. Saylor, USAF (Ret.), W. 104 22d Ave., Spokane, WA 99203-1952. Phone: (509) 747-5307. Carl Gould, 7934 Horizon Dr., Colorado Springs, CO 80920. Phone: (719) 598-1316.

107th Tactical Recon Squadron
The 107th Tactical Reconnaissance Squadron (World War II) will hold a reunion September 23–27, 1992, at the Hilton Hotel in Daytona Beach, Fla. **Contact:** Col. Robert W. Denman, USAF (Ret.), 2010 Teakwood Ln., Daytona Beach, FL 32124. Phone: (904) 756-4751.

110th Fighter Group
The 110th Fighter Group (Battle Creek, Mich. ANG) will hold a reunion for past and present members July 4–5, 1992. **Contact:** Lt. Brian Bilek, 5889 Larkwood Ct. #3B, Kalamazoo, MI 49001. Phone: (616) 969-3280. DSN: 580-3280.

330th Bomb Group
Veterans of the 330th Bomb Group will hold a reunion in conjunction with the B-29 fiftieth-anniversary celebration August 12–16, 1992, at the Sea Tac Hotel in Seattle, Wash. **Contact:** Robert C. Flischel, 413 E. Center, Germantown, OH 45327. Phone: (513) 855-7946.

330th Fighter-Interceptor Squadron
Members of the 329th/330th/331st Fighter-Interceptor Squadrons (Camron personnel, Stewart AFB, N. Y., 1953–59) are planning to hold a reunion in September 1992 in Washington, D. C. **Contact:** Ronald V. Regan, 340 Sandpiper Dr., Casselberry, FL 32707. Phone: (407) 695-0461 or (407) 356-8134.

339th Fighter Group
Veterans of the 339th Fighter Group, 8th Air Force (World War II), will hold a reunion September 22–27, 1992, in Nashville, Tenn. **Contact:** Chet Malarz, 2405 Kings Point Dr., Atlanta, GA 30338.

340th Fighter Squadron
Veterans of the 340th Fighter Squadron, 348th Fighter Group, will hold a reunion September 24–27, 1992, in San Antonio, Tex. **Contact:** Trygve Mickelson, 3556 Westfield, Fort Worth, TX 76133. Phone: (817) 926-2597.

342d Fighter Squadron
Veterans of the 342d Fighter Squadron, 348th Fighter Group (World War II), will hold a reunion September 14–20, 1992, at the Guest Quarters Suites Hotel in Waltham, Mass. **Contact:** Richard H. Holman, 47 Carpenter Rd., Walpole, MA 02081. Phone: (508) 668-1534.

Bulletin Board

Seeking contact with any members of the **55th Fighter Group** who embarked from the port of New York for Europe on HMS *Orion* in September 1943 along with the 304th Station Hospital. **Contact:** Lt. Col. Frank M. Hordich, AFRES (Ret.), 1241 Pinchot Pl., Bronx, NY 10461.

In my search for information on FB-111 and KC-135 nose art, I am seeking contact with former 509th FMS Commander **Maj. Chris J. McWilliams** and former 393d BMS commander **Col. Jack Pledger,** who initiated the Project Warrior nose art for the 509th BMW, Pease AFB, N. H. I am interested in obtaining photos of the nose art, some of which were taken by SSgt. Mike Neubert and TSgt. Thomas Bushlen. Also seeking similar information for the 380th BMW, Plattsburgh AFB, N. Y. **Contact:** Curt Lenz, 32 June St., Nashua, NH 03060-5345.

Seeking contact with **Lt. Col. Frank Ritchie** of the Joint Task Force Seven-Hardtack Series 1958 Radsafe Office at Enewetak and with members of General Leudeke's staff, including flight crew members of the General's C-54. **Contact:** John Matt, Rte. 1, Box 885, Waterford, VA 22190.

Seeking information on the use of **Wideawake Field** on Ascension Island during World War II. I am especially interested in any information on 1st Composite Squadron and reminiscences of aircrew who ferried aircraft across the South Atlantic. **Contact:** Jeff Cant, BBC ASC, P. O. Box 4235, Patrick AFB, FL 32925-0235.

Seeking members of **392d Bomb Group,** 2d Air Division, 8th Air Force, who were at Wendling, England, during World War II and are not already members of the 392d Seeking members of **392d Bomb Group,** 2d Air Division, 8th Air Force, who were at Wendling, England, during World War II and are not already members of the 392d Bomb Group Memorial Association. **Contact:** Arthur Egan, 2619 Lafayette Ave., Winter Park, FL 32789-1372.

Seeking contact with anyone who knew **Capt. Joseph Forman Meachem,** a B-17 pilot in 8th Air Force during World War II. I am especially interested in anyone who was in Stalag 17B as a POW with him. **Contacts:** James Meachem, 2160 W. Oak Ridge Rd. Apt. D, Orlando, FL 32809. Sabine Meachem, 15705 Miami Lakeway N., Apt. 110, Miami Lake, FL 33014.

Collector seeks to buy or trade **military payment certificates** in denominations from five cents to $20, from 1946 to 1973. **Contact:** Nick Schrier, P. O. Box 60104, Sacramento, CA 95860.

Seeking information on and contact with **Richard Campbell,** who was stationed at Moody AFB, Ga. in 1967–69. **Contact:** Beth Wesley, 2007 Meridian Dr., Bainbridge, GA 31717.

Seeking several **enamel chevron pins with A3C and A2C ranks** (prior to 1970). Also seeking the same ranks in the subdued patches of the same era. **Contact:** Clarence S. Duncan II, 811 Auk St., #1, Kenai, AK 99611-6864.

