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MAGAZINE



The Fighter Training Shortfall



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Aerospace and Defense

FMA

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About the cover: Capts. Steve "Baldy" Baldock and Joel "Dutch" Ver Hoef, instructor pilots with the 433d Tactical Fighter Training Squadron, 479th Fighter Group, at Holloman AFB, N. M., prepare for a T-38 flight. For an overview of the training challenges facing TAC, see p. 22. Photo © Dean Garner, 1991.

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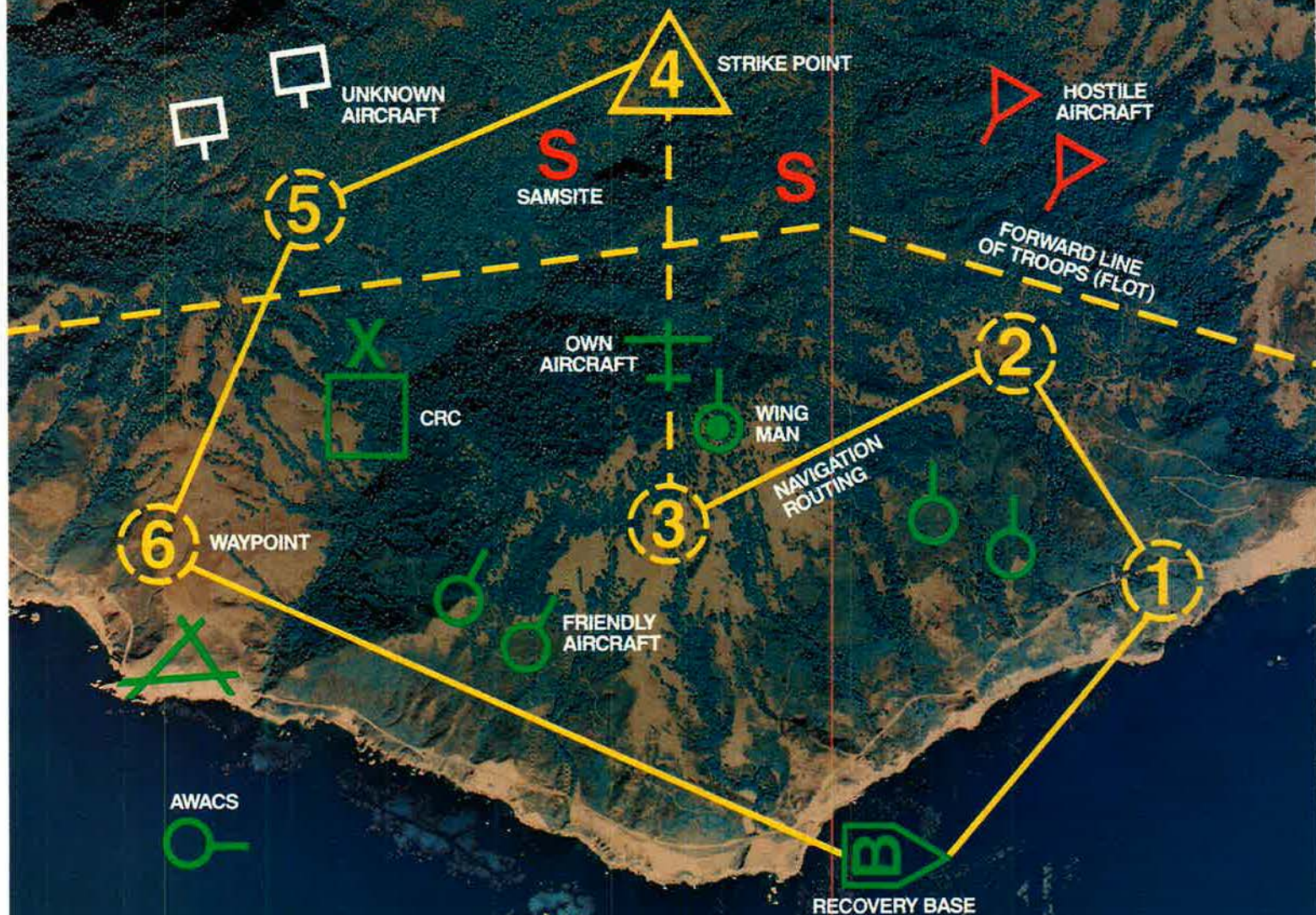


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COLLINS AVIONICS

By John T. Correll, Editor in Chief

They Want the Money

In Michael Crichton's novel *The Great Train Robbery*, archplotter Edward Pierce is finally brought to justice for conceiving, planning, and executing the theft of £12,000 in gold bullion from a moving railcar. The judge asks why he did it. "I wanted the money," Pierce shrugs.

The same explanation might be more honest than those usually given by Congressmen and others who demand swift and sweeping cuts in the US defense budget. To hear them tell it now, they are reacting to changes in the Soviet Union since August. The fact is, they were clamoring for big defense cuts last summer, long before the Moscow coup.

The Administration has shown itself more than willing to make calculated reductions in defense. The five-year, twenty-five percent cut setting up last year's budget agreement (supposedly good through 1995) was an Administration proposal. In September, with no guarantee of Soviet reciprocity, President Bush ordered a unilateral drawdown of US strategic forces.

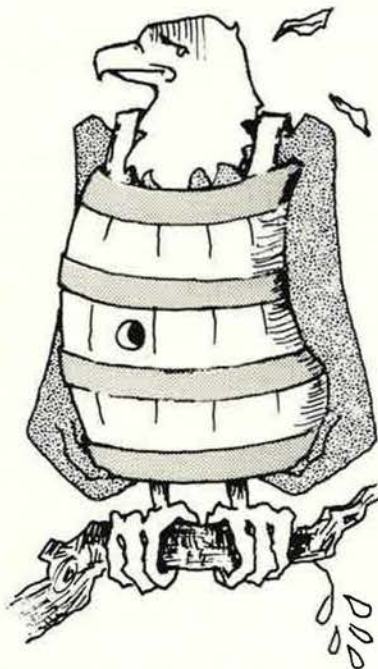
Secretary of Defense Dick Cheney predicts that Congress not adopt a hasty "slash and burn" approach to reductions. He reminded the House Budget Committee in July that defense had been cut eleven percent in the past year while domestic spending grew by seven percent and that, under the budget agreement, defense is headed for a historic low of 3.6 percent of GNP.

Rep. Lewis F. Payne (D-Va.) asked Mr. Cheney to figure out some way to provide a strong national defense for less than 3.6 percent of GNP. Rep. Martin Olav Sabo (D-Minn.) said defense must come down because the numbers in the latest fiscal projections "just simply don't fit" and "it's just clear that we're not going to make cuts in discretionary domestic spending."

The burning issue in July—or so it was said—was the federal deficit. Never mind the proclamations last January that the deficit had been resolved. It is now projected to hit \$362 billion in 1992. (The government ex-

pects to collect 19.2 percent of GNP in revenues and spend 25.3 percent. Without artificial offsets and creative accounting, the deficit would be \$425 billion.)

As a percentage of both GNP and federal spending, defense has been declining precipitously since 1986. In



It should be no mystery why Congress is demanding cuts in defense.

1992, the deficit will be substantially larger than the defense budget.

In October, Rep. Leon Panetta (D-Calif.), chairman of the House Budget Committee, called for cutting defense on the order of forty percent over ten years. He said this would leave the nation fifteen to eighteen air wings (down from thirty-six in 1990), eight or so army divisions (down from eighteen in 1990), and a force level of about one million (down from 2.1 million in 1990). Mr. Panetta's plan includes new spending—"investments" in our "rendezvous with the

twenty-first century"—of up to \$370 billion in education, health care, and economic growth measures.

Sen. Joseph R. Biden (D-Del.) proposes saving \$150 billion ("real money that can serve real needs here at home") in strategic forces. He bases this on a Congressional Budget Office study he commissioned. CBO found that only "modest" savings will accrue from the strategic reductions President Bush announced in September and priced out four options for a greater windfall. The most drastic would cut US strategic forces more than eighty percent below the proposed START Treaty limits.

A growing number of legislators on both sides of the aisle propose to cut defense by varying percentages to underwrite tax cuts.

The congressional defense cutters are accompanied by the usual gang of outriders. A spokesman for the Brookings Institution, for example, declares that events of the past few months make it possible to cut defense by half. (Brookings called for a fifty percent cut two years ago, but perhaps that was a different fifty percent.)

Washington *Post* columnist Hobart Rowen lets the cat out of the bag. "It's time," he writes, "to bust last year's budget agreement and—for the time being—quit worrying about the budget deficit." The overall goal, he says flatly, is to reduce military spending and increase "socially desirable" civilian spending.

Nobody who has watched Congress at work expects any great share of proceeds from a defense cut to be applied to the deficit. Is it a coincidence that Congress wants to formally reopen the budget agreement? As the rules stand, funds can be re-allocated within—but not between—categories. Defense can be cut, but the money cannot be spent elsewhere.

This is not to say that Congress and the outriders are unconcerned about the deficit or that they are not genuinely moved by developments in the Soviet Union. Mostly, though, they want the money. ■

Apache on the Cover

Imagine my surprise when I saw the front cover of the October 1991 issue. Of all things, it pictured a helicopter, an Army helicopter!

"Apache Attack" [see p. 54] was a fine article, albeit almost totally without mention of the "A word" (it appeared only three times). As a longtime admirer of Air Force doctrine, with a background that could almost qualify me as an Air Force brat (CAP cadet, AFJROTC, USAF Museum rat, Association member, current CAP squadron commander), I recognize that each service doesn't usually expound on the capabilities of the others.

With the apparent declining influence of Communism throughout the world, which is causing former enemies to get along, maybe all "aviators," regardless of service, can recognize the professionalism each must possess.

CWO4 David A. Hatcher, USA
Aviation Training Brigade
Fort Rucker, Ala.

Congratulations to AIR FORCE Magazine and to Richard Mackenzie for the outstanding "Apache Attack." This is the most detailed account I have seen of the heroic efforts of those Army and Air Force personnel who planned and carried out the raid on Iraqi radar sites on the morning of January 17, 1991. It is most refreshing to read a success story for a change, rather than the continual barrage of negative press regarding the exaggerated limitations of the weapon sys-

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

tems that our soldiers must use in combat.

My colleagues and I were pleasantly surprised to see the US Army AH-64 Apache helicopter featured on the cover of a magazine that is generally, and for good reason, dedicated to Air Force issues and subjects. I applaud you on the diversity of your publication.

Elton T. Gordon, Jr.
McDonnell Douglas
Mesa, Ariz.

Not a Marauder

With regard to General Milton's "The Equalizer in Korea" [see October 1991 issue, p. 72], thanks for the all-too-infrequent recognition of the job done by the B-26s in Korea and in World War II as well. However, to set the record straight, the picture is of a crew from the 5th Air Force, 3d Bomb Wing (K-8), and the 8th Bomb Squadron. The B-26 aircraft is the redesignated Douglas A-26 Invader, not the Martin B-26 Marauder. As night missions became the norm, the aircraft was dubbed "LNI" (light night intruder).

Lt. Col. Royce D. Zeeck,
USAF (Ret.)
Forest Falls, Calif.

I sense that the photos and captions were inserted by your staff because I am certain General Milton is aware of the difference between a B-26 Marauder and a B-26 Invader (the old A-26).

It is regrettable when the centerpiece of Air Force literature does not properly identify an aircraft. No Marauders served in Korea.

By the way, turning to p. 74, I was surprised to see the caption describing the loading of B-29s in Korea. I knew that B-26s did land in emergency in Korea, but I was unaware that continued operations were conducted out of those bases. The B-29s moved from Guam to Okinawa for operations but, to the best of my recollection, not onward.

Maj. Gen. John O. Moench,
USAF (Ret.)
Longwood, Fla.

● *General Moench and Colonel Zeek are just two of the two dozen (and counting) readers who wrote to correct the Intruder/Marauder blunder. General Moench is also correct in his surmise that no B-29s flew out of Korea. We regret the errors and will make every effort to avoid such historical inaccuracies in the future.—*

THE EDITORS

The Navy in Korea

General Milton does not mention the US Navy carrier-based air contribution or offer any quantitative analysis on tactical air during the early days of the Korean War.

Nine days of hostilities elapsed before the Navy launched its first strikes (July 3), which were counterair/interdiction-type missions against North Korean targets. The carriers then withdrew on the eleventh day, to replenish for thirteen days. The Navy provided close air support from its attack carriers from July 26 to September 3. During this period, the Navy flew a total of 644 sorties (six percent), the Marines 906 sorties (nine percent), and the Air Force 8,492 sorties (eighty-five percent). Overall, the Navy sorties were sporadic and not decisive.

Robert E. Schmaltz
Westford, Mass.

More Korean Corrections

I enjoyed reading "The Equalizer in Korea" and seeing the pictures, but as a combat veteran of that conflict from August 1950 through April 1951, I noted a couple of minor errors, which I feel compelled to correct.

Specifically, under the picture of the F-84 jocks on p. 72, you refer to F-80Es. There was no such bird in the FEAF, nor even in the inventory, to my memory. F-80Cs were employed, though in my outfit (51st Fighter Group, Okinawa) we flew decrepit F-80As and Bs until late spring 1950.

The article also states, "Forces of the 5th received no training in bombing, gunnery, or close air support." This may be true for 5th Air Force fighter pilots in Japan, but those of us in 20th Air Force on Okinawa (at-

tached to the 5th for the war) flew many training sorties in 1950, before the war, encompassing strafing, skip and dive bombing, and high- and low-altitude air-to-air gunnery. I recall these distinctly because they were great fun.

From what I could see, during the fluid phases of the Korean War (June 1950–spring 1951), F-80s flew the majority of airpower sorties, followed by F-51s and Navy and Marine F-4s and A-1s. F-84s didn't really get into the act significantly until F-86s were getting heavily involved in the air-to-air war near the end of 1950.

It was nice to see an article on the "forgotten" war.

Col. T. Bruce Buechler,
USAF (Ret.)
Wichita Falls, Tex.

Credit the Helicopters

I don't want to take anything away from Capt. Paul Johnson of the 354th Tactical Fighter Wing, Myrtle Beach AFB, S. C. I just want to set the record straight. According to the October issue, Captain Johnson, an A-10 pilot, received the Air Force Cross for "leading a daring mission" to rescue "a downed aviator deep inside Iraq during Desert Storm" [see "*Aerospace World*," p. 24].

Captain Johnson was not the mission leader but the leader of a flight of two A-10s. He did not land deep inside Iraq to recover the downed aviator; the lead MH-53J Pave Low helicopter did. Captain Johnson shot the truck coming toward the survivor, but the helicopter was armed and could have engaged the truck. The commander of the helicopter elected to have Captain Johnson take out the truck because he was unsure of the exact position of the survivor.

The crew of the helicopter was decorated, and the aircraft commander received the Silver Star. If the A-10 had landed to pick up the downed aviator, as media reports would lead you to believe, and the helicopter had shot the truck, the awards might have been different. Is this just one more example of the difference between "bonus boys" (stiff-wing) and the "helicopter force" (fling-wing)? . . .

Every man and woman who had anything to do with getting those aircrews where they needed to be when they needed to be there was important. However, if a helicopter had not landed that day to pick up the downed aviator, I'm sure that as much as Captain Johnson would have liked to, he could not have landed his A-10 to recover anyone. When is the Air Force going to give the "helicopter force" at least equal credit?

By the way, in reference to "Apache Attack," the MH-53J Pave Low helicopter is not an electronic warfare helicopter, though it was referred to as such.

Maj. Patrick M. St. Romain,
USAF
Fort Walton Beach, Fla.

The Navy and the Air Force

While I always enjoy people referring to my book *Thud Ridge*, I admit to being confused about what Major Sullins is crediting to me in his letter on General McPeak's reorganization plan [see "*Debating McPeak's Plan*," October 1991 "*Letters*," p. 7]. I think the plan is outstanding—just plain super. Somehow, Major Sullins seems to have me wrapped up in some imaginary evaluation of Air Force vs. Navy pilots with regard to aggressiveness and tactics. That's not my line.

I am violently proud of the fact that I fought two wars in close cooperation with Navy and Marine Corps jocks, that as ex-Thunderbird lead I announced a Blue Angel show when their narrator got sick, and that I am the only Air Force pilot ever to be invited to a Blue Angel reunion. Anyone interested in what I said about Navy pilots in *Thud Ridge* should check pp. 64–65 in the hardback or pp. 61–62 in the paperback.

In 1968, some of our Navy friends called us at Takhli RTAFB, Thailand, and said they wanted to swing by on their way from the carrier to Bangkok to exchange war stories on what each of us was doing up in Route Pack Six. We had a great session exchanging ideas that were beneficial to all of us. Nobody was worried about "playing catch-up," and if you could find two groups who were more mutually aggressive than the carrier guys and the Thud drivers of 1965–67—or their counterparts today—I'd be surprised.

We didn't try to change each others' formations, nor did we "teach" each other. We exchanged ideas that we hoped would make all of us more combat-effective, and we decided to try to meet regularly, alternating the site between our bases and their carriers. I still think that's a good way to do business.

I have no idea what Major Sullins's credentials are for making judgments on who does what better, but I suspect those judgments could be vulnerable to classification as arbitrary, general, and reminiscent of Billy Mitchell days.

There is plenty for all the air services to do, and they all have to live within individual service doctrines. I heartily support General McPeak's

new concepts, and I hope his composite wing guys still find time to share experiences with the carrier guys, one on one.

Col. Jacksel M. Broughton,
USAF (Ret.)
El Toro, Calif.

I can't believe that people like Major Sullins exist. Only a fool would compare Naval aviation with Air Force aviation. The Air Force has always believed that the number one priority is safety. The safety record of the Air Force reflects the training and concern of mechanics and flight crews alike. We take pride in flying mission after mission with as few human errors as possible. The Navy, however, covers its long list of aircraft mishaps and pilot errors with fancy films and the excuse that carrier landings are more difficult.

Major Sullins, I think you need to check aircraft losses and numbers of mechanical problems that would ground an Air Force aircraft that would fly in the Navy (at the expense of life and aircraft). I don't think you can equate economy and Navy operations when the cost of a new aircraft is more than \$20 million.

The Air Force has the finest and best-trained maintenance apparatus in history, so watch what you change. I am a taxpayer who doesn't like to see four aircraft for every pilot or maintenance personnel working sixteen hours a day to make a bad operation work.

SMSGt. Thomas R. Missel,
USAF
Bellevue, Neb.

A Team Effort

I want to thank you for the very flattering write-up I received in the September 1991 issue of *AIR FORCE Magazine* [see "*The Finest Crews in the Force*," p. 48]. You can't imagine what an honor it is to be the recipient of the Air Force Association's Chennault Award. However, the award is an honor that I must share with the men and women of "Team Stealth," the 37th Tactical Fighter Wing, and all the units that constituted the 37th Tactical Fighter Wing—Provisional at King Khalid AB, Saudi Arabia. The team was responsible for all of the successes the F-117 enjoyed during the Gulf War.

As your article stated, I was the Chief of the 37th Tactical Fighter Wing—Provisional's Mission Planning Cell. I would like your readers to know that I was part of a very special team. The remaining members of the team deserve to be recognized for their contributions: Maj. Joe Bouley, Maj.

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Letters

Joe Salata, Maj. Greg Feest, Maj. Bill Behymer, Capt. Marcel Kerdavid, and Capt. Kevin Tarrant. These men worked for five months, refining every detail of the F-117's mission in Desert Storm. They devised the tactics and techniques that carried us from the initial attack on Baghdad through the last night of the war. As the wing's tasking increased and the Mission Planning Cell expanded, they served as the experts and brought new members of the team up to speed.

Although there are many reasons for the F-117's outstanding accomplishments during the war, there are two that I consider primary. First, we trained like we were going to fight. Col. Alton Whitley, the wing commander, and Colonel Klause, the deputy commander for Operations, ensured that as the Mission Planning Cell refined the game plan, the wing's nightly training accurately reflected what would be expected during the war. The result was that every pilot, every maintainer, and every person involved with the war effort had practiced every phase of the Desert Storm plan. The only difference after the wing got the "go code" was that we crossed the border into Iraq and dropped on real targets.

The second reason for our success was the quality of the wing's personnel. From top to bottom, the wing was and still is manned by some of the finest people in the Air Force.

I would also like to mention the crucial role that our tanker buddies played. The "Beale Bandits" from Beale AFB, Calif., flying KC-135As, and the "R Model Guys" from Grissom AFB, Ind. (and other bases, I believe), flying KC-135Rs, supported us from the day we arrived in Saudi Arabia. The only way we could get to the war was to have them take us, and they got us there through some of the worst weather I ever want to see.

Again, thank you for honoring me with the Chennault Award, but I will always maintain that the award belongs to the team. It was an honor to have been associated with the men and women of "Team Stealth."

Maj. Jerry L. Leatherman,
USAF
Fort Leavenworth, Kan.