Seeking colorful **aircraft pictures and posters** and stickers. **Contact:** Mehmet Basari, 3 Ana Jet Üs, FOB Müf. K. Ligi, 42300 Konya, Turkey.

Seeking information on a **"plane parade"** I witnessed February 29, 1992, over Colorado, consisting of four large jets, each escorted by six fighter planes, heading west. **Contact:** M. Emmans, P. O. Box 2976, Evergreen, CO 80439-2976.

Seeking a set of **flight officer bars** and old warrant officer bars. **Contact:** Charles Satterly, 1036 Sarah Dr., Louisville, KY 40219.

Seeking information on the whereabouts of **Maj. "Kris" Krysak,** who was stationed at Eglin AFB, Fla., and Washington, D. C., in 1967, and Homestead AFB, Fla., in 1969. **Contact:** Jo Wright, Rte. 1, Box 110, Santa Rosa Beach, FL 32459.

Seeking information on the whereabouts of **Sgt. Dennis O'Keefe,** who was stationed in London, England, in 1936, where he knew Florence "Vicky" Veale of Finsbury Park. **Contact:** M. White, 62 Pennine Flats, Colman St., Southend on Sea, Essex SS2 5AQ, England.

Collector seeks **AAF memorabilia** from World War I through World War II. Especially interested in leather flight jackets, uniforms, flight equipment, and photo albums. **Contact:** Jon Cerar, 425 John St., Carlinville, IL 62626.

Seeking contact with the American serviceman who knew **Emily Laurie Bunker** when he was stationed in England in 1944. **Contact:** Carole Robinson, 1 Hillside Crescent, Wicklewood, Norfolk NR18 9QD, England.

Seeking information on the whereabouts of **William Wainwright,** who was stationed near Bristol, England, in 1942–43, where he knew Margaret Cook-Rowlands, who may have been working at the base. **Contact:** Jane Mitchell-Barnes, 255 Glyn Rd., London E5 0JP, England.

Seeking contact with members of **Pilot Training Class 44-F** who took primary and basic training at Cimarron Field, Okla., and Garden City AAF, Kan.

344th Bomb Group
The 344th Bomb Group will hold a reunion October 4–7, 1992, in Las Vegas, Nev. **Contact:** Lambert Austin, 5747 Darnell, Houston, TX 77096. Phone: (713) 774-3030.

354th Service Squadron
Veterans of the 354th Service Squadron will hold a reunion July 31–August 2, 1992, at the Ridpath Hotel in Spokane, Wash. **Contact:** James S. Ellis, 43340 Illinois Ave., Palm Desert, CA 92260. Phone: (619) 345-2263.

363d Fighter/Recon Group
Veterans of the 363d Fighter/Reconnaissance Group (World War II) will hold a reunion October 1–4, 1992, at the Embassy Suites Hotel in Colorado Springs, Colo. **Contact:** Felix Kozaczka, 1112 Kiowa Dr. W., Lake Kiowa, TX 76240. Phone: (817) 665-5363.

367th Fighter Group
Veterans of the 367th Fighter Group, 9th Air Force (World War II), will hold a reunion October 1–4, 1992, in Oklahoma City, Okla. **Contact:** Col. Allen J. Diefendorf, USAF (Ret.), 25985 Holly Vista, San Bernardino, CA 92404.

449th Bomb Group
Veterans of the 449th Bomb Group will hold a reunion September 8–12, 1992, at the Clarion Plaza Hotel in Orlando, Fla. **Contact:** Lee F. Kenney, 149 Augusta Way, Melbourne, FL 32940. Phone: (407) 242-8654.

453d Bomb Squadron
Veterans of the 453d Bomb Squadron, 323d Bomb Group, 9th Air Force (World War II), will hold a reunion September 17–20, 1992, at the Omni Hotel in Tampa, Fla. **Contact:** C. V. Sochocki, 1314 N. Brookfield St., South Bend, IN 46628-3074. Phone: (219) 233-6044.

454th Bomb Group
The 454th Bomb Group will hold a reunion September 17–22, 1992, in Tucson, Ariz. **Contact:** Ralph Branstetter, P. O. Box 678, Wheat Ridge, CO 80034.

460th Bomb Group
The 460th Bomb Group, 55th Bomb Wing, will hold a reunion September 24–28, 1992, in Colorado Springs, Colo. **Contact:** Robert F. Cutler, 19135 US Hwy 19 N., #A16, Clearwater, FL 34624. Phone: (813) 536-1018.

461st/484th Bomb Groups
The 461st and 484th Bomb Groups will hold a reunion September 24–27, 1992, at the Dearborn Inn in Dearborn, Mich. **Contact:** Bud Markel, 1122 Ysabel St., Redondo Beach, CA 90277. Phone: (310) 316-3330.

483d Bomb Group
Veterans of the 483d Bomb Group (World War II) and the 566th Air Engineers will hold a reunion September 15–20, 1992, in San Antonio, Tex. **Contact:** Don Erickson, 4539 Monana Dr., San Antonio, TX 78218. Phone: (512) 655-6036.

490th Bomb Squadron
The 490th Bomb Squadron will hold its fiftieth-anniversary reunion in conjunction with the 490th Missile Squadron August 25–29, 1992, at the Heritage Inn in Great Falls, Mont. **Contacts:** Lt. Michael Pabisinski, USAF, 490th MIS, Malmstrom AFB, MT 59402-5000. Phone: (406) 731-6511. Clyde Dyar, 710 White St., Walla Walla, WA 99362.

501st Tactical Control Group
Veterans of the 501st Tactical Control Group and assigned squadrons (601st, 602d, 603d, 604th, and 807th) will hold a reunion September 9–12, 1992, in Hershey, Pa. **Contact:** Vic Hopple, 40 Hialeah Rd., Greenville, SC 29607. Phone: (803) 232-1181.

756th Squadron Ass'n
Veterans who served in 756th Squadrons, which included the 756th Troop Carrier/Military Airlift/Tactical Airlift, and operated from Andrews AFB, Md., since 1954, are planning to hold a reunion October 23–25, 1992, in Harrisonburg, Va. **Contact:** Bert Stewart, P. O. Box 8396, Temple Hills, MD 20757. Phone: (301) 899-7470.

3081st Aviation Depot Group
Veterans of the 3081st Aviation Depot Group who served at Rushmore AFS, S. D., are planning to hold a reunion in September 1992. **Contacts:** Jim Aarhus, Rte. 2, Box 250A, Hayfield, MN 55940. Mike Hahn, 610 Alice Dr., Great Falls, MT 59405.

Class 42-J
Seeking members of Class 42-J (Corsicana Comet, Corsicana, Tex.) who would be interested in holding a reunion. I have the Primary Flight School annual with a total of seventeen pages and 128 students. **Contact:** Maj. R. C. Harris, Jr., USAF (Ret.), 4813 Burton SE, Albuquerque, NM 87108-3419. ■

Contacts: Col. Eugene C. Watkins, USAF (Ret.), 6972 Oak Way, Arvada CO 80004. Donald R. Wieland, 1405 W. Koenig St., Grand Island, NE 68801.

Seeking contact with the following members of 6th Bomb Group who served on Tinian in 1944–45: **Charles Badioli, John Guthrie,** and **John Eppler. Contact:** Virgil Morgan, 2719 Pacific Ave., Everett, WA 98201.

Collector seeks **World War II aviation items** from US, England, or Germany. **Contact:** Wendell Murphy, 1059 S. Broadway, Lexington, KY 40504.

Seeking information on the whereabouts of two **American airmen rescued between Loznica and Valjevo, Yugoslavia,** in the summer of 1944, after their aircraft was damaged on a bombing mission to Romania. One of the officers, a tall, blond lieutenant, had broken his leg on landing. We took them to Pranjane, traveling at night, first by wagon, then horseback, and finally oxcart. He gave me two badges from his jacket when we parted. **Contact:** Milorad Markovic, 81 Blackmoorfoot Rd., Crosland Moor, Huddersfield HD4 5AP, England.

Seeking contact with **Sgt. Teresa DeRize,** originally from Downey, Calif., who was stationed at Beale AFB, Calif., in 1983 as a KC-135 boom operator. **Contact:** Katherine Czarnecki, 7 Harwood Dr., Amherst, NY 14226.

Seeking **B-52 squadron patches,** especially from units inactivated before 1986. I am also interested in B-52-related systems, weapons, and event patches. **Contact:** Capt. Jon Drieling, 668th BMS, Griffiss AFB, NY, 13441 or 8424 Dawn Dr., Rome, NY 13440.

Seeking contact with an American serviceman named Campbell who knew **Eira James Elward** in the summer of 1944. **Contact:** Sharon Elward, 12 Verbena Close, Bellgreen, Coventry CV2 1JJ, West Midlands, England.

Seeking the following **patches from the 1960s**: 42d BMS, 26th BMS, 42d TEWS, 355th TFW. Also seeking donations of any other USAF patches from all eras. **Contact:** Gary Goldblatt, 2125 Wellington Ct., Fairborn, OH 45324.

Seeking any information on the use of **Mosquito night fighters** by the 425th Night Fighter Squadron, 9th Air Force, in France during 1945. **Contact:** Frank A. McKee, 130 W. Victoria Square, Phoenix, AZ 85013.

Collector seeks **flight scarves** from F-117, B-2, F-111, B-52, A-10, and U-2 crews. **Contact:** Ken Frederick, 24097 S. Newkirchner Rd., Oregon City, OR 97045.

Seeking information on personnel of the **16th Reconnaissance Squadron** or **340th Bomb Squadron,** 97th Bomb Group, stationed in North Africa and Foggia, Italy, in 1943–44. **Contact:** Steve Fisanick, 3031 McKinley, Dearborn, MI 48124.

Seeking photos of buildings and aircraft at **Donaldson AFB,** S. C., **Pinecastle AFB** (later McCoy AFB), Fla., and **Spence AFB,** Ga. **Contact:** John E. Odum, CAP 39048/Historian, P. O. Box 1372, Lake City, SC 29560.

Seeking information on a **USAF F-4 or F-105 pilot who ejected** after flameout while trying to rendezvous with a KC-135 over Laos during the Vietnam War, October 6, 1972. **Contact:** Lt. Col. Billy H. Miller, USAF (Ret.), Rte. 2, Box 111B, Bogue Chitto, MS 39629.

Seeking the whereabouts of **Stanley M. Lowry,** who was stationed at Sampson AFB, N. Y., in the early 1950s, went to OCS, and retired from the Air Force as a colonel. **Contact:** MSgt. Robert J. "Doc" Konior, USAF (Ret.), P. O. Box 78, Hastings, PA 16646.

Seeking the whereabouts of **2d Lt. Francis A. Mullin,** B-24 pilot, Class 44-H, Columbus, Miss., who went through combat training at Pueblo, Colo., and Tonopah, Nev. I am also seeking contact with other members of our crews. **Contact:** Paul E. Mulkin, 2232 Windsor Parkway, Apt. F, Indianapolis, IN 46227.

Seeking contact with veterans of the **24th Air Depot Group** who were on Guam between April 1945 and March 1946. **Contact:** Peter P. Naumann, 185 Moreland Ave. E., Saint Paul, MN 55118.