Living on Zulu Time

"Zulu Time" by Bruce D. Callander [see October 1991 issue, p. 78] was a delightfully educational feature, but one small error crept in. It was stated in the article that the earth was divided into twenty-four time zones. Actually, there are twenty-five time zones,

each identified by a number or a letter. The numbers extend consecutively from -12 to +12, inclusive. Twenty-three of the zones are, as Mr. Callander said, "demarcated by meridians fifteen degrees apart." But zones -12 and +12 are each only seven and a half degrees in meridional width. These zones are separated by longitude 180 (the geographical dateline), and they are twenty-four hours apart.

Lt. Col. Arthur J. Frankel,
USAF (Ret.)
Bellevue, Wash.

Another Airline Went to War

I take exception to "When the Airlines Went to War" [see October 1991 issue, p. 83] in only one detail. A major air carrier, Trans World Airlines, was omitted from the list of participating carriers.

Trans World Airlines and its people, from pilots and flight attendants to its mechanics, ramp service, dispatchers, operations control, load control, and commissary personnel, gave their time willingly and without hesitation to move all branches of our military safely and in as much comfort as possible to a distant land.

I took great pride and honor in being a participant to help position our troops for Operations Desert Shield and Desert Storm.

Michael N. Ennis
Trans World Airlines
Jamaica, N. Y.

An Enduring Jewell

Over the past years, I have enjoyed "Valor," by Contributing Editor John L. Frisbee. What a special treat it was, therefore, to read in the October 1991 issue about Lt. Kenneth G. Jewell and his "Will to Endure" [see p. 82].

Senior Justice/Maj. Kenny Jewell, USAF (Ret.), is a friend of mine. He is one in a million. As you mentioned, he was the first AAF pilot to return to flying status after having lost a leg. But did you also know that he flew commercially until the late 1970s?

Kenny Jewell also managed to carve himself a very respectable career as a justice in his home county of Bedford in western Pennsylvania. There, he and his wife Mary Kay raised a family and became a crucial part of this region. Although now retired from the magistrate's bench with his flying days behind him, Kenny remains a most important and influential member of our community.

Col. Ron Growden,
USAF (Ret.)
Bedford, Pa.



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By John T. Correll, Editor in Chief

Snapshots of Soviet Power

Nobody knows where radical change is taking the Soviet armed forces. One direction may be emphasis on technology in pursuit of an operational concept they call the "air-space war."



It's anybody's guess where the Soviet armed forces will end up. The Pentagon doesn't know, and neither does the Kremlin. President Mikhail Gorbachev says he will use his constitutional powers to prevent the splintering of the Red Army. In reality, however, Mr. Gorbachev has only as much power as the unruly republics are willing to give him.

Military reductions were already in progress at the time of the bungled coup in August. The Soviets had disbanded some seventy-five divisions and a half million troops. Military production was down by ten to twenty percent.

After the coup, change began moving in radical directions. Several republics set up their own defense ministries and laid plans for independent armed forces. It is not clear which forces will remain under the control of a central command.

Also not clear is how confidently Mr. Gorbachev can speak for the Soviet Union on military matters. Before President Bush announced his unilateral nuclear reductions on September 27, he consulted not only Mr. Gorbachev but also President Boris Yeltsin of the Russian Republic.

In many ways, questions about the size and capability of future Soviet forces are getting less attention than the issue of power relationships among the republics.

A large percentage of the armed forces and military assets are based in the Russian Republic, which also has most of the territory and wealth of the old Soviet regime. Writing in the *New*

York Times, Igor Malashenko, a spokesman for Mr. Gorbachev, says that "the possible emergence of Russia as a nuclear superpower hardly comforts the other republics."

In August, the Ukraine said it wanted no part of nuclear weapons and seemed ready to leave them in Russian hands. Two months later, the Ukrainian legislature moved to a less passive position. It said October 24 that, while the ultimate goal was to make the Ukraine nuclear-free, it insisted for now on joint control with "what was the Soviet Union" of nuclear weapons based in the Ukraine.

Caught Flat-Footed

Western Sovietologists are scrambling to revise their assumptions and their databases, both of which have been overtaken by events. The Pentagon, caught flat-footed along with everybody else, junked this year's edition of *Soviet Military Power*, which it had printed and was on the verge of distributing. The parts that could be salvaged finally appeared in a shorter report, released quietly on October 4 and billed as a "snapshot" of Soviet forces in August with "updates where we could provide them."

New assumptions made quickly after the coup are now looking shaky. Early optimism that "the good guys had won" has faded, according to Dr. Eugene B. Rumer of RAND Corp., who recently spent a month in the Soviet Union. Disillusionment, political infighting, and inability to agree on a program for action dim the hope of peaceful transformation to a pluralistic society and a market economy, he said at an Air Force Association symposium in late October.

The Soviets appear to be reducing toward a level of about three million troops, some of them territorial forces controlled by the republics. That total would be a third below peak Soviet strength in the 1980s but still the world's largest military. (The US is cutting toward a force of 1.6 million.) They are obviously willing to cut units and manpower but seem no less interested than before in advanced military capabilities.

Their heaviest reductions have been in the ground forces. Even there, they have retained their best weapons and equipment. Emerging doctrine emphasizes the air forces and the navy in a high-technology operational concept called the "air-space war."

Reuben Johnson of the Center for Soviet Assessments, just back from a visit to aircraft design bureaus in the USSR, expects at least one new fighter prototype to appear soon. That would be the debut for a "fifth generation" of Soviet fighters, the next step beyond the Su-27s and MiG-29s of today.

There is no telling, however, if and when such prototypes might reach production and operational service. Force modernization, like everything else, is in a period of transition. Overall, the Soviet armed forces figure to lose about a third of their funding and production capacity. Fifth-generation fighters will compete with other programs for the reduced funding available.

Seizing the Moment

The restraint shown by the Soviets the past few years in military matters did not extend to their strategic nuclear forces, which they continued to build and improve relentlessly.

Breaking that pattern was apparently among President Bush's objectives when he ordered the unilateral US strategic reductions in September.

As later explained by Secretary of Defense Dick Cheney, President Bush was reacting to "a window of opportunity" for mutual nuclear reductions. "This obviously is an initiative that wouldn't have been possible two months ago or two years ago," Secretary Cheney said October 1. "It's also an initiative that might not be possible two years in the future."

Responding on October 5, Mr. Gorbachev said the Soviets would take 503 ICBMs off alert, eliminate 1,000 more nuclear warheads than required by the strategic arms treaty, and freeze development and production of strategic mobile missiles.

Mr. Gorbachev further said he would keep his rail-mobile missiles off the tracks and in their permanent garrisons. Since 1985, the Soviets have fielded about 350 mobile ICBMs, most of them of the SS-25 road-mobile variety. The United States has no mobile ICBMs deployed and has now canceled both the rail-mobile Peacekeeper and the road-mobile Midgetman.

Silo-based missiles are the mainstay of the Strategic Rocket Forces. Even had developments followed the course planned previously, only about a third of the Soviet ICBM warheads would have been deployed on mobile systems.

stockpile of chemical weapons has been moved into Russian territory.)

So far, most of the Soviet reductions have been in general-purpose forces, with ground forces bearing the brunt. The Red Army had 215 divisions in 1989. Today it has about 140. Twenty-five divisions west of the Urals have been deactivated in the past two years. Significant amounts of equipment, including 16,000 tanks, have been moved to the east.

Divisions remaining in the West are well-equipped—two-thirds of their tanks are modern T-64s, T-72s, and T-80s—but the Pentagon says that the reductions and redeployments “have virtually eliminated the Soviet poten-

the August coup, and without airlift, the plotters could not get their selected shock troops to the scene of the uprising. Air Marshal Yevgeni Shaposhnikov, formerly Commander in Chief of Soviet Air Forces, is now Minister of Defense.

The Soviets were profoundly impressed by the airpower-intensive US operations in the Gulf War. As a result, they are looking hard at their own technology and doctrine.

The “Air-Space War”

The “air-space war” doctrine builds on the concepts of Marshal Nikolai Ogarkov in the early 1980s. Since then, it has gained wide, although not universal, acceptance among Soviet strategists.

By coincidence or otherwise, the concept is a reasonably good match with the changing circumstances and configuration of the Soviet armed forces. The US Defense Department summarizes it this way:

“Such a war would begin not on the ground but from air and space. Powerful massed strikes of conventional munitions, primarily long-range air- and sea-launched cruise missiles, would be conducted against military and economic targets throughout the entire depth of an opponent’s territory. Such weapons, according to Soviet sources, concede nothing to nuclear weapons in terms of effectiveness.

“In addition to these weapons, weapons based on new principles of destruction, such as directed energy (laser, particle beam, or high-power microwave), hypervelocity, and other technologies, may also be employed.

“Wide use in a future war would be made of space-based systems for reconnaissance, communications, and meteorological services. Victory would be achieved not by occupation of enemy territory with ground forces, as in the past, but by destroying important strategic military targets, retaliatory systems, and national economic potential. Such destruction is viewed as sufficient to bring down the enemy’s political system. Victory can be achieved in the initial period of war through the decisive factor of surprise.”

The Soviet military has always set great store by formal doctrine. Aware of that, US planners will no doubt give careful attention to the “air-space war” formulation.

At the same time the Soviet military confronts immense pressures to reduce and reform, it must also cope with “a severe and unprecedented

	USSR	US
Fixed ICBM	53%	21%
Mobile ICBM	6%	—
SLBM	33%	46%
Bomber	8%	33%

Soviet strategists do not talk so casually as they once did about the employment of nuclear weapons. One reason for this is that the Chernobyl powerplant disaster in 1986 moderated the Soviets’ belief that they might ride out a nuclear war with acceptable losses.

The Pentagon notes that traditional Soviet doctrine on nuclear weapons is “no longer valid” but says it has been unable to determine how nuclear weapons will figure into the new Soviet strategy, now evolving. “In the reconfigured USSR, the reformed center will probably retain control over strategic nuclear warheads,” the Pentagon said in its report, adding that “some republic leaders are demanding a role in the nuclear decision-making process.”

Obviously, the Russian Republic is the one to watch. Most of the strategic forces—seventy-five percent of the ICBMs, seventy percent of the bombers, and all of the ballistic missile submarines—are based in Russia.

(Much the same is true of general-purpose forces. Fifty-five percent of the maneuver divisions, sixty-five percent of the interceptors, and thirty-two percent of the tactical aircraft are stationed in Russia. The entire Soviet

tial to conduct sustained conventional offensive operations against NATO without prolonged and visible mobilization.” Furthermore, US officials conclude, “the restructuring now under way will lock the military into a largely defensive posture in the western USSR.”

The Strategic Rocket Forces are braced for a thirty percent cut, and the Air Defense Forces will be reduced by eighteen to twenty percent. The Soviets have not said what reductions, if any, they will make in the Navy.

The Air Forces, apparently, will escape with a reduction of only six to eight percent. Frontal Aviation, to which most general-purpose air forces are assigned, has taken hundreds of aircraft out of service since 1988, but most of them were older MiG-21s, MiG-23s, and Su-17s. They were replaced by fewer but more capable MiG-29s, Su-27s, and Su-24s. More than seventy-five percent of the fighter force now consists of fourth-generation MiG-29s and Su-27s.

Back from an eight-day visit to the USSR in October, Gen. Merrill A. McPeak, USAF Chief of Staff, reported the Soviet air forces standing tall in the new scheme of things.

The air forces refused to take part in

crisis in its own ranks," the Pentagon's October 4 report says.

The prestige of the armed forces is at the lowest point since World War II, the report continues, and "the military's role in Soviet society has changed from that of a privileged elite to an institution under siege."

Apprehension is most pronounced among the career officers, accustomed to better circumstances when times were different, but the unpopularity of the military also affects conscripts, who make up the majority of the enlisted force. Draft evasion is no longer a negligible problem. By January 1991, more than twenty percent of those called to serve were failing to report for duty.

Morale problems are exacerbated by shortages of food and clothing, including meat, butter, fruit, vegetables, uniform jackets, overalls, underwear, trousers, boots, overcoats, and shirts.

"Conditions have become so bad that the members of a Strategic Rocket Forces unit in the Urals reportedly threatened to desert because of inadequate food," the Pentagon says. "Some seventy men went absent without leave from a ground forces garrison in the Caucasus to travel to Moscow to protest food shortages."

Living standards for the professional force have "declined precipitously," the report says. The Defense Ministry estimates a shortfall of more than 200,000 housing units. Many military families who returned from eastern Europe are living in hostels, prefabricated barracks, and tents.

The average family income for military professionals is said to be thirty percent lower than that for blue-collar workers. Officers released from service face difficulty in finding jobs and housing.

The Reform Agenda

The military reform campaign, an offshoot of Mr. Gorbachev's *glasnost* and *perestroika* initiatives, had been plugging along for several years with mixed results.

As recently as last summer, the main items on the "radical" reform agenda were an all-volunteer military, territorial units in the ground forces, and greater participation by the republics in military affairs. A few months later, much of that agenda is official policy.

Marshal Shaposhnikov and Gen. Vladimir Lobov, Chief of the General Staff, both say that transition to a professional force will take time and that it is not feasible to abolish the draft immediately. Marshal Shaposhnikov favors a combined force of volunteers and conscripts, whereas General

Lobov is more inclined toward an all-professional force. As an interim measure, General Lobov says that sixty percent of the draftees could be assigned to the armed forces of their home republics, with the remainder going to the Union's army.

The stickiest questions are about the republics and how much of the force can be held together under central control. At the first meeting of the new Supreme Soviet October 21, Mr. Gorbachev said that breakup of the armed forces along ethnic and regional lines would be "dangerous, frivolous, irresponsible, and illegal."

At issue was the status of troops and units in republics that have thus far balked at signing the new Union treaty.

A week earlier, the Muslim republic of Azerbaijan had "nationalized" all Soviet army property within its boundaries. The Ukrainian legislature voted to create its own army, navy, and air force with 450,000 troops. It also laid claim to parts of the Soviet Black Sea fleet based at Sevastopol.

Robert C. Nurick of RAND told the AFA symposium in October that two military organizational models are competing for acceptance. Both postulate smaller armed forces, but they differ considerably in the matter of peacetime control.

Under the "center-heavy" model, advocated by top military leaders, republic forces would be small, perform primarily as a national guard, and provide resources to the Union forces. That approach does not sit well with the republics.

The alternative, now beginning to emerge, is the "republic-heavy" model, Mr. Nurick said. It supposes large, independent republic forces, which would be released to some joint authority in the event of crisis or war.

That model is open to doubt also, he said, because "it is not yet clear whether key republics will agree to transfer authority over their own forces to joint bodies, even in crisis." On balance, Mr. Nurick said, political trends are running against center-heavy organizational models.

Still in the Hole

The Soviet Union is in a deep economic hole and has not yet discovered a way out. It was financial and economic difficulty that stimulated Mr. Gorbachev's original reforms and set the stage for much of what has happened since.

The Soviet public puts considerable blame for these problems on the militarization of industry and excessive military spending, which once

consumed up to twenty-five percent of the Gross National Product.

According to the Kremlin, the Soviet defense budget for 1991 is 96.1 billion rubles, but that figure is almost meaningless. The Soviets explain that the new budget is actually ten percent lower than last year's—which was 70.0 billion rubles—because of more realistic pricing.

Even an accurate account of rubles spent is misleading, though, because of the many noncash subsidies, artificial cost assessments, and other special arrangements. It is generally agreed that official numbers reflect perhaps half of the actual expenses.

Nevertheless, by Western estimates, Soviet military spending has dropped by about twelve percent since 1988. Deeper reductions are anticipated, but the Soviets are limited in what they can save by eliminating units and poorly paid troops. Personnel accounted for only eleven percent of Soviet military costs in 1990.

The decline in weapons production, first noticed in 1989, continues with two objectives in mind. In addition to reducing military expenses, the Soviets are attempting to convert industry to civilian output.

Only a handful of defense plants have made the conversion so far, but there is little doubt that Soviet intentions are sincere. They have no chance of rescuing their economy or national infrastructure—housing, railroad system, telephones, utilities, and much else—without real change in the industrial base.

A substantial Soviet military industry will remain after the cutbacks and conversions. Tank production has dropped by sixty percent and aircraft production by twenty-five percent. By any standards other than those of the Soviet Union, the production rates are still high. Tank output in 1990, for example, was nearly double that of the United States.

In 1990, radical Soviet economists made headlines around the world with a proposal to cut weapons production by more than fifty percent and transform industry in 500 days. That plan was rejected at the time as too extreme.

Instead, Mr. Gorbachev and the old government went with an approach that slowed, idled, or mothballed weapons production lines while plants increased their production of civilian goods.

Now, according to the Pentagon, the same radical economists are back at work, "drafting economic plans that will most likely drive defense spending policy over the next five years." ■

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Aerospace World

By Frank Oliveri, Associate Editor

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Air Force Chief of Staff Gen. Merrill A. McPeak, Chief Master Sergeant of the Air Force Gary R. Pfingston, and Capt. Cathy McGinn, chief of Air Force Clothing Branch, sported the service's new look on October 31. The new uniform will undergo a six-month wear test next spring.

Conferees Rebuff B-2 Request

In final action on the Pentagon budget, congressional conferees rebuffed President Bush's request to buy four new B-2A Stealth bombers in Fiscal 1992, deciding instead to provisionally authorize only one.

The action did not kill, but greatly slowed, the huge Air Force bomber program. The conferees' action would effectively put off until next year a final decision on the fate of the new long-range aircraft. Until then, the program would be kept on life-support and could be reinvigorated by Congress if events warranted.

Senate and House negotiators authorized an additional \$4.4 billion in B-2 expenditures but fenced \$1 billion of this total. The procurement money—enough to buy and equip one B-2—would be held in escrow pending the outcome of efforts to fix certain low-observable (LO) problems that the bomber demonstrated in early tests. Once performance is raised to required levels, Congress must vote to obligate the funds for the single new bomber.

The conferees approved \$1.6 billion for research and development and \$1.8 billion to keep the bomber production line warm. The President had requested \$4.82 billion for four new B-2s in Fiscal 1992.

Congressional observers maintain that the B-2 program may have been a victim of poor timing. The LO testing problems occurred just before the start of the authorization conference and seemed to have a major impact on the decisions of key lawmakers.

Even before these problems occurred, however, others were warning that the bomber was in serious trouble. An Electronic Industries Association panel in September predicted that the B-2 program will produce no more than thirty-six aircraft because of the perception that the Soviet threat has diminished and because of political opposition to the revolutionary weapon system.

Returning from a trip to the Soviet Union earlier this fall, Gen. Merrill A. McPeak, the Air Force Chief of Staff, said that Soviet air defenses, with cur-

rent technological capability, can probably detect the stealthy bomber but cannot defend against it. In his October statement, General McPeak said the Air Force never argued that the bomber would be "invisible or immortal" in the face of sophisticated air defenses.

Nuclear Weapons Reduction

Defense ministers of NATO nations approved a plan that would reduce by fifty percent the number of nuclear weapons carried by US and British tactical aircraft in Europe. The move, formally endorsed in October at the NATO Nuclear Planning Group meeting in Sicily, came in response to what the ministers called a significant reduction in the Soviet military threat.

The NATO initiative comes on top of President Bush's own announcement, in September, of unilateral US cuts in ground-based tactical nuclear weapons. When the two actions are fully implemented, they will reduce the size of the current NATO nuclear inventory by nearly eighty percent.

The endorsement of the weapons-reduction plan came on the heels of a declaration by Germany and France that they would move to provide the nucleus of an independent European army. The Franco-German force, say officials of those nations, could total about 30,000 troops, a substantial increase over the 4,200-strong Franco-German brigade formed last year. The two nations called for other European nations to pledge troops to the new organization.

The Franco-German announcement touched off heated debate, with some ministers saying the move would undercut the cohesion and unity of the Alliance. Berlin and Paris, however, claimed that the new force would only complement NATO forces and that there would be much overlap between the two. Germany stated it would use its NATO-delegated forces to staff the Franco-German force. The French defense minister did not attend the meeting in Sicily; France is not a part of NATO's military command, though it is a signatory to the North Atlantic Treaty.

Soviet Response to US Reductions

Soviet President Mikhail Gorbachev promised to undertake unilateral reductions in Soviet nuclear weaponry akin to those contained in President Bush's September initiatives. On October 5, the Soviet leader said he would destroy or withdraw all land- and sea-based short-range nuclear weapons. He also called for further reductions in long-range strategic weapons.

Specifically, Mr. Gorbachev ordered the armed forces to destroy all nuclear artillery ammunition, mines, and nuclear warheads of tactical missiles; transfer all tactical nuclear weapons from surface ships and multipurpose submarines to a central storage area; and remove and destroy a large percentage of the nuclear warheads on anti-aircraft missiles.

In addition, Mr. Gorbachev would halt development of mobile intercontinental ballistic missiles and freeze mobile, rail-based ICBMs at present levels; remove 503 ICBMs from alert status and eliminate another 1,000 strategic weapons over and above START limitations; remove strategic bombers from standby alert and store the nuclear weapons; suspend nuclear testing for a year; and reduce Soviet military force levels by 700,000 troops.

President Bush called the Soviet announcement "good news for the whole world." Taken together, the actions by the US and Soviet Union will

lead to the swift elimination or removal of thousands of nuclear weapons from Europe, Asia, and the world's oceans.