Seeking contact with crew members of the B-29 ***Malo's Monster,*** which was based on Tinian, Saipan, or Guam and was commanded by Lt. Raymond Malo. I am also seeking information on and photographs of the Mitsubishi G4M2C Japanese two-engine bomber. I am especially interested in its various roles and modifications and its use against Navy ships at Okinawa in 1945. **Contact:** Ed Allgor, 16 Canyon Ln., Westbury, NY 11590.

Seeking information and detailed personal **reminiscences of World War II veterans** who served in Europe during World War II, especially between 1943 and 1945. I also collect photos, patches, clothing, and other memorabilia. **Contact:** Mananet Arnaud, 24 Place Saint-Saens, 95400 Villiers-Le-Bel, France.

Seeking contact with **Sgt. Robert Kenary,** an F-105 engine mechanic with the 388th Fighter Maintenance Squadron, Korat RTAFB, Thailand, in 1967–68. **Contact:** MSgt. J. B. Walker, USAF (Ret.), 888 Woodhill Rd., Dayton, OH 45431.

Seeking contact with **Robert D. Hays,** a P-38 pilot with the 37th Fighter Squadron in Foggia, Italy. He was last known to be in Miami, Fla., working with the postal service. **Contact:** Leslie E. Knapp, 9819 Gemini Dr., San Antonio, TX 78217.

Seeking information on and contact with the flight, ground, and maintenance crews of **F-94C Starfire (FA-540),** the first William Tell Weapons Meet winner, from Moody AFB, Ga., in April 1954. **Contacts:** Frederick Widdowson, 2701 Wildorlyn Dr., Finksburg, MD 21048. MSgt. D. B. Widdowson, USAF, R. R. #1, Box 427, Peru, NY 12972.

Collector seeks black-and-white or color **photos of USAF aircraft,** especially the C-5 Galaxy, C-141 StarLifter, C-124 Globemaster, and F-4 Phantom II. **Contact:** Andrew Biscoe, 1504 Coeur D'Alene Ave., Coeur d'Alene, ID 83814-9513.

For a book on the history of **World War II service football teams,** author seeks information, especially on team rosters and lineups. **Contact:** Melvin L. Bashore, 1633 W. 12100 S., Riverton, UT 84065.

Seeking information on **Sgt. Forrest Reilly Jackson, Jr.,** whose last known address was with the 626th AC&W Squadron, Mitchel AFB, N. Y., in 1952. **Contact:** CMSgt. Bruce C. Walling, AFRES (Ret.), 1861 West Point Dr., Cherry Hill, NJ 08003.

Seeking the whereabouts of **Reginald Edward Purdy** of Alton, Ill., who was in aviation cadet Class 43-F in either Texas or Alabama. **Contact:** Russell T. Kaufman, P. O. Box 513, Mentone, CA 92359.

If you need information on an individual, unit, or aircraft, or if you want to collect, donate, or trade USAF-related items, write to "Bulletin Board," Air Force Magazine, 1501 Lee Highway, Arlington, VA 22209-1198. Letters should be brief and typewritten; we reserve the right to condense them as necessary. We cannot acknowledge receipt of letters. Unsigned letters, items or services for sale or otherwise intended to bring in money, and photographs will not be used or returned.—THE EDITORS

Seeking a copy of **"Sink Rate,"** an Air Defense Command booklet on aerodynamics, volume one of the ADCPI62 series published by *Interceptor* flight safety magazine. **Contact:** Elmer Ross, P. O. Box 807, Everett, WA 98206.

Seeking contact with the following crew members of the B-24 *The Uninvited,* based at Cerignola, Italy, in 1944. **Chuck Love, Jesus Muro,** and **Bill Carter. Contact:** Dan McGeary, 13700 W. Tahiti, #346, Marina Del Rey, CA 90292.

Seeking contact with the following survivors of a crash of eight F-84 Thunderjets near Richmond, Ind., June 8, 1951: **Maj. Richard E. Willsie, Capt. Robert A. Jackson, Capt. Bryce (or Brice) E. Long, Lt. John R. Bonar,** and **Lt. Eustace D. Coltharp. Contact:** James M. Duly, 1611 Wane Ct., Fort Wayne, IN 46808-1807.

Seeking patches, scarves, and stories about the **Flying Tigers,** from their beginning to the present. **Contact:** Joseph Hoffer, 6A 1st St. W., Randolph AFB, TX 78148.

For a novel about an 8th Air Force B-17 crew stationed in England, author seeks correspondence with World War II **B-17 bombardiers. Contact:** Cheryl A. Pula, 57 New Hartford St., New York Mills, NY 13417.

Seeking a photo of **F-111A #67-092,** which was lost over southeast Asia sometime after November 1972. **Contact:** Joseph C. Caffarelli, 195 Prospect St., Apt. 102, East Orange, NJ 07017-2647.

Seeking contact with crew members of the B-17 ***Hell's Henchmen*** of the 401st Bomb Group, 8th Air Force, in World War II. **Contact:** Mike Merryman, 2613 Foron Rd., Centralia, WA 98531.

Seeking information on the **exact positions of American units** in southern England prior to departure for the Normandy beaches on D-Day. **Contact:** Frances Fee, Southern Tourist Board, 40 Chamberlayne Rd., Eastleigh, Hampshire SO5 5JH, England.

Seeking contact with **Kenneth M. Sumney,** who served with the 1st Fighter Group in Sardinia in late 1943. Also seeking contact with other veterans of the 1st Fighter Group and of the 414th Night Fighter Squadron. **Contact:** Alessandro Ragatzu, Via Sulcitana 134, Elmas Ca Sardegna 09132, Italy.