In addition, Mr. Gorbachev called for creation of a joint US-Soviet early warning system to detect nuclear attack. He also suggested that both sides remove nuclear weapons from forward military tactical aviation units.

Requirement for TASM

Although President Bush included the termination of the Short-Range Attack Missile II (SRAM II) in his unilateral reductions to the US nuclear arsenal, DoD said the program was canceled mostly for technical reasons and that a requirement for such a system still may exist.

DoD spokesman Pete Williams said in October that the program was challenging and that DoD was unsatisfied with its progress. The Boeing-built SRAM II was expected to be the forerunner of the SRAM-T, which was to fill the Tactical Air-to-Surface Missile (TASM) mission. Mr. Williams said DoD had not decided whether to continue trying to fulfill the TASM mission. That decision is expected to be worked out with NATO allies, Mr. Williams said.

President Bush said a credible air-delivered nuclear capability would remain in Europe. In addition, NATO and the US are studying modernization of tactical nuclear weapons delivered by aircraft.

DCAA Testimony on McDonnell Douglas

McDonnell Douglas stock dropped by nearly \$2 per share in early October, following testimony from Defense Contract Audit Agency (DCAA) Director William H. Reed. Mr. Reed said that McDonnell Douglas was in a difficult financial condition, "which might adversely affect its ability to perform" under its government contracts.

McDonnell Douglas quickly responded to Mr. Reed's claims, calling them "inaccurate and grossly out of proportion." Some Wall Street analysts suggested that Mr. Reed's statements were off base and distorted the true picture of the firm.

McDonnell Douglas Vice President and Treasurer William Austin said operating earnings performance in the first half of the year was the best the company has ever seen. Total aerospace debt, he said, peaked at \$3.3 billion in March and dropped to \$2.9 billion by the end of the second quarter. Mr. Austin predicted that debt would drop further in the third quarter, possibly descending to 1989 levels, which earned the firm status as "an A-rated company" in the eyes of Moody's Investor's Service and Standard & Poor's.

Mr. Reed's testimony before the House Energy and Commerce Committee's Oversight and Investigations Subcommittee indicated that the DCAA believed the firm would lose \$900 million on the full-scale development contract for the C-17 transport. He said that DCAA and the Defense Plant Representative Office will likely agree that cost to complete the FSD contract would be \$7.3 billion. The program ceiling is \$6.6 billion. The firm has used a program overrun estimate of \$7.03 billion for FSD for financial reports.

C-17 Ahead of Schedule

The C-17 exceeded its flight plan schedule of 2.0 to 2.5 flights per week, completing ten flights in its first three weeks and logging more than twelve test hours in the air. [See "The C-17 Is Up," p. 46.] The missions have ranged from under an hour to 3.5 hours, concentrating on the preflight flight envelope and calibrating the air data systems.

Early in the program, two flights were terminated due to flight-control problems and anomalies. The aircraft has taken off three times with aircraft weights of up to 375,000 pounds. While using only idle reverse thrust and maximum braking, the aircraft



In a scene indicative of the changing times, the Commander of the Soviet Air Forces in Poland talks with Lt. Col. Hank Poburka, deputy commander for Operations of the 32d TFG, Soesterberg AB, the Netherlands, at an air show near Prague. At the request of the Czechoslovak Air Force, two F-15Cs, two F-16Cs, a VIP UH-1N helicopter, and a Navy F/A-18 from USS Forrestal took part.

—USAF photo by Capt. Eric Schnaible

landed within approximately 2,000 feet. It is expected to land within shorter distances.

KITE-2 Fails

The Army Strategic Defense Command failed in September to successfully launch the Kinetic Kill Vehicle Integrated Technology Experiment (KITE-2) interceptor for the SDIO High Endoatmospheric Defense Interceptor (HEDI) program. The missile jumped off its launch rail. This was the experiment's second failure.

The missile exploded prematurely after leaving the launch rail. Army engineers said the initial warhead explosion set off a chain reaction of explosions in the remaining two stages, which destroyed the missile. Telemetry received from the missile showed that the on-board electronics unit triggered the test vehicle's warhead, according to the Army. The source of the signal remains unknown.

The failure occurred at the White Sands Missile Range, N. M. The first failure, in August, was caused when the flight-control computer detected low voltage in the battery that powers the destruction mechanism and aborted the mission. A third attempt is expected in late spring or early summer 1992.

A-X Design

In its A-X fighter request for proposal, the Navy states that a "clean-sheet" stealthy design will likely be preferred over a derivative multimission aircraft. The formal request for A-X concept exploration and definition studies was issued on August 28.

Strike and antisurface warfare will be emphasized, while air-to-air capabilities will be subordinate. The airplane, however, is expected to have a "respectable" air-to-air capability.

As in the former A-12 program, stealthiness is still considered essential. Performance and weight requirements have been relaxed, however. By emphasizing the need for stealth, the Navy effectively issued a warning to contractors planning to propose a derivative aircraft. Making a nonstealthy existing aircraft stealthy would be not only very difficult but also prohibitively costly.

F/A-18E/F Contract

In September, the Navy awarded McDonnell Douglas Corp. a \$25 million, cost plus fixed-fee contract for development and engineering studies of the "stretch" F/A-18E/F fighter.

The proposed upgrade to the F/A-18 currently in service would produce a longer aircraft and provide it with better fuel-carrying capability, which in turn would improve its range. In



On October 10-14, the 75th Fighter Squadron Association held a reunion of the 23d Fighter Group "Flying Tigers" at Eglin AFB, Fla. Here, veterans Col. Joe Brown (Ret.), Brig. Gen. Robert L. Scott (Ret.), and Brig. Gen. David "Tex" Hill (Ret.) greet Col. David Sawyer, commander of the 23d Fighter Wing at England AFB, La., which gave an A-10 demonstration for the group.

addition, the company will improve engine inlets, increasing the aircraft's speed and performance. A larger wing will also be included in the design.

The Defense Acquisition Board (DAB) will decide whether to move the program to the engineering and manufacturing development stage in January 1992, when the contract is expected to end.

The Navy recently decided to use the General Electric F414-GE-400 engine to power the F/A-18E/F. The F404 derivative will have 22,000 pounds of thrust and will weigh about 2,445 pounds. The F404 is used by current F/A-18s and has an 18,000-pound-thrust capacity.

X-31 Flight Test

The X-31 Enhanced Fighter Maneuverability demonstrator aircraft will continue the envelope expansion portion of its flight test program at the NASA Ames Dryden Flight Research Facility, Edwards AFB, Calif., after transferring from Rockwell International's facility at Palmdale, Calif.

Following that phase, the X-31 will move to the Naval Air Test Center, Patuxent, Md., for tactical utility demonstration tests. Those tests, to begin in early 1993, will demonstrate the value of thrust vectoring and other enhanced control technologies for close-in combat maneuvering.

The testing will be conducted by representatives from the Defense Advanced Research Projects Agency, Navy, Air Force, NASA, Germany, Rockwell International, and Messerschmitt-Bölkow-Blohm.

Hughes/BAe to Team on ASRAAM

Hughes Aircraft Co. and British Aerospace Dynamics signed agreements to pursue Britain's Advanced Short-Range Air-to-Air Missile (ASRAAM) contract, the firms announced in September.

In addition, the two firms hope to establish long-term cooperation to develop the worldwide ASRAAM market. British Aerospace Dynamics will be the prime contractor with Hughes as subcontractor to develop the infrared seeker and to conduct captive flight tests of the developmental seeker and guidance unit. However, if Hughes is selected as the prime contractor for ASRAAM in the US, British Aerospace Dynamics will be subcontractor.

The team projected a worldwide market for as many as 15,000 missiles. The missile will have a reprogrammable guidance computer that can be easily modified to meet specific tactical and mission requirements of other nations.

AAWS-M Delay Approved

Though he permitted a six-month delay in the Advanced Antitank Weapon System-Medium (AAWS-M) program, Under Secretary of Defense for Acquisition Donald Yockey said the program would be canceled if the system puts on any more weight.

An Acquisition Decision Memorandum, released in October, said that a weight limit was set by the DAB. It added that, if the AAWS-M exceeds that limit, the Joint Requirements Oversight Council will review the pro-

—USAF photo by Bruce Hoffman

gram and the DAB may cancel it. The AAWS-M must not exceed fifty pounds.

While expressing concern about the weight of the system, Under Secretary Yockey approved a restructuring of the AAWS-M engineering and manufacturing development program, which would add an initial risk-reduction phase and postpone pre-production qualification tests by six months. Under Secretary Yockey also ordered the Army to develop an alternative plan in case the costs of the program cannot be controlled.

The Army and the Marine Corps, both of which will use the AAWS-M, have named the system "Javelin," the services announced in September. Javelin is in its twenty-sixth month of full-scale development.

NASA Reorganization Complete

In October, NASA Administrator Richard Truly completed the reorganization of the agency as recommended by the Augustine Committee. Mr. Truly placed Arnold Aldrich in charge of the new Office of Space Systems Development and Richard Petersen, former director of the Langley Research Center, at the head of the Office of Aeronautics and Space Technology. William Lenior will continue as associate administrator for the Office of Space Flight.

The Office of Space Systems Development will take responsibility for Space Station Freedom development, large propulsion systems development, the National Launch System, other large spaceflight developments, and the advanced transportation systems program planning function. NASA's existing Spaceflight Office will deal specifically with safety and efficiency of spaceflight operations.

News Notes

- The number of US military personnel on active duty dropped to its lowest level since before the outbreak of the Korean War in June 1950, according to the Pentagon. As of late July, there were 2,018,361 personnel in uniform, 31,362 fewer than a year ago. The prewar 1950 force level was 1,459,462.

- The Navy successfully completed the first test flight of the Harpoon anti-ship missile with Block 1D system improvements in early September at the Pacific Missile Test Center at Point Mugu, Calif. The missile was launched from an A-6E aircraft, flew fifty nautical miles, and hit the target ship. The test was the first of five,

which will include ship launches in addition to air-launch tests. The Navy plans to retrofit in-service Harpoons with the Block 1D upgrade. The improvements include guidance software changes that will allow the Harpoon to reattack a target by flying cloverleaf search patterns if the missile does not acquire the target on the first approach. A second test was successful in October.

- US defense spending can be reduced by one-third or more over the next ten years, according to a Brookings Institute study released in September. The study concluded that savings of \$316 billion to \$619 billion could be achieved. The eighty-page document, written by William Kaufmann of the Massachusetts Institute of Technology and John Steinbruner, director of Brookings' Foreign Policy Studies program, took issue with Pentagon assessments of the future threat to US security. The report sug-

gests that, with the Pentagon moving toward developmental systems, the defense budget will once more begin to grow in the mid-1990s after declining every year since Fiscal 1985.

- At least one Navy Fighter Weapons School "Top Gun" class was canceled due to structural cracking in Navy aggressor F-16Ns. The grounding of fifteen F-16Ns has led the Navy to seek replacements for them. The potential candidates include the F-14, the F/A-18, and the A-4M. The MiG-29 was also seen as a potential candidate.

- NASA successfully tested a small robotic vehicle in terrain similar to that of two Viking landing sites on Mars, the agency said in September. NASA is seeking low-cost ways to explore Mars. The minirovers and microrovers provide NASA with new low-cost exploration alternatives. Microrovers are in the under-eleven-pound weight class, while minirovers

Senior Staff Changes

RETIREMENTS: B/G Charles F. Luigs; M/G John P. McDonough.

PROMOTION: To be **ANG Brigadier General:** Glen W. Van Dyke.

CHANGES: M/G Lawrence E. Day, from Cmdr., Chanute TTC, ATC, Chanute AFB, Ill., to DCS/Tech. Training, Hq. ATC, Randolph AFB, Tex., replacing B/G Floyd K. Tedrow . . . B/G Francis C. Gideon, Jr., from Cmdr., Foreign Technology Div., AFSC, Wright-Patterson AFB, Ohio, to Cmdr., Foreign Technology Div., AFIC, Wright-Patterson AFB, Ohio . . . B/G Timothy D. Gill, from Dep. Dir., Ops., J-3, Hq. USMACV, Camp H. M. Smith, Hawaii, to Command Dir., NORAD Combat Ops Staff, NORAD, Cheyenne Mountain AFB, Colo., replacing B/G Arnold R. Thomas, Jr. . . . B/G Donald J. Harlin, from Dep. Chief of Chaplains, Hq. USAF, Bolling AFB, D. C., to Chief of Chaplains, Hq. USAF, Bolling AFB, D. C., replacing retired M/G John P. McDonough . . . M/G Gary W. O'Shaughnessy, from Dir., Jt. Electronic Warfare Ctr., and Cmdr., Hq. ESC, Kelly AFB, Tex., to Dir., Jt. Electronic Warfare Ctr., and Cmdr., Hq. AFIC, Kelly AFB, Tex.

B/G Monroe S. Sams, Jr., from Dep. Dir., Pers. Prgms., DCS/Pers., Hq. USAF, Washington, D. C., to Commandant, Armed Forces Staff College, NDU, Norfolk, Va. . . . B/G Graham E. Shirley, from Vice Cmdr., Hq. ESC, Kelly AFB, Tex., to Vice Cmdr., Hq. AFIC, Kelly AFB, Tex. . . . B/G Floyd K. Tedrow, from DCS/Tech. Training, Hq. ATC, Randolph AFB, Tex., to Cmdr., Chanute TTC, ATC, Chanute AFB, Ill., replacing M/G Lawrence E. Day . . . Col. (B/G selectee) Anthony J. Tolin, from Ass't DCS/Plans, Hq. TAC, Langley AFB, Va., to Cmdr., 57th Fighter Weapons Wing, TAC, Nellis AFB, Nev., replacing B/G W. Thomas West . . . B/G W. Thomas West, from Cmdr., 57th Fighter Weapons Wing, TAC, Nellis AFB, Nev., to Dep. Dir., Ops., J-3, Hq. USMACV, Camp H. M. Smith, Hawaii, replacing B/G Timothy D. Gill.

SENIOR EXECUTIVE SERVICE (SES) CHANGES: Alan P. Babbitt, from Ass't DCS/Comptroller, Hq. AFSC, Andrews AFB, Md., to Principal Ass't DCS/Financial Management and Comptroller, Hq. AFSC, Andrews AFB, Md. . . . Eugene C. Kalkman, from Technical Dir., Dep. Cmdr., Tactical Sys., Hq. ESD, AFSC, Hanscom AFB, Mass., to Chief Engineer, DCS/Engineering and Prgm. Mgmt., Hq. ESD, AFSC, Hanscom AFB, Mass. . . . Howard W. Leaf, to Dir., Test & Eval., Hq. USAF, Washington, D. C. . . . Matt L. Mieziva, from Ass't Dep. Cmdr., Tactical Sys., Hq. ESD, AFSC, Hanscom AFB, Mass., to DCS/Engineering & Prgm. Mgmt., Hq. ESD, AFSC, Hanscom AFB, Mass. . . . Jerome P. Sutton, from Dep. Prgm. Dir., AMRAAM SPO, ASD, AFSC, Eglin AFB, Fla., to Prgm. Dir., Range Systems, ASD, AFSC, Eglin AFB, Fla. . . . Raymond Urtz, from Technical Dir., Command and Control, Rome Laboratory, ESD, AFSC, Griffiss AFB, N. Y., to Dir., C³, Rome Laboratory, ESD, AFSC, Griffiss AFB, N. Y. ■

weigh up to fifty-two pounds. The rovers are expected to carry cameras to study the surface and to scan the horizon of Mars. They will also carry micromachined sensors to test the atmosphere and soil, spectrometers to gather geologic information, and seismometers to capture data on crustal motion, according to NASA.

- The Soviet Union launched six tactical satellites with one booster in September. The satellites will likely replace six satellites of the same type already in orbit.

- A Soyuz TM-13 successfully linked with the space station Mir in early October, delivering an Austrian, a Kazakh, and a Ukrainian to the station. One of two Soviet cosmonauts on Mir returned with the Austrian eight days later.

- The Air Force accepted the first operational C-27A intratheater airlifter in September. The Air Force plans to buy ten C-27s, which have a total program cost of \$330 million. The aircraft is manufactured by Alenia of Italy. The C-27 underwent forty-five days of qualifications operational test and evaluation before the actual delivery.

- V-22 tiltrotor flight testing resumed in September, when the third Osprey flew for eighteen minutes at Bell Helicopter's Arlington, Tex., facility. Flight tests had been suspended on June 11 after the fifth V-22 crashed.

- Yet another contender for the USAF-Navy Joint Primary Aircraft Training System (JPATS) has entered the fray. The EMB-312H flew for the first time in September in Brazil. Embraer, the Brazilian firm that builds the aircraft, modified its basic Tucano trainer.

- Lockheed completed electronic integration of the Milstar satellite in September, and acoustic testing has been successfully completed. The satellite is scheduled to be delivered in November 1992.

- British Aerospace and Alliant Techsystems agreed in October to form a team to build and sell BAe's Merlin smart 81-mm mortar round in the US. BAe spent nearly \$90 million of its own money to develop Merlin and is currently marketing the system throughout Europe and NATO. The round is an active, millimeter-wave-guided shell that can be launched from conventional mortar tubes. The team will use Merlin as a jump-off point to pursue the entire smart munitions market, including air-delivered, artillery, and mortar-delivered smart munitions.

- Pratt & Whitney will set up a joint R&D center in Japan to accelerate development of engines for the super-

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sonic transport. The proposed center will study metals, composite materials, gas turbines, and electronics. The center is to open in late 1992.

- Boeing delivered the first CH-47D Chinook to the Spanish Army in September. Boeing is remanufacturing nine Spanish Chinooks to the CH-47D configuration. The remaining deliveries are slated for completion by mid-1993. The upgrade provides substantial performance increases and lowers operational and support costs

over the extended lifetime of the aircraft. Boeing Helicopters is modernizing more than 500 Chinooks, including 472 for the Army, thirty for the British Royal Air Force, and nine for the Spanish.

- Orbital Sciences Corp. successfully completed the second launch of the two-part Zest mission series in September. The Zest vehicle deployed an SDIO experimental payload on a precise suborbital trajectory. Zest is a two-stage, rail-launched vehicle. The

—USAF photo by Walt Baker



Maj. Gen. Gary W. O'Shaughnessy (right) accepts command of the new Air Force Intelligence Command from Chief of Staff Gen. Merrill A. McPeak during ceremonies at Kelly AFB, Tex., on October 17. Intelligence functions formerly belonging to Electronic Security Command, USAF Special Activities Center, and elements of the Air Force Intelligence Agency have been consolidated under AFIC.

SDIO experiment aimed to create a high-energy release cloud and observe its characteristics with a variety of ground-, air-, and space-based sensors.

- The first flight of the Joint Services ALE-47 Countermeasures Dispenser System (CMDS) was completed at Eglin AFB, Fla., in September. The Air Force and Navy are developing the system for the F-16 and the F/A-18. The \$100 million ALE-47 program is managed by Aeronautical Systems Division's Electronic Combat and Reconnaissance System Program Office. The system, a threat-adaptive, software-programmable dispensing system developed by Tracor Aerospace, is capable of dispensing chaff, flares, and active-radio-frequency expendables against threat systems. The systems will be deployed on F-16s and F/A-18s in the summer of 1993.

- Raytheon Co. said in September that it has significantly improved the capability of short-range air-to-air missiles by developing an advanced, tail-controlled missile airframe with reduced drag and improved kinematics. Several live firings have demonstrated that the airframe "greatly increased velocity, maneuverability, and endgame performance over the existing version of the Sidewinder missile," the company said.

- The Air Force Computer Acquisition Center (AFCAC) joined Air Force

Systems Command's Electronic Systems Division at Hanscom AFB, Mass., in early October. AFCAC was initially formed to acquire commercially available computer systems for USAF customers. In addition, it acquires commercial high-technology communications and computer systems for the Air Force and DoD, along with other federal agencies. It will per-

form the same mission under ESD control.

- In October, the Swedish industry group developing the JAS-39 Gripen fighter submitted its offer to the Swedish government for the second group of aircraft. The new order is for 110 of the new fighters and development of the two-seat version (JAS-39B). A government decision is expected July 1, 1992. Three JAS-39 prototypes have flown more than 200 tests. The offer was requested by the government.

- The USAF-NASA X-29 flight test program concluded in October, following nearly seven years of flying. The final test was the last of the X-29 "High Alpha" (high angle of attack) program at NASA's Ames Dryden Flight Research Facility. It was the aircraft's 374th flight since its first flight in December 1984.

- The Soviet Ilyushin Design Bureau chose Rockwell International's Collins Avionics division to provide the avionics suite for the Il-96M transport in October. It will be the first time an avionics firm from the West will outfit a Soviet aircraft. Collins indicated that the Soviets plan to build at least 200 of the aircraft.

Honors

President Bush awarded the creators of the Pegasus launch vehicle the 1991 National Medal of Technology. Pegasus was developed by Orbital Science Corp. and Hercules Aerospace Co. Rear Adm. Grace Mur-

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A stream of smoke is released from ports on the nose of the X-29 Advanced Technology Demonstrator to provide information on forebody vortex flows at high angles of attack. The aircraft completed its first phase of high-angle-of-attack military utility flight testing in late September at Edwards AFB, Calif. The X-29 program is a joint effort of USAF and NASA.

tract for the procurement of six E-2C Hawkeye airborne tactical control aircraft. Expected completion: March 1993.

The Navy awarded General Electric Corp.'s Aircraft Engine Business Group a \$15 million letter contract to provide for engineering studies and testing to define an F404 derivative engine for the F/A-18E/F aircraft. Expected completion: January 1992.

The Navy awarded Bell Helicopter Textron, Inc., a \$74 million, ceiling-priced letter contract for eight AH-1W SuperCobra helicopters, one composite maintenance trainer, spares, support equipment, and associated data. Expected completion: July 1993.

The Army awarded General Dynamics Corp.'s Air Defense Systems Division a \$114 million, firm, fixed-price contract for 4,413 Stinger reprogrammable microprocessor (RMP) missiles and 199 Stinger RMP captive flight trainers. Expected completion: February 1994.

The Army awarded Allied Signal's Garrett Auxiliary Power Division a \$10 million, firm, fixed-price contract for 131 gas turbine engines for the AH-64 helicopter. Expected completion: September 1993. ■

ray Hopper, USNR (Ret.), also received the award for her pioneering work in computer technology.

The International Society for Optical Engineering chose the Relay Mirror Experiment spacecraft payload package for its Technology Achievement Award. The award was presented to USAF's Phillips Laboratory, the Relay Mirror Program Office, Ball Aerospace Systems Group, and Applied Technology Associates, Inc.

DoD spokesman Pete Williams received the Government Communicator of the Year Award from the National Association of Government Communicators.

Purchases

The Air Force awarded a \$954 million firm, fixed-price contract to McDonnell Douglas Corp. for thirty-six Fiscal 1991 F-15E aircraft. Expected completion: September 1994.

The Air Force awarded Martin Marietta a \$385 million, cost plus award fee contract for the assembly, test, and systems support segment of the Small Intercontinental Ballistic Missile (SICBM) Engineering and Manufacturing Development program. Expected completion: September 1996.

The Navy awarded Grumman Corp. a \$13 million firm, fixed-price con-

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With transition training cut and SUPT not fully implemented, TAC squadrons may have a big gap to fill.

By James W. Canan, Senior Editor



The Fighter Training Shortfall



THE high-priority task of training new pilots to fly fighters is posing a problem for the Air Force. Tactical Air Command had to cut back transition training programs that it counts on to turn fledgling flyers into fighter jocks. This could force operational fighter squadrons to become finishing schools for newcomers to their cockpits.

That prospect leaves TAC uneasy. It spells trouble for the squadrons. They must make the most of their allotted flying hours to maintain and improve their combat proficiency. They are not set up and do not have time to train new arrivals in combat flying skills that should have been learned beforehand.

"What concerns me," says Gen.



Top: Capt. Joel "Dutch" Ver Hoef, an instructor pilot with the 479th Fighter Group, prepares for flight during Basic Fighter Transition (BFT) training at Holloman AFB, N. M. BFT was devised under budgetary duress to replace the longer, more comprehensive Lead-In Fighter Training (LIFT) program. **Above:** Contractor representative Raoul Cenicerros inspects one of the 479th's thirty BFT AT-38s.

John M. "Mike" Loh, TAC's commander, "is that the responsibility for training will be transferred from our specialized training organizations to our operational squadrons. I want those squadrons to concentrate on combat readiness and on their operational missions and not be burdened with a large training load."

TAC picks up the training of prospective fighter pilots after they complete Air Training Command's undergraduate pilot training (UPT) and get their wings. It puts them through two more courses of in-

struction on all aspects of combat flying in high-performance aircraft, finally in the fighter type that they are slated to fly on operational assignment. Those programs have always done a thorough job, but now they may come up short for want of time and resources.

Pressed to save money and cut forces, TAC reduced and remodeled its fighter-transition instructional courses—the Lead-In Fighter Training (LIFT) program at Holloman AFB, N. M., and the following formal training unit (FTU) programs at Luke AFB, Ariz., Tyndall

AFB, Fla., MacDill AFB, Fla., Cannon AFB, N. M., and Davis-Monthan AFB, Ariz. It gave LIFT a new name—Basic Fighter Transition (BFT).

The cutbacks have a negative compound effect. BFT lasts only about half as long as LIFT and provides less than half as much flying time. Thus BFT is fated to accomplish much less than LIFT, notwithstanding its apparently high quality. At the same time, the FTUs are harder pressed to pick up the slack because their curricula and flying time have taken a ten percent cut.

General Loh says that TAC, as a result, faces "something of a cascade" of shortfalls in fighter transition training—with BFT "delivering a [trainee] product to our FTUs that they're not capable of handling"—unless both programs are good enough to compensate for their quantitative cutbacks.

The Inevitable Drop-Off

"I'm keeping a wary eye on the quality of the training," the TAC Commander asserts. He hopes for the best. "We may not see a significant difference. We've taken care to organize BFT into a very meaningful package of training."

There is sure to be some drop-off. General Loh notes that pilots in BFT miss out on training in "tactical weapons deliveries and some two-vs.-one air combat maneuvers" that LIFT provided, but BFT does very well by "the basics" of fighter maneuvers and stick-and-rudder skills.

TAC should have a pretty good idea fairly soon of how its truncated training programs are working out. It has kept track of all BFT graduates, beginning with the first class, which graduated last April. By early 1992, enough BFT graduates will have come through the FTUs and will be flying fighters in operational units for TAC to do a valid statistical analysis of how good they are and what they may lack.

The basic question, says General Loh, is "How long does it take—how many sorties—for a pilot to become fully mission-ready once he gets to his operational squadron, compared to the pilots of the past few years who had the benefit of the longer LIFT and FTU courses?" He emphasizes that TAC will not relent on its requirements for pilot proficiency. "We won't lower the standards for certifying that a pilot is mission-ready. Not at all."

Even without statistical evidence, there is little doubt that the operational squadrons are being forced to undertake some flight training formerly polished off in the intermediate programs. The question is how much. Comparisons of the LIFT and BFT programs may provide clues.

BFT lasts four weeks, compared to LIFT's eleven weeks, and is smaller and less comprehensive than LIFT in every respect. BFT uses thirty AT-38 aircraft, has fifty-

one instructor pilots, and is set up for 9,000 flying hours a year, including eleven sorties per student. LIFT used 111 AT-38s, had 165 instructor pilots, and provided 35,000 flying hours annually, including twenty-five sorties per student.

TAC deactivated three of LIFT's four flying squadrons in the 479th Tactical Training Wing at Holloman, implemented BFT with the one remaining squadron, and renamed the unit the 479th Fighter Group. It was a close call. TAC nearly lost the entire lead-in transition program to Defense Department budget cutters and had to strike a bargain to keep enough planes and personnel to stay in business.

To find funds for BFT, TAC traded an F-16 squadron at Luke AFB long devoted to foreign military sales instruction—training overseas customers of the fighter.

What's Missing Now

BFT emphasizes aircraft handling and fundamental fighter maneuvers. It also provides pilots destined for attack fighters two additional sorties for dropping practice bombs from the AT-38's centerline pylon. BFT offers no advanced training in surface attack, air-to-air combat, and low-level navigation, all of which were included in the LIFT program.

Pilots emerged from LIFT thoroughly schooled in the fundamen-

tals of air-to-air and air-to-surface combat flying. Pilots graduating from BFT must depend on the FTUs to provide such advanced combat flying instruction.

If the pilots in passage don't get such training in the FTUs, the operational units will have to give it to them, and General Loh emphasizes that "it is not the mission of [those] units to bring pilots up to a basic level of proficiency in their aircraft."

The FTUs hold the key to sparing operational squadrons a flight-training overload. Each FTU has fallen off in flying time—from fifty-seven sorties to fifty-one or fifty-two—but has improved the quality and efficiency of its instruction, TAC officials claim.

In TAC's lexicon, that instruction is "weapon-system specific," meaning that each FTU trains its student pilots in the fighter that each will fly in the operational Air Force. Those headed for F-15s are assigned after BFT to the FTU at Tyndall; for F-16s, the FTUs at Luke or MacDill; for A-10s, the FTU at Davis-Monthan; and for F-111s, the FTU at Cannon.

The move from AT-38 trainer aircraft to weapon-system fighters is a major challenge for neophyte fighter pilots. In General Loh's view, the biggest difference between pilots coming out of BFT and those who came out of LIFT, with its "more

BFT instructor pilots at Holloman check out their flying schedule board during a break. TAC is concerned that shortened fighter transition training programs will turn out fighter pilots who are not fully prepared for combat flying and that this will force operational fighter squadrons to complete their training—a job for which the squadrons do not have time and are not set up. TAC is keeping track of BFT graduates to see how they do.



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SUPT won't be fully implemented until 1996, so we're facing a five-year period with a shortfall of [fighter] training."

Next year, Air Training Command will begin phasing in SUPT and phasing out UPT. Each student entering SUPT will be tested for flying aptitudes and skills and will be assigned to one of two training tracks—the fighter/bomber track or the tanker/transport track. Each will be earmarked for one of the four types of combat aircraft.

Students fly the subsonic T-37 primary trainer and the supersonic T-38 advanced trainer in UPT and graduate from the course as skilled pilots. By and large, though, they are not as prepared to fly the partic-

tactically oriented flying," may be their "confidence in being able to handle the FTU program."

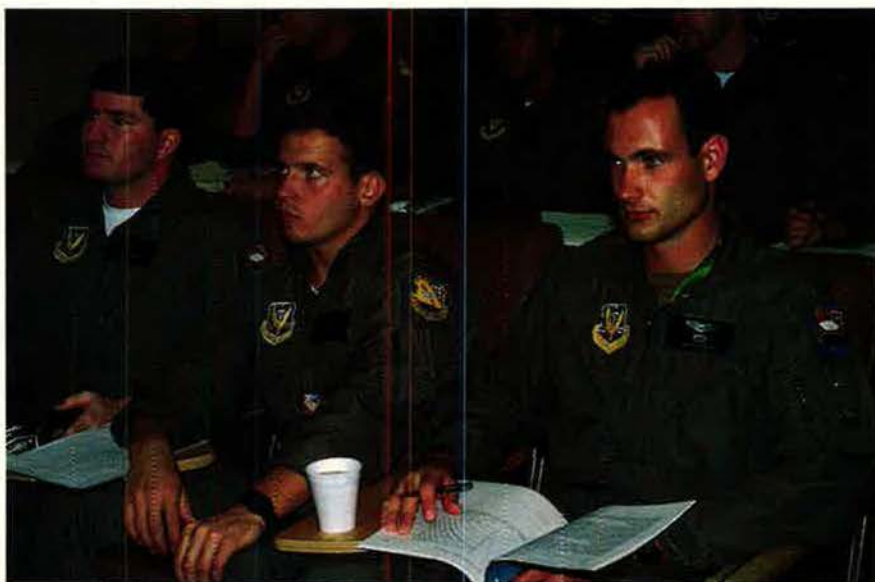
Lt. Col. Dennis Weaver, TAC's deputy chief of formal training, believes BFT "is doing a good job" but is turning out "less qualified" graduates who have had "less stick time in fighter skills." Thus they "require more attention" from the FTU instructor pilots, who "try to tailor each training flight to the individual student's needs," he explains.

Each FTU course lasts approximately five months. The FTUs received the first set of BFT graduates last spring and were scheduled to forward those pilots to operational squadrons late last fall.

Colonel Weaver describes FTU graduates as "generically qualified fighter pilots." He notes that the Air Force's decision to adapt F-16s to the close air support mission "will require a special [FTU] course" that TAC is now mulling.

Real-world circumstances determine how TAC apportions some elements of advanced fighter combat training between FTUs and operational units. Air-to-air and air-to-surface training are examples. Many operational fighter squadrons have less difficulty scheduling training time on surface attack ranges than they have in reserving airspace for practicing air combat maneuvers.

Colonel Weaver expresses optimism. "I don't think we'll have to shift too much training to the ops units," he says.



Top: A1C Shari Hummert, an aerophysiology technician, imparts techniques for withstanding G forces to a pilot trainee in a centrifuge at Holloman AFB. **Above:** BFT student pilots learn basic fighter maneuvers in the classroom prior to practicing them in flight. BFT teaches such maneuvers and stick-and-rudder skills but omits much of the advanced training that the LIFT program provided.

ATC's Big Changeover

TAC expects help from a major change in Air Training Command's flight-training program: ATC's switch from generalized undergraduate pilot training (UPT) to specialized undergraduate pilot training (SUPT).

General Loh notes that SUPT will give student pilots "more specialized training in fighter operational tactics and techniques" and that this "will undoubtedly improve the quality of the [pilots] in our lead-in and fighter-application training programs. But we're not there yet.

ular planes of the major commands as those commands would like them to be. SUPT is designed to prepare them better, but it will only be able to do so much.

Despite their specialized schooling, SUPT graduates will still require additional training in operational aircraft. ATC officials emphasize that SUPT is designed not to produce fighter pilots or bomber pilots, for example, but rather to produce pilots who are thoroughly prepared for follow-on training in those planes.

As Air Training Command began

Cpts. Steve "Baldy" Baldock and "Dutch" Ver Hoef head for their AT-38s on the Holloman flight line. They have a big challenge as BFT IPs: making the most of a sharply truncated fighter transition training program. BFT uses only fifty-one IPs, compared to 165 in the former LIFT program; lasts only about one-third as long as LIFT; provides less than half the number of sorties; and is authorized to fly only one-fourth the number of AT-38 advanced trainers.



© Dean Garner, 1991

making the transition from UPT to SUPT, Lt. Gen. Joseph W. Ashy, ATC's commander, cautioned that the specialized course "shouldn't be confused with the follow-on training [the SUPT graduates] will get in the major commands."

A few years ago, having decided to turn to SUPT, the Air Force reconsidered its follow-on fighter training requirements and moved to dispense with TAC's LIFT program. The idea was that SUPT and the FTUs could do the job without benefit of transition training. But the timing was premature, and TAC took exception.

"We fought to keep [BFT] at Holloman, because SUPT isn't here yet," General Loh declares. "I'm not convinced that we won't need some additional fighter lead-in [training], even when SUPT is here, before we let people jump into the cockpits of advanced fighters. I'm hopeful that, with SUPT, we will be back where we were—with a longer lead-in training program and a longer basic fighter applications training program."

Preventing Pilot Overload

The Air Force provided for fighter transition training many years ago, having concluded that new pilots should not be expected to master hot supersonic fighters right out of flight school. TAC studies showed that it is better to introduce

novice pilots to fighter procedures, formations, and maneuvers in the same supersonic planes that they had flown during undergraduate training, namely the T-38s, and not in operational fighters. Learning all those things while getting a feel for a strange plane—a real fighter—is too much to ask of relatively raw pilots, TAC decided.

Learning fighter skills in an AT-38 during lead-in fighter training before applying them in an F-15 is roughly analogous to learning how to balance and maneuver a bicycle before trying to control a motorcycle, TAC officials claim.

The war in southeast Asia gave rise to lead-in fighter training. US fighter pilots and planes often had all they could handle. A TAC document notes that "our kill-to-loss ratio was unacceptable during that war, given our past performances in World War II and Korea." Toward the end of the war, the Air Force undertook "a detailed study of the tactical air forces' performance in the . . . air-to-air arena to determine the causes of their degraded performance," the paper says.

The study found that the training of Air Force fighter pilots had left them "deficient" in the "ability to max-perform their aircraft and . . . to maintain situational awareness in a dynamic, large-scale, aerial warfare environment." It also concluded that the Air Force fighters of

the time were no great shakes at aerial combat, and it recommended that the Air Force get cracking on a better fighter.

New fighters and the lead-in fighter training program resulted. The Air Force developed the F-15 and F-16 concurrently with LIFT, which it put into effect at Holloman in 1977. Its goals: new fighters capable of outmaneuvering and outturning all aerial adversaries and a fighter transition training course that would prepare pilots to make the aircraft perform to the utmost without losing control.

Safer and Easier to Fly

There is a school of thought in the Air Force that today's fighters, by virtue of their extensive automation and superb handling qualities, are actually less demanding of their pilots in many ways and thus require less lead-in fighter training. TAC designed BFT with this in mind. General Loh says there is something to it, but he warns against carrying the rationale too far.

"It's true," he says, "that [today's] fighters are safer and relatively easier to fly and navigate. On the other hand, the fighters can do more than previous fighters could, and we have added a considerable number of tasks that their pilots have to do. The training load is probably even more difficult today than it was in the past, because of



Captain Ver Hoef briefs a BFT class at Holloman. BFT stresses aircraft handling and fundamental fighter maneuvers. It familiarizes pilots with surface attack procedures but provides no advanced training in that mode or in air-to-air combat and low-level navigation, all of which were included in the LIFT program.

the breadth of tasks and the degree of proficiency that we require of our new pilots.”

Modern sensors and cockpit technologies combine to give contemporary fighter pilots unprecedented situational awareness. General Loh acknowledges this advantage but also makes the point that the pilots have more situations to be aware of, and to cope with in a flash, than ever before.

“It’s a far cry from the days of the F-86 and the F-100, and even the F-4, in terms of the dexterity and the real-time decision-making required of our [fighter] pilots,” he declares. “So in the types of training that they get, we’ve shifted emphasis more to fighter application—applying fighters to missions, which have become much more complex—than to basic flying skills, even though some of these [modern] fighters still have idiosyncracies, quirks, that need to be understood.”

General Loh maintains that TAC will turn out trustworthy fighter pilots no matter how their training is divided among SUPT, BFT, the FTUs, and the operational units. He asserts, “We’re going to put pilots in our cockpits who can fly safely. We will not compromise safety. It’s not safety, it’s proficiency—the degree of proficiency that we expect of the pilots at each stage of the training process—that I’m concerned about.”

The fighter training cutbacks have come at a time of diminishing demand for new pilots all across the Air Force. Air Training Command is producing more pilots than USAF can accommodate. An estimated five hundred new pilots were said to be waiting for openings in advanced training or in operational aircraft: at the end of last summer.

Force-structure cuts threaten to make matters worse. The fighter world is a glaring example. The Air Force will lose ten combat-coded,

active-duty tactical fighter wings—from thirty-six down to twenty-six—over the next five years. This is a big reason why the Air Force will need 2,500 fewer pilots by the end of calendar 1993 than originally planned. The number of new pilots will be cut nearly in half from this fiscal year to the next—from 1,525 down to 870.

The Air Force plans several moves to strike a better balance between pilots and planes.

It will force many undergraduate pilots to choose between quitting UPT and finishing the course with no flying assignments in prospect for two or three years after graduation. It will also transfer many senior pilots in operational units to nonflying jobs or to Air Training Command as instructor pilots, thus reducing ATC’s reliance on “first assignment” IPs, those who become instructors on graduating from pilot training.

Given such circumstances, would it be possible for TAC to do without new pilots for the time being and unburden its fighter training programs?

“We’re not shutting off the flow of new UPT graduates into fighter cockpits,” General Loh replies. “We still want to bring in a fair share of new pilots and absorb them. We must. Every pilot training class that comes out of UPT will have fighter assignments in it.” ■



Captains Ver Hoef and Baldock check out their AT-38s before taking BFT students aloft. After BFT training, pilots enter formal training units (FTUs) to train in the fighter that each will fly in operational squadrons. FTUs have also been cut back, so it seems that the squadrons are left to pick up the slack.