Seeking contact with **Oklahoma State University AFROTC** alumni. **Contact:** Cadet Capt. Mark A. Archuleta, AFROTC Det. 670, OSU, 220 Thatcher Hall, Stillwater, OK 74078-0207.

Seeking contact with the following people who were stationed at the Palace Hotel, Southport, England, during World War II: **Marion O. Wilson, Maxie B. Seale, Ronnie McCullak,** and **Corwin Guese.** Also seeking members of Class 42-J Primary Flight School, Corsicana, Tex. **Contact:** R. C. Harris, Jr., 4813 Burton, S. E., Albuquerque, NM 87108-3419.

Seeking information on an air rescue operation April 21, 1956, from Albrook AB, Panama, to pick up an injured **American flyer, Jimmie Angel,** in the city of David in western Panama, and bring him back to Gorgas hospital in Ancon. Jimmie Angel died there December 8, 1956, after having been comatose for several months. **Contact:** Edward J. Sharratt, 247 Victoria St., London, Ontario N6A 2C3, Canada.

Seeking information on **Projects Wasp 1 and 2** (experimental nuclear-powered aircraft), **Aurora** (aircraft that followed the development of the SR-71), TR-3A, and TR-1. **Contact:** Henry J. Schuren, 1 Debbie Dr., Stanhope, NJ 07874.

Seeking contact with **SMSgt. Donald McGowan,** a C-130 flight engineer at Naha AB, Japan, in 1966–68. **Contact:** Bill Cannon, 15883 Indies Ct., Fountain Valley, CA 92708.

Seeking contact with anyone who knew **Eddie Sargant,** a pilot shot down in Korea who died trying to avoid a village while the crew bailed out. He may have flown B-26s or B-29s and was possibly stationed at Yokota AB, Japan, although he also had traveled to England. **Contact:** J. S. White-Cloud, 2 The Drift, Back Hills, Botesdale, Norfolk IP22 1DH, England.

Seeking information on the World War II 8th Air Force B-17G ***Lady Helen of Wimpole,*** which may have been part of the 91st Bomb Group. I am especially interested in its serial number, names of

its pilot and crew members, and an explanation of its name. **Contact:** Léon Croulebois, 41 Rue Brancion, 75015 Paris, France.

The **2d Troop Carrier Squadron,** deactivated December 24, 1945, is being reactivated as the 2d Airlift Squadron June 1, 1992, at Pope AFB, N. C. The squadron will be assigned to the 23d Wing, known as the Flying Tigers. Seeking memorabilia, photos, and historical information on the squadron, especially units and campaigns supported and commanders. **Contact:** Lt. Col. Randy E. Honnet, USAF, Commander, Pope AFB, NC 28308-5000.

For its fiftieth-anniversary celebration, Reese AFB, Tex., is seeking information and memorabilia related to **Army Air Corps and Air Force activities at Reese.** Especially seeking copies of yearbooks from graduating flying classes. **Contact:** Lt. Col. Phillip M. Romanowicz, USAF, 54th FTS, Reese AFB, TX 79489-5000.

Seeking information on and photographs of **Maj. Gen. Alfred F. Kalaberer,** a B-24 pilot in the HALPRO Group in North Africa and commander of the 462d Bomb Group in the China-Burma-India theater and on Tinian, before retiring in 1963 from Allied Air Forces South. Also seeking color pictures or descriptions of B-29 #263393. **Contact:** Lt. Col. Al Krebs, USAF, P. O. Box 1049, Forsyth, MT 59327.

Seeking contact with **Mary Elizabeth Wright,** daughter of **Lt. Col. F. L. Wright,** who was stationed at Keesler AFB, Miss., in 1944–45. **Contacts:** Mary Ann Rivers Primos, 1518 E. Meadowbrook, Jackson, MS 39211. Billie Barfoot Latting, 425 Pecan Ave., Philadelphia, MS 39350.

Seeking information on and contact with **SSgt. Joseph DeCosta, USAAF,** of Cambridge, Mass., who was based at RAF Chelveston, England, and married Ann Bathie Anderson on February 16, 1944. **Contact:** Andrea M. DeCosta, 5 Penzance Spur, Off Long Readings Ln., Slough, Berkshire, England.

Seeking information on World War II activity on the island of **Owi,** part of the Dutch Schouten Islands in the southwest Pacific. The 864th Engineer Aviation Battalion was the first to occupy Owi and planned and built two airstrips. **Contact:** Bob George, 1723 Beechwood Blvd., Marion, IN 46952.

Seeking information on or the whereabouts of **Lt. Charles "Chuck" Hall, USAF,** who was born in 1915 in Wisconsin or Illinois. **Contact:** Ruth Anne Morris, 4 Michele Dr., Middletown, NJ 07748-1242.