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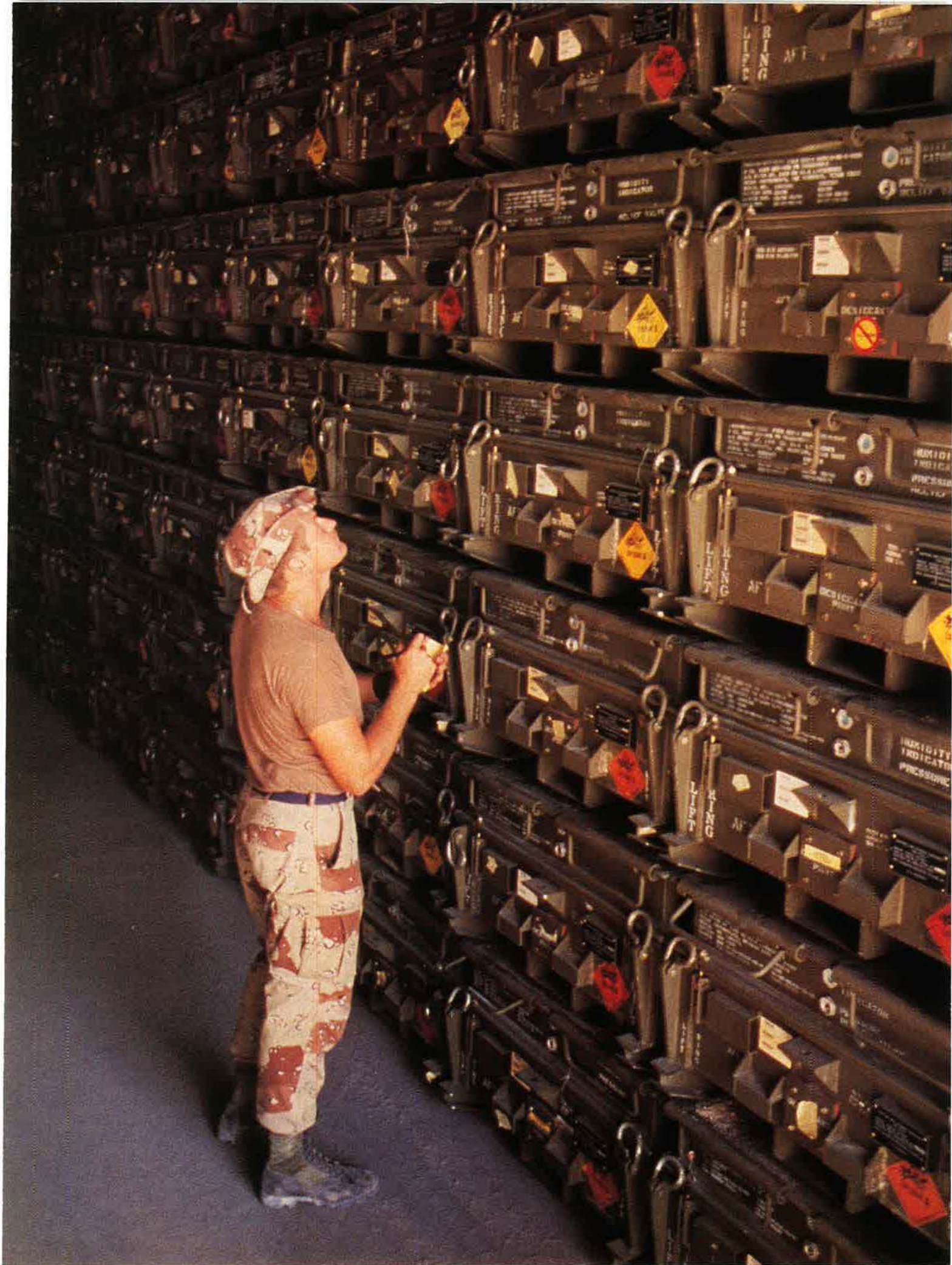
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sence of a formally declared national emergency. Today, however, surge is officially defined as "the accelerated production, maintenance, and repair of selected items and the expansion of logistics support services to meet contingencies short of a declared national emergency, utilizing existing facilities and equipment."

The "surge" reported in the popular press was essentially a speedup of items already in the production pipeline. Except for consumables and small items, there appears to have been no significant expansion of production.

David J. Berteau, the principal deputy assistant secretary of defense for Production and Logistics, told Congress that the Gulf War "did not really tax our industrial base. . . . Our existing inventories of weapon systems and munitions were adequate to support Desert Storm requirements, so it proved unnecessary to surge or mobilize production of these complex, long-lead items except on a very selective basis."

Furthermore, as one Army commander noted, much of the "surge" was in maintenance and overhaul. Air Force Logistics Command accelerated the repair of more than 80,000 parts and expedited the overhaul of seventy aircraft.

Shackles in Three Days

The war effort was aided by the ingenuity and spirited support of industry and the systems-logistics community. Maximum effort was cheerfully given. What it was possible for the troops to get, they got. One case in point: When the Pentagon needed shackles to secure Army M1 tanks for overseas movement, AM General provided them in three days without any government paperwork.

Such voluntary cooperation from industry made it easier to get by without the powers of the Defense Production Act (DPA), which had lapsed.

Finally, some major new weapon systems were leapfrogged through development into operational status. The E-8 Joint STARS aircraft, for example, flew combat missions six years before official deployment.

However, accelerated deliveries

were extensive [*see table, opposite*] and definitely represented a surge as currently defined. The surge that took place was important and impressive. In his statement to Congress, Mr. Berteau gave several examples:

- In August 1990, the Defense Logistics Agency had three producers who each month could supply three million Meals, Ready to Eat. By war's end, twenty-two producers were supplying sixteen million MREs a month.

- In August 1990, three contractors could deliver 1.3 million tray pack meals a month. After the surge took place, five contractors were producing 4.7 million tray packs a month. Delivery of other food products increased similarly.

- When Operation Desert Shield began, the Defense Department had no production base for desert boots. Sixty days later, four contractors were producing 136,000 desert boots each month, including the new "Schwarzkopf model."

- At the start of the US buildup in the Gulf, the Pentagon had two contractors who each month produced 60,000 injectors for atropine, a nerve-agent antidote. Their production of injectors rose to a monthly peak of 717,000.

In February, with the war still going on, Pentagon Comptroller Sean O'Keefe gave the House Armed Services Committee a sample list of "production surge items" that might be needed for the continued prosecution of Operation Desert Storm or for replenishment afterward.

The list included Patriot air-defense missiles, Hellfire and TOW antitank missiles, the Army's Tactical Missile System, Multiple Launch Rocket System reloads, certain types of Army ammunition, AGM-88 HARMs (high-speed anti-radiation missiles), Tomahawk cruise missiles, AGM-65 Maverick air-to-ground missiles, and various bombs, flares, and munitions.

The war was both short and popular. There was no need to expand weapons production, and the Pentagon encountered no insurmountable problems with the industrial base.

"Disastrous" Shortages?

"Had the Gulf War lasted longer,"

says James A. Blackwell, Jr., who directs industrial base studies for the Center for Strategic and International Studies in Washington, D. C., "the lack of a coherent industrial response, authorized by the DPA, would have resulted in disastrous shortages of critical spare parts, consumable items, certain ammunition, and other items."

The commander of AFLC, Gen. Charles C. McDonald, testified that "our success in Desert Shield/Desert Storm was largely due to the strong funding received for aircraft War Readiness Spares Kits/Base Level Self-Sufficiency Spares (WRSK/BLSS) from 1984 through 1987. While funding was reduced significantly in FY 1988 and FY 1989 (forty-seven percent and twenty percent, respectively), the impact on Desert Shield/Desert Storm operations for most systems was not critical because our total spares posture was healthy."

However, "selected weapon systems, such as the F-15E, did experience degraded support due to inadequate funding," said General McDonald. "These shortfalls were overcome by robbing WRSKs through cannibalization prior to unit deployment and surging depot repair of exchangeables. If hostilities had been extended, adequate support would have been jeopardized."

There were many instances when commercial products were acquired quickly and substituted for military items. Global Positioning System (GPS) receivers have been cited as an example. In that case and others, however, there is more to the story.

Commercial GPS receivers do not have the "selective availability" feature, which allows its users to decode encrypted satellite data. Highly accurate information of prime military value is normally encrypted to deny its use to the enemy.

"When we were forced into a quick buy of commercial receivers to support the desert operations, we made a conscious decision to turn [the selective availability] off and risk allowing enemy use," Gen. Donald J. Kutyna, commander in chief of US Space Command, told the Senate. "Iraq was not equipped with smart weapons, which might use GPS in their guidance systems,

Desert Storm Surge List

Items/Materials	Quantity	System	Items/Materials	Quantity	System
Guns	8	F-16	Radio/TV comm. equipment	50	Space & comm.
Fire-control sighting	143	AC-130, F-15	Airborne comm. equipment	3	C- '30
Optical sighting equipment	30	F-15	Radio navigation, airborne	12	H-53
Fire-control designation	83	F-16	Airborne radar equipment	237	H-60, H-53, E-3, F-15
Aircraft gun fire control	210	F-15, F-16, C-130	Night vision equipment	35	E-3, C-130
Aircraft bombing fire control	165	F-16	Electronic countermeasures	276	F-4, F-111, F-15, H-53
Misc. fire control	15	F-16	Misc. airborne comm. equipment	148	E-3, F-15, F-16, C-5
Aircraft structural component	122	C-5, C-135	Resistors	1	B-52
Helicopter rotor blades	11	H-53	Filters	3	B-52, F-15
Hydraulic, vacuum, deicing	87	C-5, C-135, C-130, E-3A, F-15	Switches	2	F-16
Air cond., heat, pressure equipment	54	C-135, F-4, B-52, E-3, F-111, F-16	Connectors	1	B-52
Misc. accessories/components	352	KC-135, E-3, C-135	Lugs, terminals	1	F-16
Tires	82	C-130	Electron tubes and hardware	26	F-15, comm.
Gas turbine/jet engines	493	F-15, F-16	Filters and networks	3	KC-130
Gas turbine/jet components	4,418	F-16	Relays, solenoids	1	C-141
Engine fuel systems, nonaircraft	17	F-16	Electron tubes	13	E-3
Engine fuel systems, aircraft	180	F-16	Antenna, wave guides	282	E-3, F-111, F-16, comm.
Engine electrical systems, aircraft	388	F-16	Cable, cord, comm.	5	F-16
Misc. engine accessories	69	F-16	Circuit cards	197	F-15, space & comm.
Transmission equipment	4	C-141, B-52	Misc. electrical	250	F-15, F-16
Bearings	1	F-111	Motors	18	C-130, F-16
Compressors	1	B-52	Electrical control systems	418	C-5
Power and hand pumps	4	F-16	Generators and sets	156	C-5, F-16
Plumbing fix and accessories	1	C-135	Transformers, distribution	1	F-16
Pipe and tube	2	C-130	Converters, electrical	102	E-3, F-15, comm.
Hose and tubing	3	F-16, C-141	Lights and fixtures	1	F-16
Fittings and specialties	1	F-15	Traffic & trans. sig.	1	F-15
Valves, powered	144	F-16, C-135	Navigational instruments	124	F-16, comm.
Valves, nonpowered	20	F-15, C-135, F-111	Flight instruments	61	B-52, C-141, F-15, F-16, C-130, F-5
Aircraft maint. & repair equipment	32	C-5	Auto pilot/airborne gyro	157	F-16, C-5
Pins	1	E-3	Engine instruments	17	F-15, C-141
Coil, wire springs	1	B-52	Electronic measuring equipment	3	F-16, E-3A
Gasket material	1	F-15	Time measuring instruments	1	F-15
Portable building	4	Space & comm.	Measuring instruments	284	C-5
Construction equipment	7	F-16	Pressure, temperature measuring equipment	111	F-15
Telephone/telegraph	135	Space & comm.	Operational training devices	68	F-16, F-15
Teletype	40	Space & comm.			

Production of these items and materials was accelerated in the quantities shown for the Persian Gulf War.

Source: Department of Defense.

so the risk to the coalition forces was minimal. In light of the startling success and praise heaped on GPS by the troops, this situation will not be prevalent in the future."

After the war, the Department of Defense informed Congress that "Operations Desert Shield and Desert Storm acquisition and procurement experience indicates a requirement for additional study on the appropriate balance between war reserve programs and industrial base capability."

On numerous occasions during the Persian Gulf War, American forces relied on overseas suppliers for important components. Never did these sources fail to deliver, say Pentagon officials, and only twice did Washington have any trouble with a foreign supplier. All cases were resolved amicably and without threats.

Need for Persuasion

Even so, there have been many reports that the US government may have had to resort to high-level persuasion to ensure timely fulfillment of these deliveries. In several cases, reports the Congressional Research Service, reliance on overseas sources complicated the smooth flow of US supplies to the Persian Gulf, even when foreign governments were cooperating fully.

General McDonald has said that, "if the foreign suppliers had chosen to cut us off for political reasons in those few cases where they were the sole source, we might have had trouble recovering."

The Gulf War was well-fought and well-supported, but the questions of expanded defense production and industrial mobilization never arose. There is no new evidence to refute the previously prevailing estimate that industry would need at least eighteen to twenty-four months to expand production for major military items.

There is no apparent reason to believe that industrial capability has improved since that estimate, but there are many reasons to conclude that it has declined. Much of the surge reported in Operation Desert Storm is explained by the change in definition of the term.

The Gulf War experience, along with the new US defense strategy,

may stimulate a reconsideration of the need for expanded defense production and industrial mobilization in time of crisis. It has been forty years since the nation last mobilized for war.

Contrary to nostalgic belief, mobilization for World War II did not happen instantly. Expansion of military production capabilities began well before Japan's December 7, 1941, attack on Pearl Harbor, and peak production was not achieved in many war-critical industries until mid-1943.

For the duration of the Korean War, the US deliberately avoided disruption of civilian production, but mobilization was still extensive. By July 1952—two years after the outbreak of conflict—US aircraft production had grown to 800 a month, more than double the 1950 rate. By 1953, production had reached 1,000 a month. Most war industries expanded similarly.

The nation did not mobilize for the Vietnam War, choosing to rely instead on reserve stocks and limited surges in selected industries.

In 1989, a defense industrial base project chaired by Sens. Jeff Bingaman (D-N. M.) and John McCain (R-Ariz.) concluded that industrial mobilization was not a component of US national security strategy. That report observed that the nation has not conducted a rapid industrial mobilization in this century.

"Reconstitution"

Regardless of how mobilization may have figured in Pentagon thinking in 1989, it is a definite component of the current defense strategy, which has undergone major revision in the past year and now places heavy emphasis on the capability to "reconstitute" forces.

The new defense strategy assumes that, for the foreseeable future, most military contingencies and conflicts can be handled by relatively small standing forces with existing stocks and support and the nation can count on ample warning time and adequate industrial preparedness to mobilize expanded forces for greater contingencies.

According to Gen. Colin Powell, Chairman of the Joint Chiefs of Staff, reconstitution capability has three subcomponents: industrial capability, mobilization capability,

and force regeneration capability.

The military chiefs make it clear they regard force reconstitution as a hedge against extreme contingencies, not as a step that would be taken for every conflict. Even with that stipulation, the new strategy represents a much stronger commitment to mobilization capability than was the case in earlier strategy. The Joint Chiefs of Staff say that the ability to reconstitute forces "may well prove to be the linchpin of America's long-term security."

Moreover, the Gulf War experience suggests that expanded production might be required in circumstances short of full force reconstitution, classic mobilization, and extreme contingencies.

Over the past fifty years, a considerable body of opinion has held that mobilization planning is irrelevant. The theory is that modern wars will be fought on a "come as you are" basis, with forces in hand, and that the conflict would be over before any mobilizing could take place.

In many conflict scenarios, that is probably a valid expectation, but actual war on the battlefield does not always follow the predictions of theory. Short-war assumptions were popular before (and even during) the "regional contingency" in Vietnam, a war that dragged on for a decade.

Planning for industrial responsiveness is not only practical but also imperative. As the Department of Defense said in its industrial base report for 1990, "maintaining an ability to reconstitute production rates to support regional conflicts, including possible Foreign Military Sales, on short notice is a challenging new issue for DoD."

Adm. David E. Jeremiah, the Vice Chairman of the Joint Chiefs of Staff, says that the reappearance of a major new Soviet threat would be preceded by a long mobilization and "therefore, we will have time to reconstitute the necessary forces—provided we still have the infrastructure on which to build them."

Whether that will be the case is an open question. The United States seems destined to enter the future with a strategy that counts on the capability to reconstitute forces but with a defense industrial base that is declining on all fronts. ■



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The armed forces think lessons they learned in the Persian Gulf War can help lower the casualty rate.

Friendly Fire

By Stewart M. Powell

WHEN Air Force pilots fly close air support (CAS) missions in the future, they will have the benefit of new air-to-ground training based on the hard-won lessons of the Persian Gulf War—in particular, ways to prevent losses from “friendly fire.”

Today, the wartime experience of A-10 and F-16 aircrews is being used to shape preparations for fast-paced, nonstop, round-the-clock warfare of the kind that promises speedy victory with limited casualties. Improvisations and innovations developed by pilots in the forty-three-day war will be studied for years.

The war was hardly over before the armed forces began tinkering with doctrine, exploring new technologies, and updating tactics to reduce the risk of friendly fire the next time. One Tactical Air Command analysis credits CAS planes with “contributing to the destruction” of 3,500 tanks, 2,600 artillery pieces, and 2,400 armored vehicles. Their elimination as factors in the war spared the coalition potentially high casualties.

At the same time, it became clear

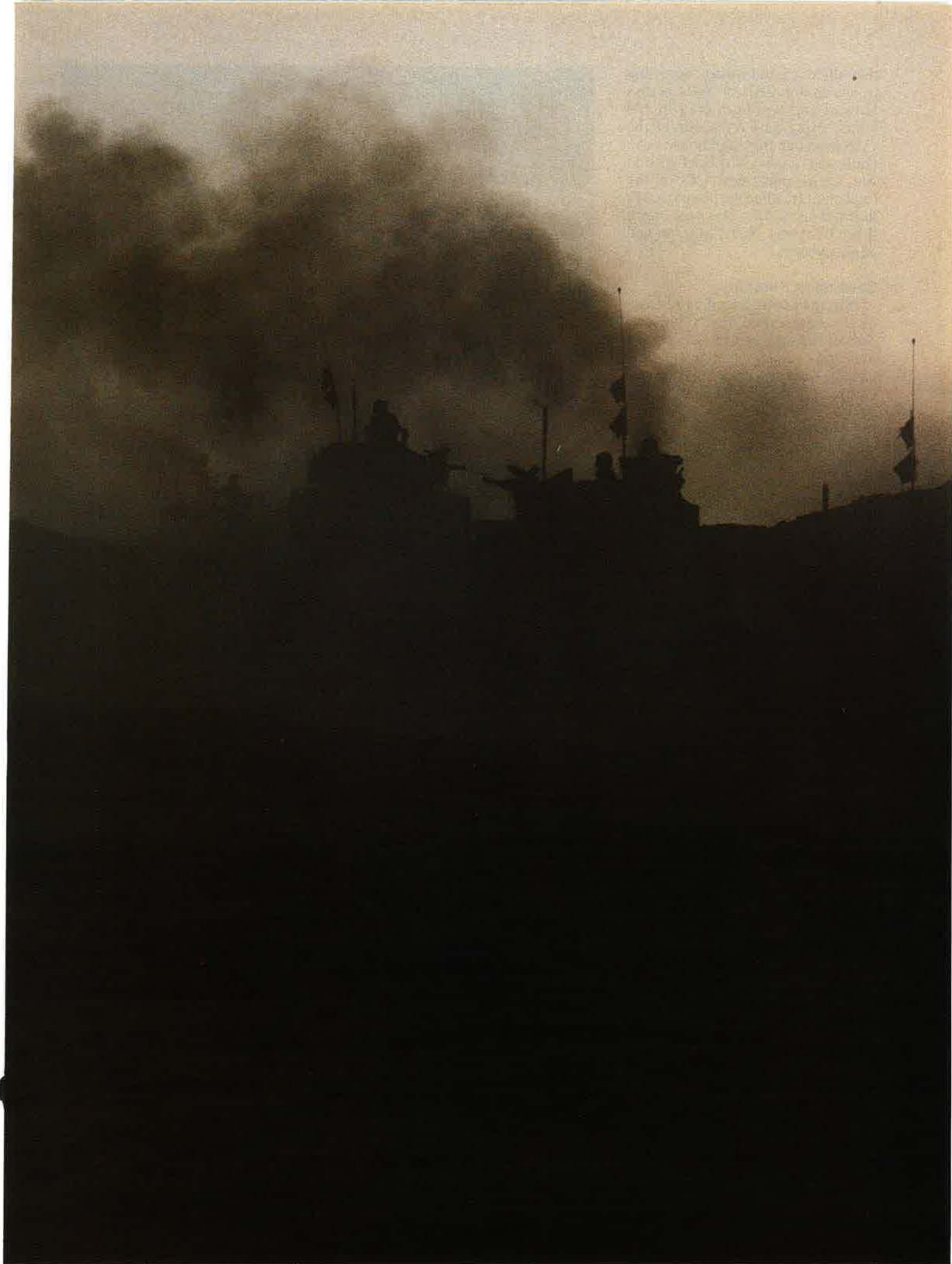
that the ferocity of the American-led air, ground, and sea campaign carried a price in terms of accidental strikes on friendly forces, especially on the ground, where some 10,000 US and Iraqi armored vehicles faced off against each other. Mistaken identification by American ground units and aircraft, coupled with malfunctions of certain weapons, caused death or injury for 107 Americans during the short-lived conflict. In addition, twenty-two Britons were killed or wounded in accidental attacks by American forces.

Analysts are still debating the significance of the latest friendly fire losses. One clear cause of the high percentage of fratricide was the absence of sustained enemy resistance. Friendly fire claimed a disproportionate share of the relatively low number of American casualties.

Missions flown by CAS aircraft accounted for a big chunk of the Air Force’s 65,000 sorties and played a crucial role in demolishing Iraqi weapons. In theater, 132 A-10s and twelve OA-10s flew 7,175 sorties and 249 F-16s flew 13,500 sorties.

So successful was the CAS effort

Friend or foe? Aircrews flying close air support need the instruments, data, and tactics to be sure of the answer in a split second to employ weapons effectively and avoid hitting their own troops. The National Training Center (right) at Fort Irwin, Calif., is where they hone their skills, aided by new instruments that allow them to “kill” and “be killed.”



that allied ground forces were able to sweep hundreds of miles across Kuwait and southern Iraq in 100 hours, using only a fraction of the CAS missions that could have been employed. During this brief ground war, USAF pilots flew 1,485 of the total of 4,500 allied sorties narrowly defined as CAS. The rest were flown by Army, Navy, Marine, and allied aviators.

Seventeen Percent

During the war, friendly fire casualties represented seventeen percent of the total of 615 US servicemen and -women killed or wounded in Iraq, Kuwait, and Saudi Arabia in Operation Desert Storm. In the past, friendly fire losses accounted for "something less than two percent of all casualties in battle," according to a landmark study of 269 instances of fratricide in World War II, the Korean War, and the Vietnam War. The study was completed in 1982 by Army Lt. Col. Charles R. Shrader for the Army Combat Studies Institute at the Army's Command and General Staff College at Fort Leavenworth, Kan.

The Air Force, in an official Gulf War analysis released in September, put the matter this way: "The loss or injury of any military member is at once tragic and regrettable, but the casualties sustained by the United States in the Gulf War must be considered in light of what they *could*



—Staff photo by Guy Aceto

To help reduce the number of friendly fire incidents, the Air Force is giving its F/A-16s low-altitude, terrain-following systems, enhanced computer capability, forward-looking infrared radar, and the Automatic Target Handoff System, all of which will help to alleviate the problem.

have been—and what some had predicted they *would* be, before the war—had the bulk of Saddam Hussein's forces been fit, supplied, intact, and in place, awaiting the onset of the ground operation. That they weren't was primarily due to the success of the air campaign."

"If we had plodded along methodically, conservatively, and hadn't gone after them in the highly aggressive manner that we did, the [overall] casualty rate would have been significantly higher," said Ma-

rine Lt. Gen. Martin Brandtner, director of operations for the Joint Chiefs of Staff. "The very means by which we won the victory did cause to some extent the battlefield situation that resulted in some of these incidents."

Moreover, "having a ground war of only 100 hours is so far out on the edge of experience that you expect anomalies," said Charles Hawkins, executive vice president of the Historical Evaluation and Research Organization, of Fairfax, Va. "There were lots of nervous airmen, lots of nervous soldiers. Once you have experience fighting, the little tricks of identification start being developed."

The tally of friendly fire was far more accurate than in past wars, as well. Damage assessment teams reached destroyed M1A1 Abrams tanks and Bradley Fighting Vehicles within days of their destruction and were able to confirm friendly fire due to telltale traces of depleted-uranium rounds used only by American forces.

Had such postwar accounting been available in the past, the two percent estimate of friendly fire losses might never have gained currency. Mr. Hawkins, formerly a platoon leader and rifle company commander in the 101st Airborne Division, went back through casualty reports from one battalion during a four-month period of the Vietnam

—USN photo by PHC Holmes



In the Gulf War, Syrians and Egyptians fighting side-by-side with US forces used Soviet-built tanks that resembled Iraqi vehicles. The Iraqis compounded the confusion by using both French- and Soviet-built tanks. The complexities caused by the mix of systems were of no avail to this Iraqi tank's crew, however.

War in 1970. He found that more than thirteen percent of battlefield losses were due to friendly fire.

Other analysts, however, attribute the higher rate of friendly fire losses to the intensity of modern maneuver warfare. Had the ground offensive dragged on for two to three weeks, as originally predicted by Gen. H. Norman Schwarzkopf, with several thousand casualties, friendly fire losses might still have been a large share of the losses, these experts contend.

"There's been a revolution on the battlefield," said James A. Blackwell, Jr., a former Army officer and now deputy director of political-military studies at the Center for Strategic and International Studies in Washington, D. C. "The application of precision guided munitions and information processing gives a new dimension to the opportunities for friendly fire that we didn't anticipate."

The Final Tally

Lt. Gen. Charles A. Horner, the commander of Central Air Forces and the air boss of the Gulf War, notes that the impact of a single modern weapon gone astray can be catastrophic. "If an incident happened in World War II or Korea, you had a guy with a shrapnel wound," observes General Horner. "Now you have large numbers of KIA [killed in action] and WIA [wounded in action]."

In its final tally, the Pentagon identified more than two dozen incidents of fratricide.

- On land, US ground units launched seventeen inadvertent attacks on American and British ground forces. These attacks killed eighty-one Americans and two Britons. These seventeen misguided attacks also destroyed twenty-seven US M1A1 tanks and Bradley Fighting Vehicles—fully seventy-seven percent of the Army's materiel losses.

- In the air, US Air Force and Marine Corps fighters and one Army helicopter carried out ten mistaken strikes on friendly troops. They killed or injured twenty-six Americans and twenty British servicemen.

- One USAF Maverick antitank missile, launched from an A-10, apparently lost its lock on an Iraqi tar-



Allied soldiers helped protect themselves from friendly fire by distinguishing their vehicles with inverted "V"s, seen here on the A-1 echelon of the Royal Scots Dragoon Guard advancing into Kuwait. Also visible on some of these vehicles are fluorescent orange air recognition panels.

get, went awry, and destroyed a Marine armored vehicle, killing seven Marines and wounding two others. In the war, US forces launched 5,278 Mavericks.

- Evidently, at least four AGM-88 high-speed antiradiation missiles "flexed" target frequencies en route to Iraqi targets and picked up secondary targets, which happened to be US radars. The HARMs struck two US ground sites, killing one Marine and wounding three others. On two other occasions, HARMs exploded near US warships but caused no casualties. US forces fired more than 1,000 HARMs.

The worst air-to-ground incident of the war occurred when two US A-10 pilots, confident they were over the Iraqi armored column they were to attack, fired Maverick missiles against what turned out to be thirty-seven British Warrior armored vehicles parked in the Iraqi desert. The daylight attack killed nine British soldiers and wounded eleven.

A five-month British inquiry attributed "no blame or responsibility" to British forces and "did not establish" whether the US pilots "were at fault." General Horner said that the US investigation established that the pilots believed they were in "the right place" while the ground forces believed the pilots "knew where they were." Said General Horner, "Obviously, it broke

down. [But] you could not present a case before a jury and get anybody convicted on this, I guarantee you that."

Reducing the Risk

In advance of H-Hour last January 17, each armed service tried desperately to reduce the risks of friendly fire. The realization that 3,529 American tanks and combat vehicles would be fighting side-by-side with Syrian and Egyptian units using Soviet-built tanks that resembled Iraqi vehicles stirred an all-out effort.

Fluorescent orange air recognition panels were added to combat vehicles, as were luminescent painted "V"s and more than 15,000 off-the-shelf infrared beacons known as "Bud lights." The Army rushed more than 7,500 handheld satellite navigation devices into the field to combat chronic confusion over units' locations on the trackless desert.

The Air Force used the five-month deployment to adapt to the special challenges. The basics of CAS "did not change," recalled Air Force Col. Thomas J. Lyon, a veteran of eighteen A-10 missions in southwest Asia as deputy commander of the 23d Tactical Fighter Wing and now the man who handles joint USAF-Army matters at Tactical Air Command Headquarters, Langley AFB, Va. "The buildup

gave us a great opportunity to refine the things that we were doing on a day-to-day basis.”

Of the 16,233 sorties flown by A-10s from the outset of Desert Shield in August 1990 to the end of Desert Storm on February 28, 1991, fifty-seven percent were flown before hostilities began. This was part of an unprecedented in-theater training operation to prepare and adapt US forces for the coming conflict.

The Air Force honed air-ground coordination with the traditionally self-reliant Marine Corps to help strengthen the leathernecks' two-pronged assault through the

Aircrews fashioned night warfare capability for the venerable A-10s by using the Maverick's cockpit targeting display screen as a rudimentary night vision device. It was like “looking through a soda straw,” Lyon recalled, but it worked. “We did some very innovative things over there out of necessity.”

The A-10s altered tactics to deal with a stubborn, unpredictable Iraqi surface-to-air threat that dogged the slow-flying jets. The two-ship, cover-and-attack approach favored by F-15s and F-16s for night operations was adopted by the A-10s, with one pilot spotting the target from a higher altitude and watching

fire. The report added, “We have yet to devise a cost-effective approach to achieving improved identification procedures.”

In the Air Force, service leaders looked to doctrine, technology, and training to improve combat effectiveness and help cut the risk of air-to-ground fratricide.

Gen. John M. Loh, TAC's commander, reached agreement last August with Army Gen. John W. Foss, outgoing commander of the Army's Training and Doctrine Command (TRADOC) at Fort Monroe, Va., on an “umbrella concept” for updating doctrine for air-land operations. Desert Storm added momentum to an ongoing effort to join the services at the outset of a cumbersome process that will shape everything from peacetime training and weapons acquisition to wartime tactics.

“Instead of the Army going off on one tangent and the Air Force going off on another tangent,” said Army Capt. Joe Curtin, a TRADOC spokesman, “we're getting together on how we're going to fight in the future.”

The most significant postwar developments, however, are a series of changes that will enhance training opportunities for CAS pilots to work more closely with ground forces under realistic conditions, including night warfare.

Allied operations proved that CAS remains “a very critical mission” for the Air Force that “requires a great deal of training and interoperation with the Army,” said General Loh. “It's a tough, difficult mission to conduct—one of the toughest. Therefore, we need to train harder and harder at it and equip our aircraft with systems that are capable of doing close air support better.”

Officials expect to strengthen the training links between A-10 units and the Army divisions they support—for example, the tie between the 23d Tactical Fighter Wing and the 5th Infantry Division (Mechanized) based at Fort Polk, La., or the 354th Tactical Fighter Wing's bonds with the 24th Infantry Division (Mechanized) at Fort Stewart, Ga.

Six pilots from each A-10 wing linked to Army divisions already serve as air liaison officers (ALOs) within the divisions.

—Staff photo by Guy Aceto



A-10 pilots prepared for the shooting war with an unprecedented in-theater training operation, flying fifty-seven percent of their missions before the ground war started. The slow-flying A-10s adopted the two-ship, cover-and-attack approach to cope with the stubborn, unpredictable Iraqi surface-to-air threat.

Saddam Line of minefields and bunkers into southern Kuwait. Existing close air coordination procedures were rehearsed with Army forces. More than 2,000 forward air controllers eventually moved out with coalition ground units.

Air Force pilots improvised to provide ground forces the nighttime CAS they would need if Iraqi forces fought to hold Kuwait. “We found out very quickly that we needed to be there at their request day and night,” said Colonel Lyon, who accumulated 350 combat hours in southeast Asia. “We had known it for years, but it just came home to us a lot quicker over there.”

for antiair activity during his partner's strike before the planes switched roles.

Updating Procedures

When the war ended, the armed forces turned almost immediately to the task of revising doctrine and updating force training procedures.

In an interim postwar assessment last July, the Pentagon identified the underlying problem: Despite more than five months of coordination and efforts to mark thousands of tanks and armored combat vehicles, “the procedures and materiel used by coalition forces were only marginally effective” against friendly

Training With the Army

USAF training with Army units during rotations at the sprawling, 1,000-square-mile National Training Center at Fort Irwin, Calif., is expected to be exempt from steep budget cuts that will be felt elsewhere in the force.

The Air Force also is preparing to consolidate forces to train and deploy with quick-reaction Army units, such as the 82d Airborne Division's Ready Brigade, based at Fort Bragg, N. C. A composite wing of A-10s, F-16s, and C-130 Hercules transports is envisioned at Pope AFB, N. C., to support the XVIII Airborne Corps based at Fort Bragg.

"The Air Force has been accused of not having an appreciation for those guys on the ground the way Marine pilots do," said Colonel Lyon, who brooks no criticism of his service's commitment to the CAS mission. "I take that as a service argument. If I fly close air, I may not have an infantry school background [like Marine aviators], but I definitely have an appreciation to do that mission."

Over the coming year, the Army's National Training Center will add instruments that enable A-10s and F-16s to "kill" and "be killed" during training exercises, a development that officials say will enable both forces to improve precautions against fratricide.

NTC trainers will be able to assess the results of the 200 to 250 CAS sorties flown during a typical fourteen-day Army training rotation. They will use a computer simulation system like the one used to monitor Red Flag exercises at Nellis AFB, Nev. The change will strengthen training for pilots, who fly half of their CAS missions each year at the NTC. Currently, only combat vehicles and helicopters equipped with the Multiple Integrated Laser Engagement System can accurately track their fire.

The changes may help the Air Force and Army build on the lessons of Desert Storm, which put



—Staff photo by Guy Aceto

In these days of budget-cutting, one area of training seems safe from the ax: USAF-Army rotations at Fort Irwin. New computers will strengthen CAS training and improve precautions against fratricide. The lessons learned in Desert Storm will also reduce friendly fire losses without diminishing combat effectiveness.

a premium on knowledge of forces' locations. "We have to become more aware of how we're doing our job," said Colonel Lyon. "The Army has an accountability requirement to tell the Air Force where friendly forces are, as well. These are simple things. We can do it better through training."

The changes should set the stage for CAS pilots to get the realistic night training they need with Army forces to avert the eleventh-hour adaptations required in the Gulf War. "Learning had to occur fairly quickly over there," recalls Colonel Lyon. "When we came back, we began moving to enhance our aircraft and to train our pilots for more operations at night."

Better Equipment

The Air Force is banking on some technical improvements to enhance the effectiveness of CAS missions at night.

A-10s are being upgraded with cockpit lighting compatible with night vision goggles, a target information display on a cockpit screen, and a new low-altitude safety and targeting enhancement package that will provide pilots aural ground-

proximity warning, a radar altimeter, improved accuracy for the 30-mm cannon at slant ranges up to 4,000 yards, and an air-to-air aiming feature for the formerly fixed-sight cannon.

F/A-16s are getting a new low-altitude terrain-following system as well as enhanced computer capability to improve the accuracy of bombing and cannon fire. Enhanced night capability is envisioned with forward-looking infrared radar systems.

Eventually, both the F/A-16 and the A-10 are expected to get Automatic Target Handoff Systems to enable ground-based forward air controllers to transmit accurate targeting information via data bursts to the targeting aircraft.

The ground services are moving, too. A task force at TRADOC devoted early efforts to developing identification, friend from foe (IFF) devices for tanks and armored vehicles. The Marines improved positive target identification at the distant ranges of their thermal sights.

The modifications in training, coupled with better equipment, adaptations in tactics, and revisions in doctrine, are intended to overcome the challenges that came to light during the Persian Gulf War. Even so, the campaign to reduce friendly fire losses without diminishing offensive combat effectiveness is expected to take years. ■

Stewart M. Powell, a national security correspondent for Hearst Newspapers, has covered security affairs for more than a decade while based in Washington and London. He covered Operations Desert Shield and Desert Storm on the Arabian peninsula and in Saudi Arabia. His most recent article for AIR FORCE Magazine was "They Deliver," which appeared in the August 1991 issue.

USAF Human Systems Checklist

Works in progress at Air Force Systems Command's Human Systems Division, Brooks AFB, Tex., and at Armstrong Laboratory, Brooks AFB and Wright Patterson AFB, Ohio

Human Systems Program Office

ACES II Advanced Recovery Sequencer

Program to develop improved sequencing/sensing system for the Advanced Concept Ejection Seat II. The system will expand the performance envelope of the seat, will be reliable and maintainable, and will reduce life-cycle cost. **Contractor:** McDonnell Douglas. **Status:** Engineering development.

Active Noise Reduction

Investigation of a new electronic approach to noise attenuation in aircrew helmets to reduce hearing loss and improve communications capability. **Contractors:** Bose, Ketrion. **Status:** Engineering development.

Advanced Training System

Program to develop for Air Training Command's Technical Training Centers an interactive computer-support system capable of performing and unifying training, development, delivery, testing, and evaluation. With special emphasis on improving training for wartime and sortie generation, ATS will have an impact on the electronic and mechanical specialties, which have expanding training requirements. **Contractors:** IBM, SAIC. **Status:** Full-scale development (FSD), initial development.

Aircraft Mishap Prevention

Program to develop a centralized human factors database. AMP will operate jointly with other human factors-related databases, research, literature, and abstract services. The program provides for analysis, identification, and dissemination of human factors-related trends for reducing aircraft mishaps. **Contractor:** ETA. **Status:** FSD.

Aircrew Chemical/Biological Ensemble

Initiative to develop a new aircrew chemical defense ensemble with improved chemical protection and reduced thermal load. **Contractor:** Hoechst Celanese. **Status:** FSD, initial production.

Aircrew Eye-Respiratory Protection

Program to replace the MBU-13/P chemical/biological oxygen mask with an improved system. Final objective is to equip all crew members in all aircraft with a chemical defense capability. **Contractor:** Boeing. **Status:** FSD, limited production.

Automatic Life Preserver

Development, design, and qualification of an automatic water-actuated inflator for existing LPU-G/P life preservers. Procurement of 4,195 life preservers. **Contractor:** S-Tron. **Status:** Production.

Automatic Liquid Agent Detector

Program to provide a small, lightweight, rugged unit that will detect falling liquid chemical agents and activate audible and visible alarms. **Contractor:** Arvin Calspan Corp. **Status:** Production.

Base Training System

Initiative to develop computerized training management and to optimize training methods in the field for on-the-job training for both military and civilian members of the Department of Defense. **Contractor:** McDonnell Douglas. **Status:** FSD.

Chemical Defense Ground Crew Ensemble

Program to design and develop a one- or two-piece clothing configuration with hood to provide liquid, vapor, and aerosol protection. It also would reduce thermal stress, provide limited flame protection, and be washable and decontaminable. **Contractor:** In-house. **Status:** FSD in Fiscal 1993.

Chemically Hardened Air Transportable Hospital

Program to provide capability for front-line medical personnel to deploy, set up, and operate in high-threat chemical environments. Aim is to provide immediate and improved treatment of troops to increase personnel return to combat units and unit combat effectiveness and to reduce permanent injuries. **Contractor:** ILC Dover. **Status:** Prototype and initial production.

Civil Reserve Air Fleet Aeromedical Evacuation Shipsets

Program to convert commercial Boeing 767 and MD-80 aircraft to aeromedical evacuation platforms by removing airline interiors and installing litter stanchions, liquid oxygen converters, and electrical power converters. **Contractor:** E-Systems. **Status:** Boeing 767, production; MD-80, FSD.

Clothing Branch

Program executes all aspects of research and development on uniform items from concept to phase-out, including test and evaluation, development of specifications, value engineering, and quality assurance. **Contractor:** Red the Uniform Tailor. **Status:** FSD.

Combat Edge

Investigation of methods to provide fighter pilots with enhanced protection against the effects of Gs and to improve pilot endurance using a Pressure Breathing for G System that reduces dependence on the anti-G straining maneuver. **Contractors:** Boeing, General Dynamics. **Status:** Production.

Disposable Eye-Respiratory Protection

Program to develop an inexpensive, compact, disposable mask to be used for short-term chemical/biological protection. **Contractor:** TBD. **Status:** Pre-FSD.

Lightweight Helmet Development

Development and procurement of a lightweight helmet designed for improved stability in the high-acceleration environment. **Contractor:** Gentei Corp. **Status:** Production.

Maintenance Skills Tutors

Program to develop computer-based training systems that use artificial

intelligence to teach advanced troubleshooting skills to improve tactical air forces maintenance. **Contractor:** TBD. **Status:** Pre-FSD.

Night Vision System

Development of a low-profile night vision system that will enable aircrews to see outside the aircraft despite limited illumination while retaining the capability to monitor cockpit displays. System will be ejection-safe. **Contractor:** TBD. **Status:** Conceptual.

Operational Support System

Program to support Threat-Related Attrition (THREAT) System application validation efforts and to conduct concept exploration activities associated with employment of the THREAT System to support Air Force contingency and wartime operation planning requirements. **Contractor:** BDM International. **Status:** Ongoing.

Passenger Smoke and Fume Protection

Development of a device that provides supplemental oxygen for rapid-decompression/oxygen-deficient situations and eye and respiratory protection to passengers aboard MAC aircraft. **Contractor:** TBD. **Status:** Request for proposal preparation.

Pilot Selection and Classification

Program to develop hardware and software evaluation capability to select the most capable flight-training candidates. Payoffs include selection of highest-quality pilots, reduced attrition, optimal assignment, and decreased training costs. **Contractor:** CTA. **Status:** FSD.

Survivable Collective Protection System

Program to develop a shelter capable of withstanding attacks from conventional munitions and chemical/biological weapons. Provides collective protection system and long-term rest and relief. **Contractor:** Price Brothers Corp. **Status:** Production.

Thermal Flash Blindness Protection

Development of systems to protect aircrews from permanent and temporary flash blindness effects associated with nuclear detonations. **Contractor:** TBD. **Status:** Ongoing.

Threat-Related Attrition (THREAT) System

Development of new methodology for estimating personnel attrition and an automated system to estimate attrition rates for Air Force planners and programmers. **Contractor:** BDM International. **Status:** Concept exploration and demonstration/validation (dem/val).

Transportable Airborne Therapeutic Station

Program to develop storage cart for transporting medical records and equipment aboard aeromedical evacuation flights. **Contractor:** Krug International. **Status:** FSD.

Transportable Blood Transshipment Center

Program to develop a transportable modular facility for in-theater recharging or refreezing of human blood and blood products en route to worldwide theaters of military operations or disaster areas. **Contractor:** Arthur D. Little, Inc. **Status:** Full-scale engineering development.

Transportable Collective Protection System

Development of mobile system to provide personnel a toxic-free work/rest and relief environment. May provide chemical protection to bare bases and deployed and detached units. **Contractor:** ILC Dover. **Status:** FSD.