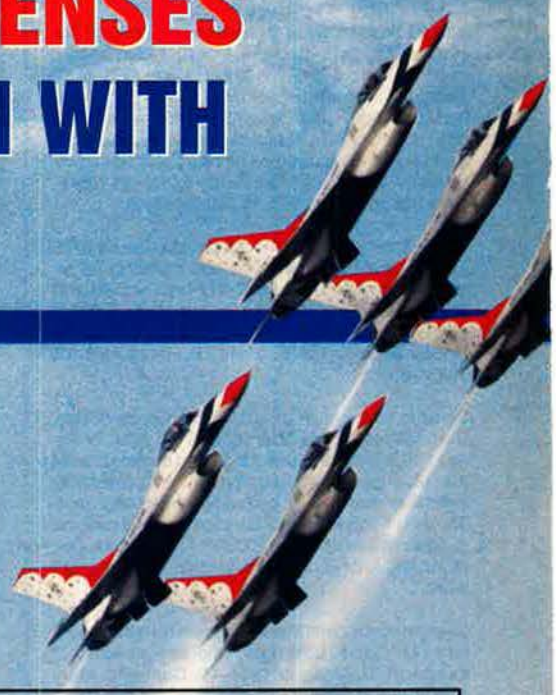
Seeking information on the whereabouts of **Lt. Frank M. "Foxy" Fox,** who served in 27th Bomb Squadron, 30th Bomb Group, 7th Air Force, in the central Pacific from May to October 1944. His last known address was in Waynesville, Ohio. **Contact:** Robert W. Forker, 720 E. Wisconsin Ave., Milwaukee, WI 53202.

Seeking information on the whereabouts of **Edward J. O'Connor** (last known address in New Jersey) and **William McBill** (last known address, Hollywood, Calif.), who served with me at RAF Bovington, England. **Contact:** William K. Warren, 408 Westgate Blvd., Youngstown, OH 44515.

Seeking information on or contact with anyone who was assigned to **Oscura AAF** (Aux.), Alamogordo Bombing Range, N. M., during July and August 1945. **Contacts:** George W. Osborn, 502 S. 18th St., Worland, WY 82401. SMSgt. Antonio J. Cappello, USAF (Ret.), 1 Aspinet Rd., Middletown, RI 02840.

Seeking contact with two members of the 738th Bomb Squadron, 454th Bomb Group, Cerignola, Italy, in World War II: **Sgt. George E. Neth,** a B-24 radio operator from Long Island, N. Y., and **1st Lt. Don W. Avey,** originally from Cincinnati, Ohio. **Contact:** Lt. Col. Howard C. Horton, USAF (Ret.), 309 Wild Harbor Rd., North Falmouth, MA 02556. ■

DON'T LET MEDICAL EXPENSES SOAR... GET PROTECTION WITH AFA's CHAMPLUS®



A CHAMPUS Supplement Which Helps Limit Your Unreimbursed Medical Expenses.

CHAMPUS is a federally-funded health benefits program designed to help service families pay for medical care in civilian medical facilities, including doctors' charges. However, with CHAMPUS there is a gap between the percentage of medical expenses which are reimbursed and the amount you have to pay out-of-pocket. That's why you need CHAMPLUS®. As a member of the Air Force Association, you are eligible to purchase one of the best CHAMPUS Supplements available, with competitively low rates.

FEATURES THE NEW EXPENSE PROTECTOR BENEFIT

This benefit limits out-of-pocket expenses (expenses beyond CHAMPUS-allowable charges) for covered services in any single calendar year to $1,000 for any one insured person (or $2,000 for all insured family members combined). Once those out-of-pocket expense maximums are reached, CHAMPLUS® will pay 100% of excess reasonable and customary charges for the remainder of that year.

An example of how the Benefit works:

You are hospitalized for 35 days and the hospital charges you $330 per day — $95 per day more than allowed by CHAMPUS. Your out-of-pocket expense would be $3,325. With the Expense Protector Benefit your cost would be limited to $1,000. All reasonable and customary costs over this amount — for the entire calendar year — would be paid.

ELIGIBLE APPLICANTS

All AFA members under age 65 who are receiving retirement pay based on their military service, spouses under age 65 of active duty or retired members and their unmarried dependent children under age 21, or 23 if in college, are eligible. Upon reaching age 65, your coverage may automatically be converted to AFA's Medicare Supplement Program.

RENEWAL PROVISION

Your coverage will continue as long as you remain eligible for CHAMPUS benefits, the Master Policy with AFA remains in force, your membership continues, and you pay your premiums.

There is no waiting period for active duty members who enroll within 30 days of retirement if their dependents have been insured for two years previously.

EXCEPTIONS AND LIMITATIONS

Coverage will not be provided under this plan for pre-existing conditions (conditions which were treated during the 6 months prior to the effective date), until the expiration of 6 consecutive months of coverage during which time no further treatment is received for the condition. After the coverage has been in effect for 12 consecutive months, ALL pre-existing conditions will be covered. Children of active duty members over age 21 (age 23 if in college) will continue to be eligible if they have been declared incapacitated and if they are insured under CHAMPLUS® on the date so declared. Contact AFA for details.

EXCLUSIONS

This plan does not cover and no payment shall be made for: routine physical examinations or immunizations; domiciliary or custodial care; dental care (except as required as a necessary adjunct to medical or surgical treatment); well-baby care after the age of 2 years; injuries or sickness resulting from declared or undeclared war or any act thereof or due to acts of intentional self-destruction or attempted suicide, while sane or insane; treatment for prevention or cure of alcoholism or drug addiction; eye refraction examinations; prosthetic devices (other than artificial limbs and artificial eyes), hearing aids, orthopedic footwear, eyeglasses and contact lenses; expenses for which benefits are or may be payable under Public Law 89-614 (CHAMPUS).

LOOK AT WHAT AFA CHAMPLUS® PAYS

Care	Retired	Active Duty
Inpatient civilian hospital care	the 25% of allowable charges not paid by CHAMPUS, plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year	the greater of the total daily subsistence fees, or the $25 hospital charge not paid by CHAMPUS
Inpatient military hospital care	the daily subsistence fee	the daily subsistence fee
Outpatient care (covers emergency room treatment, doctor bills, pharmaceuticals, and other professional services; see exclusions for limitations)	the 25% of allowable charges not paid by CHAMPUS, after the deductible has been satisfied, plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year	the 20% of allowable charges not paid by CHAMPUS after the deductible has been satisfied, plus 100% of covered charges after out-of-pocket expenses exceed $1,000 per person (or $2,000 per family) during any single calendar year

CHAMPLUS® offers many attractive benefits. For a complete description of the Plan, including exceptions and limitations, please refer to the Certificate of Insurance, or call our Insurance Division toll-free at

1-800-727-3337

x4905

To enroll in the program complete the application.→

RATES

Plan I: For Military Retirees
QUARTERLY PREMIUM SCHEDULE
In-Patient Benefits Only

Member's Age	Member	Spouse	Each Child
Under 50	$ 34.11	$ 73.10	$24.25
50-54	$ 50.97	$ 79.69	$24.25
55-59	$ 74.72	$ 85.29	$24.25
60-64	$ 89.27	$107.54	$24.25
65 & over*	$116.66	$148.51	

Plan I: For Military Retirees and Dependents
QUARTERLY PREMIUM SCHEDULE
In-Patient and Out-Patient Benefits

	Member	Spouse	Each Child
Under 50	$ 52.65	$107.08	$55.13
50-54	$ 69.18	$117.90	$55.13
55-59	$ 95.64	$155.69	$55.13
60-64	$120.15	$179.28	$55.13
65 & over*	$156.37	$246.29	

**Not eligible for Medicare*

Rates for incapacitated children who reach the limiting age for coverage will still be based on the sponsoring member's rate for the coverage.

Plan II: For Dependents of Active Duty Personnel
ANNUAL PREMIUM SCHEDULE
In-Patient Benefits Only

	Member	Spouse	Each Child
All Ages	N/A	$17.40	$10.42

In-Patient and Out-Patient Benefits Only

All Ages	N/A	$69.55	$52.12

APPLICATION FOR AFA CHAMPLUS®

Group Policy 4609—G1
Metropolitan Life Insurance Co.,
Home Office: New York

Full name of Member _____
Rank Last First Middle

Address _____
Number and Street City State Zip Code

Date of Birth _____ Current Age ____ Height _____ Weight _____ S.S.N. _____
Month/Day/Year

This insurance coverage may only be issued to AFA members. Please check the appropriate box below: ❑ I am currently an AFA Member ❑ I enclose $21 for annual AFA membership dues. (includes subscription ($18) to AIR FORCE Magazine)

PLAN & TYPE OF COVERAGE REQUESTED

Plan Requested (check one)
❑ AFA CHAMPLUS® PLAN I (for military retirees & dependents)
❑ AFA CHAMPLUS® PLAN II (for dependents of active-duty personnel)

Coverage Requested (check one) ❑ Inpatient Benefits Only ❑ Inpatient and Outpatient Benefits

Person(s) to be insured (check one)
❑ Member Only
❑ Spouse Only
❑ Children Only
❑ Member & Spouse
❑ Member & Children
❑ Spouse & Children
❑ Member, Spouse & Children

PREMIUM CALCULATION

All premiums are based on the attained age of the AFA member applying for this coverage. Plan I premium payments are normally paid on a quarterly basis, but, if desired, they may be made an annual (multiplied by 4) basis. Plan II premiums are payable annually ONLY.

Quarterly (annual) premium for member (age ____) $ _____
Quarterly (annual) premium for spouse (based on members' age) $ _____
Quarterly (annual) premium for ____ children @ $ $ _____
_____
Total premium enclosed $ _____

If this application requests coverage for your spouse and/or eligible children, please complete the following information for each person for whom you are requesting coverage.

Names of Insured Dependents Relationship to Member Date of Birth (Month/Day/Year)

_____

_____

_____

(To list additional dependents, please use a separate sheet.)

In applying for this coverage, I understand and agree that (a) coverage shall become effective on the last day of the calendar month during which my application together with the proper amount is mailed to AFA, (b) only hospital confinements (both inpatient and outpatient) or other CHAMPUS-approved services commencing after the effective date of insurance are covered and (c) any conditions for which I or my eligible dependents received medical treatment or advice or have taken prescribed drugs or medicine within 6 months prior to the effective date of this insurance coverage will not be covered until the expiration of 6 consecutive months of insurance coverage without medical treatment or advice or having taken prescribed drugs or medicine for such conditions. I also understand and agree that all such preexisting conditions will be covered after this insurance has been in effect for 12 consecutive months.

Date _____, 19____ _____
(Member's Signature)

6/92

Application must be accompanied by a check or money order. Send remittance to: Air Force Association, Insurance Division, 1501 Lee Highway, Arlington, VA 22209-1198

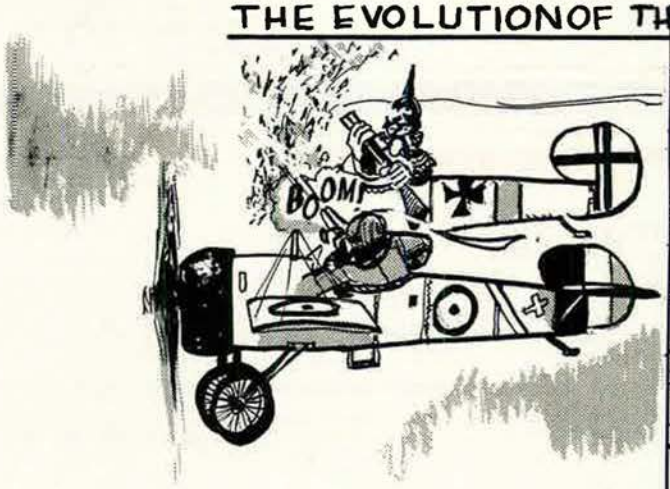
AFA

Bob Stevens'

"There I was..."