Universal Water Activated Release System

Program to provide the crew member an automatic backup parachute release capability that will release the parachute canopy upon saltwater entry. **Contractor:** TBD. **Status:** Source selection for FSD.

Vacuum Packed One-Man Life Raft

Development of a zero-leak life raft inflation system to be used on current life raft. Procurement of 1,450 vacuum packed systems for use by SAC, AFRES, and ANG. **Contractor:** Conax Florida Corp. **Status:** Production.

Wartime Medical System

Development of automated system analysis tools for the Air Force Surgeon General to optimize wartime medical system and that will contribute to development of wartime medical manpower standards. Allows planners to evaluate selected medical system options against known threats to US air bases. **Contractor:** BDM International. **Status:** Concept exploration and dem/val.

Armstrong Laboratory

Aeromedical Neuropsychiatric Standards

Evaluation and application of research techniques in neuro-behavioral sci-

ence applied to flying population. Active studies on aviator suicide, ten-year psychiatric outcomes, seizure risk after head injury, and new cognitive assessment tests. **Contractor:** TBD. **Status:** Ongoing.

Aeromedical Visual Standards

Development of new techniques for visual disease detection, epidemiologic studies of visual disorders, and development and evaluation of optical devices that may enhance or protect visual performance in the flying population. **Contractor:** TBD. **Status:** Ongoing.

Crew Protection and Life Support

Program of basic, applied, and advanced research to ensure effectiveness and safety of aircrew personnel exposed to mechanical stresses, including acceleration, aerodynamic forces, impact, transient thermal energy, and vibration. **Contractors:** Many. **Status:** Continuing.

Crew Systems Design Techniques

Program to develop design and evaluation criteria for display and control technologies to improve crew member-avionic system interface. Intermediate products include helmet-mounted display (HMD), quick disconnect system, and specifications for testing HMD and miniature cathode ray tubes. **Contractors:** Many. **Status:** Continuing.

Early Disease Detection

Research to detect significant asymptomatic illness in otherwise healthy flying population. Aerospace Medicine Directorate operates 23 study groups to follow disease conditions over time to learn their operational significance. **Contractor:** TBD. **Status:** Ongoing.

Logistics Systems Technology

Development of models to aid logistics personnel and designers with computer-aided design and computer-aided modeling. Aim is to produce an integrated maintenance information system that interacts with the aircraft and the maintenance technician to permit faster repair of the aircraft and higher sortie-generation rates. **Contractors:** GDE, Logicon. **Status:** Advanced development.

Noise

Development of models on the effects on noise and sonic boom on humans, animals, and structures. Supports development of Environmental Impact Assessments. **Contractors:** Many. **Status:** Continuing.

Occupational and Environmental Health

Program to provide consultative support to Air Force bases through telephone consultations and on-site visits. Consultation is provided in occupational medicine, ergonomics, hearing conservation, radiation monitoring, safe drinking water standards, environmental compliance, and hazardous waste disposal and minimization. **Contractors:** Many. **Status:** Continuing.

Operator/System Interfaces

Exploration of ways to improve aircrews' ability to perform under challenging operational conditions. Technologies include active noise reduction, voice communication countermeasures, helmet-mounted system technology, night vision goggles, and display systems. **Contractors:** Many. **Status:** Continuing.

Radiation

Program of studies on the biological effects of electromagnetic and ionizing radiation. Supports program offices in ensuring appropriate safety measures in design of systems producing radiation. **Contractors:** Many. **Status:** Continuing.

Selection and Classification Technology

Development of the Air Force Officer Qualifying Test, used with other indicators for selection of officers for the Air Force, and development of the Basic Attributes Test, a battery of psychomotor, cognitive, and effectiveness tests, for selection and classification of pilot candidates. **Contractors:** Metric, CTA. **Status:** FSD, advanced development.

Technical and Aircrew Training Technologies

Program to develop intelligent, computer-assisted training devices for basic skills enhancement, single-job tutors for flight-line maintenance personnel, intelligent instructional software for technical training instructors, multi-ship training devices, and helmet-mounted displays for various aircrew members. **Contractors:** Lehigh University, University of Texas at San Antonio, General Dynamics, Boeing, General Electric, Rockwell. **Status:** FSD, advanced development.

Toxicology

Program to provide toxicological evaluations of Air Force chemicals and materials, studies to support program offices in evaluating the risk to human health of new materials under development, and development of a pharmacokinetics model to allow assessment of a chemical based on its structure and activity. **Contractors:** Many. **Status:** Continuing. ■

**A noise behind you sounds behind you
—even if you're hearing it through
earphones.**

—Illustration by Guy Acoia

3-D Sound And Other Innovations

By James Kitfield

AIR FORCE technologists, in search of clues that might help them solve some of the deepest problems that now lie before them, are turning more and more to an unexpected source: Mother Nature herself.

In the sound of a twig snapping in the forest, researchers discern an ally in the battle to prevent task overload of fighter pilots. Rotted, moss-covered logs could hold the answer to the problem of toxic waste cleanup. The breaking of a branch offers insights into the development of high-energy-density propellants. A humble mollusk shell or the exoskeleton of a horned beetle could solve mysteries of structure and form for future aircraft.

The emphasis on studying natural processes was noted last September at AFA's National Convention in Washington, D. C., where Air Force Systems Command officials provided briefings on current vanguard initiatives in AFSC's critical Science and Technology program.

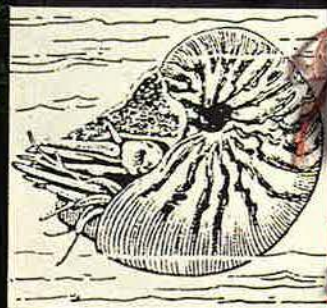
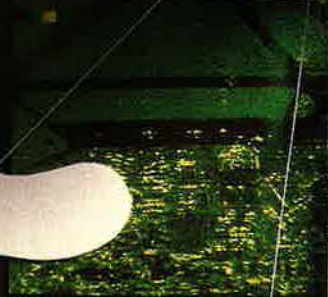
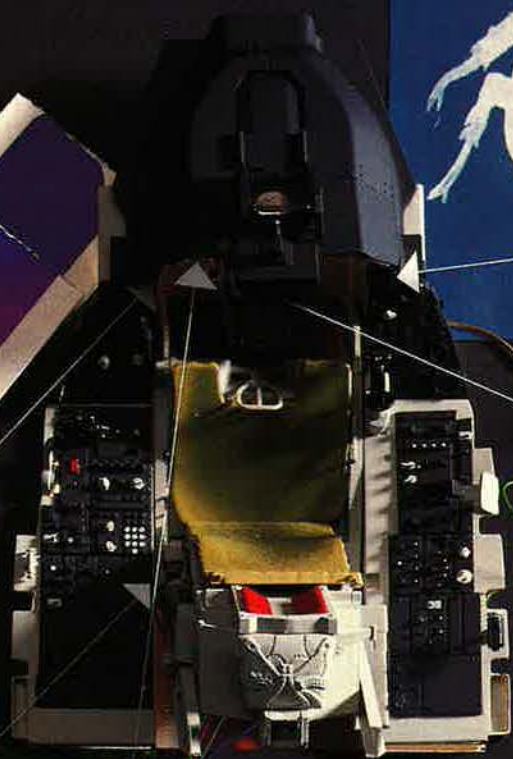
"Our scientists are studying proven methods that Mother Nature has used for centuries," says Lt. Col. Jan Cerveny, program manager

for Bioenvironmental Hazards Research at the Air Force Office of Scientific Research (AFOSR) at Bolling AFB, D. C. "We're discovering how to apply built-in technological advantages of the plant and animal kingdoms and learning how to use them to our advantage."

Take, for example, 3-D sound.

Air Force experts, noting the trend toward more complex, single-seat, multimission aircraft, have become increasingly concerned that pilots are being saturated by the work load imposed on them in the cockpit. The pilot of an F-15 fighter, for instance, develops his "situational awareness" by absorbing data from seventy-five different displays and warning indicators. Moreover, he must give almost instant correct responses on 300 separate switches, eleven of which are on the control stick.

A pilot can become so overwhelmed by competing information signals that he keeps his eyes focused too long on something inside the cockpit, or he ignores the one indicator that might be critical to his survival. One answer to this problem, scientists say, may be to use



AmAero

Nautilus macromphalus

Haliotis



three-dimensional sound to improve a pilot's situational awareness without adding to his work load.

"It's much the same as [when] you walk in a forest and hear a twig snap behind you," says Dr. Richard McKinley, a biomedical engineer in the Bioacoustics and Biocommunications Branch of the Armstrong Laboratory at Wright-Patterson AFB, Ohio. "Most people can turn around and locate the [source] of that sound to within five to ten degrees."

No New Hardware Needed

With 3-D sound, Dr. McKinley says, engineers can provide a pilot with that sort of information on the relative location of things outside a pilot's field of view—be it an enemy missile, ground targets, a pilot's own wingman, or even the end of a runway at night in bad weather.

"The real advantage of 3-D sound is that we can provide all that information in a natural way that doesn't require the pilot to look down into his cockpit or learn any new skills," says Dr. McKinley. "He only has to use the same 'hardware' that we all carry with us."

Much of the data on human reaction to sound were collected at Armstrong Laboratory, Brooks AFB, Tex., by isolating a large geo-

desic sphere inside a soundproof room. The aluminum alloy structure has 272 loudspeakers spaced at regular intervals. Sound can "move around" the sphere at up to two revolutions per second, about the same rate that pilots can roll an F-16 fighter.

Researchers discovered that, by combining data gained from the geodesic sphere with a 3-D audio display generator (which processes audio signals 400 times faster than a personal computer does), they can create the illusion that a sound is coming from a specific point in space.

"We just completed a study that shows that if you make the voice a pilot hears over his headphones sound like it's coming from somewhere outside his head, it's the same as if you turned up the volume by three degrees," says Dr. McKinley. "What they're responding to is the fact that we've presented sounds to pilots in the past in an unnatural way. Sounds come from outside rather than inside your head."

Researchers are trying to create a kind of discussion inside the cockpit, separating various voices and sounds that a pilot might hear as he monitors multiple radio signals and then assigning each voice a specific

point in space. Combined with sensors such as radar warning receivers, 3-D sound can instantly give a fighter pilot the location of an oncoming enemy missile without his ever having to look at a visual display inside the cockpit.

Researchers are likewise exploring the ability to communicate the direction of a wingman by combining 3-D audio and the Global Positioning System (GPS).

Several civilian applications of 3-D audio are now being investigated. The Air Force and the Hines Research Center, part of the Veterans Administration, are examining the use of 3-D sound, the GPS, and a computer navigation system as an autonomous navigation aid for the blind. It's also thought that air traffic controllers could keep better track of aircraft if communications to the controller sounded as if they were coming from specific locations in the control center.

To date, researchers have concentrated their efforts in the laboratory and in high-fidelity simulators at McDonnell Douglas and Rockwell International. The Defense Advanced Research Projects Agency is sponsoring an effort to put a flight-worthy version of 3-D audio in a Marine AV-8B Harrier, with first flight expected in 1992.

Dr. McKinley held open the possibility that a sound system of this type might find its way into the next-generation F-22 Advanced Tactical Fighter, now being developed by Lockheed, Boeing, and General Dynamics.

"The initial version of the Advanced Tactical Fighter won't have 3-D audio," says Dr. McKinley, "but follow-on upgrades possibly will. What I find exciting is that 3-D sound takes advantage of another sensory modality that we all have, but which we've used less heavily than sight because technology didn't allow us to. That means we can add new information without adding more signals or displays."

Paint-Stripper Bugs

With the public becoming increasingly concerned about the state of the environment, Air Force officials have looked closely at the service's share of the more than 1,000 Defense Department facilities that regularly generate hazardous

—Illustration by Guy Acelio



waste. What they have found has not been encouraging.

At the San Antonio Air Logistics Center, Kelly AFB, Tex., for instance, paint is stripped from roughly thirty C-5 Galaxy air transports each year. The process, in which machines air-blast tiny plastic beads against the painted surface, produces huge quantities of contaminated waste.

In the fight against such contamination, Air Force researchers are now concentrating on enlisting the microorganisms responsible for carrying out nature's own degradation process. They believe these natural "bugs" can be engineered not only to digest the hazardous toxins created by the paint-stripping process but also eventually to do the whole job themselves.

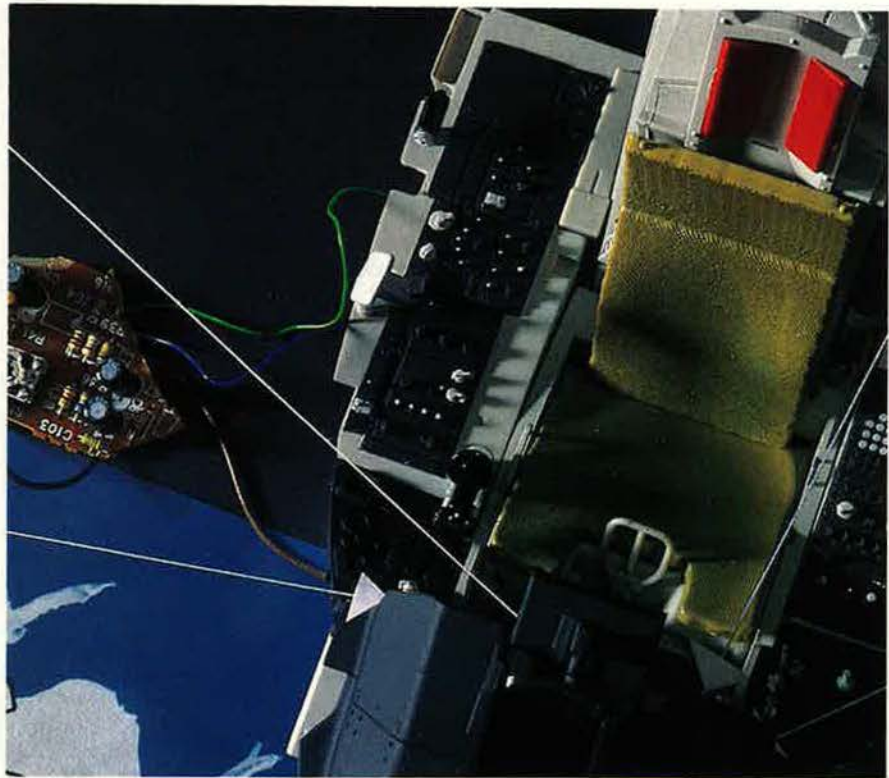
The Air Force has already tested biologically produced fungal and bacterial enzymes that make soluble the plastic-bead residue of paint stripping, leaving only the paint chip waste products. The enzymes then metabolize the toxic heavy metals in the paint chips, making the waste nonhazardous.

Experts estimate that this advance could cut the cost of treating the approximately half-million pounds of waste produced annually by Kelly's paint stripping from \$150,000 to \$25,000.

Finding an effective and practical enzyme-based paint-stripping system is a longer-range goal. Researchers have already identified microorganisms in the lab that can remove and degrade Air Force polyurethane paints. Not only could the natural paint-stripping method significantly lower Air Force maintenance costs, but the bacteria enzyme has also been found to remove paint from aluminum beverage cans, a commercial spin-off that could save \$75 million annually in aluminum recycling costs.

In studying a mercury-contaminated site at the Oak Ridge, Tenn., National Laboratory, researchers discovered a strain of bacteria that has a very high tolerance for toxic heavy metals. The bacteria biologically reduce the heavy metal salts in waste water and can separate heavy metal contaminants such as silver, gold, mercury, chromium, and lead for collection and removal.

That will allow the Air Force to



—Illustration by Guy Aceto

recover chromium from plating operations more safely and cheaply. The photography industry is interested in the bacteria's ability to remove silver from negatives and old X-ray films.

During Operation Desert Storm, Air Force scientists were able to develop a method that induced certain bacteria to make their own "luminescent tags" for easy detection. That led to a biodetection system for biological warfare agents that decreased detection time from twenty-four hours to two hours.

Scientists are harnessing the ability of plants to convert the energy from sunlight to electricity in trillionths of a second. "By coating a leaf of spinach with a thin layer of platinum, for instance, we've been able to tap the current from the chloroplast [the locus of photosynthesis in a plant] without electrodes," says Dr. Fred Hedberg of AFOSR.

That breakthrough, he says, offers the potential for an ultrafast optical-to-electronic switching capability. Uses might include a system that would safeguard a pilot's vision by instantly blocking an incoming laser beam.

Another Air Force initiative stems from a conviction among propulsion experts that a plateau has

been reached in the amount of energy they can extract from conventional rocket propellants.

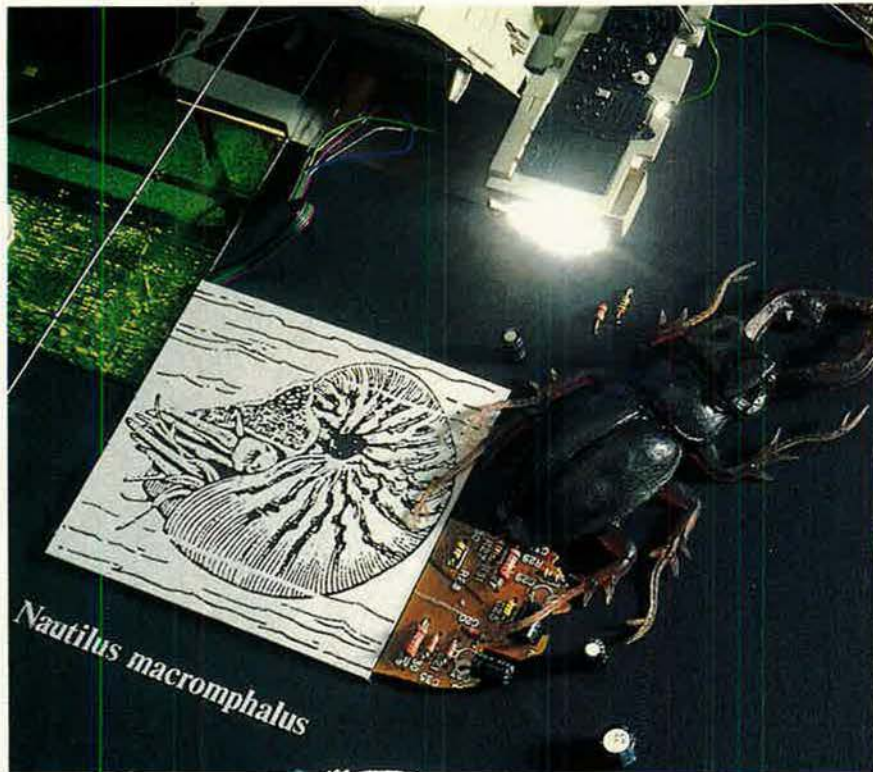
Increasing Energy Density

A key limiting factor is the energy density of today's most advanced rocket fuels, such as the liquid oxygen and hydrogen that power the space shuttle's main engine. Increasing the energy density of such fuels by just ten to twenty percent could almost double the shuttle's payload.

The High-Energy-Density Materials program was launched in 1986 by AFOSR and the Air Force's Phillips Laboratory. Using advanced chemical technology, new computational capability represented by the supercomputer, and such advances in instrumentation as the laser and electron microscope, researchers have embarked on a quest for new concepts of energy storage.

The effort has concentrated on arranging some of nature's smallest building blocks in new ways. One concept, for instance, involves storing large amounts of energy in a molecule by squeezing the atoms together to form high-energy bonds, much the way energy is stored in a compressed tree branch or metal spring.

Phillips Lab scientists are now



developing such a strained hydrocarbon system to use as an additive in a hydrocarbon-based rocket fuel. The additive could translate into a twenty to ninety percent increase in the power of a Titan-sized rocket.

Another concept involves trapping highly energetic atoms. This would permit technologists to store metal powder fuels as atoms or small clusters. If such a system proves out, it could double the shuttle's payload capacity or lift a shuttle-sized rocket into space without solid rocket boosters.

"Desert Storm conclusively demonstrated the critical role space plays in our nation's defense, yet our ability to place more and heavier payloads into space is limited by the current propulsion technology," says Dr. Stephen Rodgers, chief of emerging technologies in the propulsion directorate at Phillips Lab. "We're responding to that challenge by trying to develop revolutionary new rocket propellants with the most energy in the smallest mass possible."

Few Air Force projects present more difficult challenges or promise greater potential payback than the National Aerospace Plane (NASP). A joint program of the Defense Department and the National Aeronautics and Space Administration,

the hybrid aircraft will be designed to use conventional runways, sustain hypersonic flight up to Mach 25 within the atmosphere, and achieve low-Earth orbit like a spacecraft. However, no structural materials known to man can withstand that kind of flight.

"Because the aerospace plane will be flying through the atmosphere at a low angle of attack, and thus for a much longer time than the space shuttle, the temperature on its leading edges could reach as much as 4,000° to 5,000° Fahrenheit," says Dr. Terrence Ronald, the head of materials technology at the NASP Joint Program Office at Wright-Patterson. "We simply don't have any materials that would survive those conditions right now."