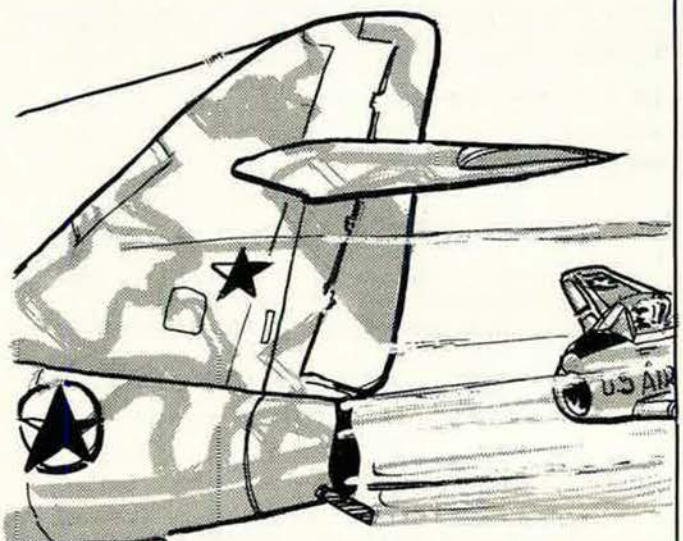
SINCE THE FIRST AIR COMBATANTS THREW ROCKS & FIRED PISTOLS AT EACH OTHER, TACTICS and EQUIPMENT HAVE MADE QUANTUM LEAPS. A DOGFIGHT IS NOW A "FUR BALL", BUT THE PILOTS ARE STILL ***FIGHTER PILOTS!***

THE EVOLUTION OF THE FIGHTER PILOT

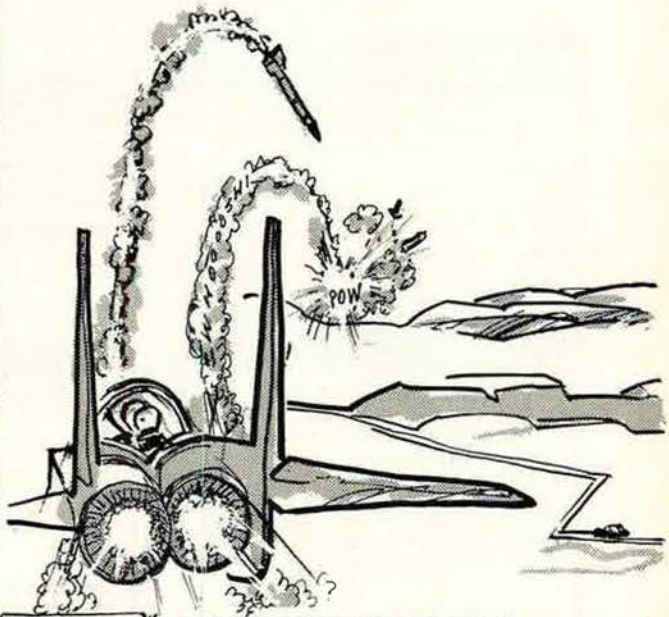


EARLY WWI "I FLEW UP WINGTIP TO WINGTIP and BLEW OFF HIS PROP WITH A 10-GAUGE SHOT GUN."

WW II "IT WAS DUCK SOUP - HE DOVE AWAY and I NAILED HIM WITH A 10° ANGLE-OFF BURST USIN' MY K-14 SIGHT."



KOREA-'NAM "I KNEW I WAS IN RANGE, I COULD SMELL HIS EXHAUST. I WAS THAT CLOSE TO HIS TAILPIPE SO I SALVOED ALL ROCKETS. WITH RADAR LOCK-ON, IT WAS A PIECE O' CAKE!"



GULF WAR "MY TRUSTY COMPUTER GOT HIM - HE WAS ONLY 10 MILES AWAY."

(TO BE CONTINUED) - DON'T MISS THE YEAR 2050 - NEXT ISSUE -

THANKS TO P.J.M. EL PASO, TX. Bob Stevens

THE JPATS SOLUTION.

Configured for JPATS, the Grumman/Agusta S211A is the best choice to replace the T-37B and T-34C in Air Force and Navy primary undergraduate pilot training programs. The S211A airframe and engine are modern derivatives of proven, mature operational systems. Simple and reliable, this aircraft features superb low-speed handling, a large performance envelope, a cockpit environment conducive to learning, and low cost of ownership. It's a cost-effective combination of attributes no other trainer can match. Grumman Aircraft Systems, Bethpage, Long Island, NY 11714, 516-575-3350.

GRUMMAN

GRUPPO AGUSTA

GRUMMAN

A SINGLE MISSILE FOR MULTIPLE PLATFORMS? ONE SLAM FITS ALL.

MDMSC: Smart choices for tough decisions.

Greater combat effectiveness. Improved operational efficiency. Two critical objectives of the USAF composite wing structure. And SLAM can help fulfill them both.

Built by McDonnell Douglas Missile Systems Company (MDMSC), the combat-proven Standoff Land Attack Missile is compatible with virtually all SAC and TAC aircraft. It's a conventional weapon that helps ensure aircraft survivability while knocking out its targets with pinpoint accuracy and low collateral damage—all with minimal pilot workload. And SLAM provides excellent battle damage assessment. Best of all, SLAM is ready now. Missiles have been in production since 1988. Worldwide logistics are in place. It's seen action in Desert Storm. That means known costs, known reliability, and known performance.

For the Air Force, help is not just on the way, it's here. It's SLAM.

MCDONNELL DOUGLAS
A company of leaders.