Mimicking Mollusks

In the search for such super-resilient materials, researchers are turning to the science of "biomimetics," or the creation of synthetic systems that mimic structural designs found in nature. For instance, the abalone's shell, which resem-

bles common chalk, was found to be extremely tough for its size. Researchers viewing it under an electron microscope discovered that the shell might have served as the prototype for advanced ceramic composites. Its molecules are arranged in a unique brick-and-mortar pattern with a natural polymer acting as the cement between the bricks.

By enlisting the abalone's molecular pattern and substituting higher-tech materials such as boron-carbide ceramic and aluminum, scientists have synthesized an impact-resistant armor twice as tough as man-made ceramics now in use. The Army is testing that armor at Lawrence Livermore National Laboratory.

Also of interest to researchers working on the NASP is the exoskeleton of the horned beetle. In relation to its size, the exoskeleton is lightweight and able to absorb tremendous amounts of kinetic energy.

Scientists are now studying the unique, double-helical design of the skeleton's material in hopes of learning what part the design may play in the shell's strength and flexibility. They've already discovered that, in contrast to conventional composites, which are reinforced with perfectly round, similarly sized graphite fibers, nature's composites are made of more complex structures of intertwining fibers that vary in shape and size.

Researchers are also encouraged by the exoskeleton's ability not only to insulate the beetle but also to allow it to "breathe" and sense damage to the skeleton. Certainly, say technologists, a tough, multifunctional skin able to remove heat and sense damage would prove useful in future aircraft.

"While we have been studying some of these advanced materials for twenty or thirty years at the most, nature has been optimizing structures and processes for millions of years," says AFOSR's Dr. Hedberg. "Advancements in technology have now given us new ways to probe and hopefully unlock some of those secrets of nature." ■

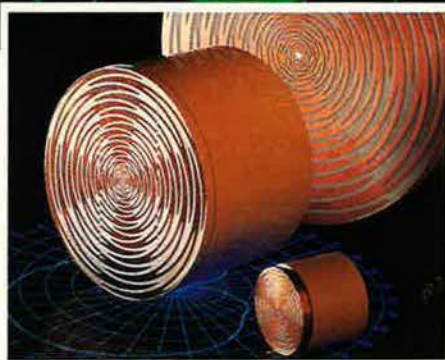
James Kitfield is a defense correspondent in Washington for Government Executive Magazine and 1991 winner of the Gerald Ford Prize for Defense Journalism. His most recent article for AIR FORCE Magazine was "Curtain Up on Materiel Command" in the August 1991 issue.

Photo depicts radiation patterns from a 2 inch Dual Linearly Polarized Sinuous Antenna

The Randtron Dual Polarization Sinuous Antennas! An end to EW/ESM "Polarization Blindness"

Today's fast changing electronics defense environment demands a continuing focus on the development of advanced technologies. Loral Randtron Systems' tradition of excellence in microwave engineering and manufacturing is proven again with the availability of an antenna designed as a drop-in replacement for the single polarization spiral traditionally used in EW or ESM applications.

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Fifteen hours out of California, their B-17 became the first US airplane downed by the enemy during World War II.

—Photo by Paul Kennedy

Shot Down at Pearl Harbor

By Ernest L. Reid

‘DAMN IT! Those are real bullets they’re shooting. I am hit in the leg.” With these words—the last spoken by 1st Lt. William R. Schick, to the best of my knowledge—our troubles became apparent. We were soon to become the first US airplane crew shot down in World War II.

It all began on the night of December 6, 1941, at Hamilton Field, near San Francisco, Calif. I was a member of the 38th Reconnaissance Squadron, then en route to the Philippines on a permanent change of station. Capt. R. T. Swenson was the pilot of the B-17 on which I was copilot. Aviation Cadet G. C. Beale was the bombardier, and 2d Lt. H. R. Taylor was the navigator. Lieutenant Schick, the squadron flight surgeon, had just joined the organization. He had been taken out of the Flight Surgeon School at Randolph Field, Tex., a few days before he graduated in order to go with us and had been assigned to go as a passenger on our plane.

The crew members were MSgt. L. B. Pouncy, the engineer and a veteran of many years in the Army Air Corps; Sgt. Earl T. Williams, the assistant engineer and a capable mechanic and gunner; Cpl. M. C. Lucas, the radio operator; and Pvt. Bert Lee, a gunner.

All in all, it was as experienced an aircrew as could be found in the newly renamed Army Air Forces. A few members of the crew, including Captain Swenson and Lieutenant Taylor, had already made a flight to Hawaii in the spring of 1941. Lieutenant Taylor had been assigned to Ferrying Command for a few months and had made several trips to England. In those days, it took a pilot at least one year and 400 hours as copilot before he could be checked off as first pilot on a B-17. I had completed



Lieutenant Reid's B-17 (above) had been hit amidships, igniting the plane's pyrotechnics. Out of habit, Lieutenant Reid set the parking brake, though this B-17 was clearly not going anywhere. At right are Lieutenant Reid's logbook and the telegram he sent his wife after the attack.



DATE	AIRCRAFT FLOWN		ENGINE	CROSS-COUNTRY		No. PASS.	REMARKS OR INSTRUCTOR'S SIGNATURE CERT. NO. & RATING
	MAKE AND MODEL	CERTIFICATE NUMBER		FROM	TO		
12-6-41	B-17C	2070		Hamilton	Hickum		Went Plane Sgt down in a patrol.
12-12-41	B-17C	2063		"	"		Patrol
12-18-41	"	"		"	"		Sub Hunt. No luck
12-23-41	B-17E	4144		Wheeler	Hickum		Patrol 1st Landing
12-24-41	B-17E	4245		"	"		
12-26-41	"	32197		"	"		
12-27-41	"	"		"	"		
1-5-42	"	"		"	"		

I hereby certify that the foregoing entries are true and correct.

Signed E. LeRay Reid Pilot's Signature

AIRCRAFT WEIGHT AND ENGINE CLASSIFICATION				Instrument Radio or Hood		As Instructor		DUAL
Class.	Class.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.
	4M	19	50					
				3	00			
				1	00			
				8	55			
				2	40			
				10	40			
					20			
					45			
					42	10		
					45	40		
					87	50		

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MRS REID-
559 CENTRAL AVE NEWHAVEN (CONN)-
WIRE MOTHER LOVE-

71625
1031

my first six months and had about 100 hours logged as copilot.

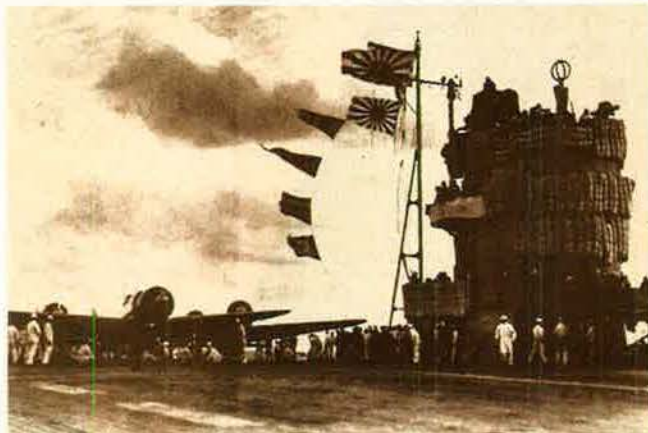
Thirteen B-17s were involved in the flight to Hawaii. We were scheduled to take off at fifteen-minute intervals starting at 9:00 p.m. Western time. At about 7:00 p.m., we had a briefing by a general from Washington. I haven't forgotten the last words he spoke to us because, only a few hours later, they took on an added significance. His words were: "Good hunting and good bombing, men."

Good hunting and good bombing! Little did any of us know just how soon we would be in a position where we wished we could do just that.

One item turned out to be of great significance: While we had all of our guns on the plane, we had no ammunition. We were scheduled to pick up the ammunition in Hawaii and carry it with us to the Philippines.

The Taste of Fear

Our plane, the second one to go, took off on schedule. The trip was tiring but uneventful until the last fifteen minutes. In that short period of a fourteen-hour-plus flight, I saw more action, witnessed more significant events, and felt more strange reactions than in my previous twenty-one years or, for that matter, in all the years



Six Japanese carriers, Akagi (above), Hiryu, Kaga, Shokaku, Soryu, and Zuikaku, spearheaded the infamous attack. Lt. Cmdr. Shigeru Itaya, a Zero pilot from Akagi who commanded the first wave of fighters, claimed credit for downing Lieutenant Reid's B-17, though he thought it was a transport.

since. I have seen much aerial warfare in the intervening years and experienced many of the emotions I felt that day, but never with the same intensity.

No doubt the element of complete surprise made my impressions so vivid and lasting. On later combat missions, I felt fear, but not the same kind. We knew what to expect, and the feeling became somewhat routine. The first few missions were anticipated with an unpleasant feeling in the stomach, but this gradually faded as we gained experience. However, the same feelings, only much stronger, were always present in my forty-nine missions when I came under enemy fighter attack or a bad antiaircraft artillery barrage.

The feeling is fear. Your stomach feels hollow and tight, and your mouth becomes dry. The extent to which

it becomes dry appears to be a measure of how scared you are. It is a normal reaction, and, as long as it can be controlled, your work does not suffer. In fact, fear sharpens your reactions and makes possible the split-second decisions that you often need in order to save yourself and your crew.

Approaching Hawaii

Fifteen minutes before we finally came to a sudden stop on the East-West runway of Hickam Field, we caught our first glimpse of land. It was Diamond Head, a welcome sight. We all looked forward to spending the rest of the day on the beach at Waikiki. As we approached Oahu, Lieutenant Schick began taking pictures with a small camera he had brought along.

As we passed Diamond Head, I noticed a few bursts of AA fire across the landmass, off to our right. I thought some American AA unit was practicing. Then I saw a flight of six pursuit ships apparently flying through a bunch of ack-ack bursts. I recall thinking that somebody on the ground was getting a little careless about where he was shooting.

It was 8:00 a.m. I remember the exact time, because I had to fill out a status report on our engines every hour on the hour.

(At 7:50 a.m., Japanese Imperial Navy Commander Mitsuo Fuchida gave the final signal ordering the attack on Pearl Harbor and the other military installations in the Pacific.)

My status report took a few minutes. When I again looked up, we were on a long base leg to Hickam Field. This leg took us right down the canal toward Pearl Harbor. Captain Swenson ordered me to lower the landing gear. As I did, I noticed a great deal of black smoke coming up from Pearl Harbor. There was too much ack-ack around, and I began to feel that something was wrong, although I still had no idea what it was.

I asked Captain Swenson about the smoke. He thought the islanders were burning sugarcane as he had seen them do during the last trip he made to the islands. I didn't feel too confident about that explanation because I couldn't picture burning sugarcane making such black, oily smoke. In addition, that explanation didn't account for all the shooting. We had made the flight under radio silence, but we were cleared to contact the tower. They had not answered any of our calls.

We had to continue our approach; our gas supply would soon become a problem. We were now at 600 feet and turned to our final approach. I got my first clear look at Hickam Field.

What I saw shocked me. At least six planes were burning fiercely on the ground. Gone was any doubt in my mind as to what had happened. Unbelievable as it seemed, I knew we were now in a war. As if to dispel any lingering doubts, two Japanese fighters came from our rear and opened fire.

A tremendous stream of tracer bullets poured by our wings and began to ricochet inside the ship. It began to look as though I would probably have the dubious distinction of being aboard the first Army ship shot down.

Without waiting for an order from Captain Swenson, I pushed the throttles full on, gave it full rpm, and flicked the "up" switch on the landing gear. It seemed only logical to get quickly into some nearby clouds and try to



Ten of the thirteen B-17s that took off from Hamilton Field, Calif., on the December 6 flight landed safely at a blazing Hickam Field. Maj. Truman Landon, commanding officer of the flight, had all but given up Lieutenant Reid's crew for dead until he saw them late in the day on December 7.

escape almost certain destruction, since we had no way of fighting back.

I had no sooner taken these steps than smoke began to pour into the cockpit. The smoke was caused by some of their tracer bullets hitting our pyrotechnics, which were stored amidships. Captain Swenson and I both realized there was now no choice but to try to land. The captain yanked the throttles off, and I popped the landing gear switch to the down position again. The wheels had only come up about halfway, and they came down and locked before we hit the ground.

While all this was happening, Lieutenant Schick, who had been standing between Captain Swenson and me, said in disbelief, "They are shooting at us from the ground." I had just time to yell at him that the shots came from the back when he screamed that he had been hit in the leg.

Broken in Half

Seconds later, we hit the ground. Because of the smoke inside the cockpit, we couldn't see outside very well, and the plane bounced hard. It took both of us on the controls to get the wings level after that first bounce. Then the tail came down. Almost immediately, the plane began to buckle and collapse, breaking in the middle where the fire had burned through. When that happened, we stopped very quickly.

Habits die hard. One thing a pilot does on stopping is to pull off each of the mixture controls, shut down the switches on each engine, and hit the "gang" bar, which shuts off everything even if the individual switches have not been turned off. Captain Swenson went through the whole routine even though it would have been quicker to hit the "gang" bar and leave. The copilot's key job, after stopping, is to set the parking brakes. I did so, even though it was obvious we were not going anywhere. We found out later that the entire rear end of the plane was hanging by a few spars that hadn't burned through.

The cockpit was now completely black with smoke, and it was imperative to get out fast. I felt my way back to the top escape hatch and could make out the figure of Captain Swenson as he pulled himself up and out. The

plane was in a very awkward position. The rear half, for all intents and purposes, was no longer with us, so when I jumped from the leading edge of the wing, normally about six feet off the ground, I dropped about ten feet. I felt no shock or pain when I landed.

Everyone else in the front had gotten out. We were not sure about the ones in the rear. Obeying my first impulse to get away from the ship before it blew up, I ran a few feet forward and came out of the smoke just in time to see a Japanese plane making another pass at us down the



Of the remaining B-17s, Capt. R. T. Swenson's (with Lieutenant Reid as copilot) suffered the worst damage. Lt. Frank Bostrom was able to land his on a golf course, and Lt. Robert Richards made a successful belly landing on the too-short airstrip at Bellows Field (above) on the other side of Oahu.

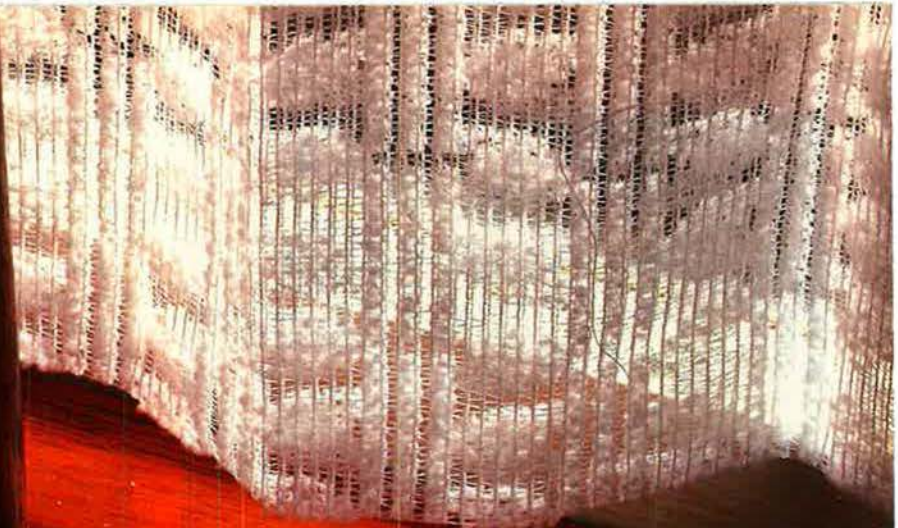
runway. I decided it was better to risk blowing up with the plane than to chance getting hit by a Japanese bullet. I ran back to our ship and hopped up on the left tire under the engine nacelle where, I figured, the mass of metal would protect me from the bullets. As soon as I heard the roar of the fighter passing overhead, I dove out of the smoke and looked around.

I spotted Captain Swenson and Lieutenant Taylor but saw none of the others. I guessed that they had already run for the safety of the row of hangars. I later learned, however, that Aviation Cadet Beale had been shot in the leg. Lieutenant Schick, who had been hit once while in the plane, had managed to get out, but a bullet fired from a Japanese plane had struck him in the head. He was picked up by an ambulance and taken to the hospital but died later that day.

Lieutenant Taylor had been hit in the ear by a piece of shrapnel, and so much blood had flowed down the creases of his neck that he looked seriously wounded. Tentatively at first and then more boldly, Captain Swenson and I wiped away at the blood until we finally came to the damaged area. It was a small nick in his earlobe, and he didn't even know the cause of our concern because he felt no pain.

"There's a War On!"

We then ran for the protection of the nearest hangar. Inside the hangar, a sergeant had just opened a door counter in the supply section and was laying out .45-caliber automatics and loaded ammunition clips. We



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each grabbed a gun and a couple of ammo clips and headed for the back door. The sergeant yelled at us to come back and sign for the guns. One of us hollered back something along the lines of, "Forget it—there's a war on!"

In back of this hangar was the main barracks. We went inside to ask directions to the hospital, where we wanted to check on the status of our crew. It was about then that Lieutenant Taylor let me know that a good part of my hair had been singed off. That must have happened as I was going through the escape hatch—I had felt a quick flash of fire but no pain.

We headed across the parade ground to the hospital and arrived as one of the first ambulances returned from picking up the wounded. I still hadn't grasped the amount of damage already done to Hickam Field and was thinking only in terms of our crew. The first case lifted out as we stood by the back door was not one of ours. It was a grievously wounded airman. One of his legs had been blown off at the thigh, and his side was torn apart. While I was not normally overly upset by seeing accidents or even death, this horrible sight, on top of everything else, was a little too much. I had to sit down on the hospital steps for a few minutes before I could get myself moving again.

In this short time, the scene was transformed. A steady stream of ambulances was pulling up to the front door, and wounded men were coming in under their own power or were being helped by friends. The hospital was soon full, and patients had to be set down in rows along the corridors until someone could care for them. We could not find anyone from our crew in this confusion.



Lieutenant Reid was surprised that his telegram (left) got out on that chaotic day, but the operator took a business-as-usual approach. She was not the only one unaware of Japanese intentions. This makeshift gun emplacement testifies to the unpreparedness of US forces in the region.

There was nothing we could do there, so Captain Swenson, Lieutenant Taylor, and I decided to find the Officers Club in hopes that someone there could suggest something we could do to help. We did not know where it was, but we saw the officer's housing area in back of the hospital, so we headed there to ask directions.

The first house we saw bore a sign that read, "Major Akers." We rang the doorbell, and a maid came to the door. We asked her how to get to the Officers Club. She

just stood there gaping at us. In retrospect, I can see why. Part of my hair was singed off, Lieutenant Taylor had blood all over his flying coveralls, and some of his blood had splashed on both Captain Swenson and me.

"I'll Get You a Brandy"

After a few seconds, a lady's voice came from the back of the house. She asked, "Who is it, Marie?" The maid said, "It's some men, Mrs. Akers. I think they have been in an accident." Mrs. Akers then came to the door and after one look said, "Oh, you poor men! Come in, and I'll get you a brandy."

It took us several minutes to convince her that there was a war on. She had been outside hanging up clothes and thought she was watching maneuvers. Her two children were still outside playing. She called them in. A few minutes later, the second attack started. None of us, of course, had any experience in a bombing attack, but we decided to get under the dining room table, which was massive.

So there we were—Captain Swenson, Lieutenant Taylor, Mrs. Akers, the maid, two children, and I—all curled up under the table for five or ten minutes until the attack was over.

Finally, we decided it was finished, and we crawled out. I asked Mrs. Akers if I could use her phone and charge a cable to the mainland.

I got the cable operator. "Is it still possible to send a cable to the States?" I asked.

"Of course," she said. "Why do you ask that? What is going on out at Hickam anyhow?"

I told her I guessed there was a war on and to please send the following cable: "Am Safe, Wire Mother. Love, Roy."

She assured me that it would be sent. I suspect it was one of the last cables to get out that day. My wife did receive it.

We found out later that morning that the main barracks, in which we had been earlier in the day, had been badly damaged in the second attack and many men there had been killed.

We spent the remainder of the day checking on the other twelve aircraft that had flown with us to Hawaii. One, the crew of which had seen us shot down, flew to the other side of Oahu and landed at a small airport. One landed on a golf course and later flew out. The others landed safely at Hickam Field. One of these had taken enemy fire but was not seriously damaged.

While walking down the edge of the runway and looking in awe at what was left of our plane after the fire had been put out, I spotted our commanding officer, Maj. Truman H. Landon, walking toward us. He looked dejected but, when he saw us, his face lit up with a big smile. He ran to us and shook hands, saying, "Thank God. I thought you might all be dead."

The next day, I climbed up into the cockpit of our plane. I discovered four bullet holes in the armor plate behind my seat. I was one of the lucky ones on the Day of Infamy. ■

Ernest L. Reid was a 2d lieutenant in the US Army Air Forces on December 7, 1941, and served throughout the Pacific theater in World War II. He now lives in Florida.

Many Desert Storm needs had to be filled by local purchase, which involved more than a stack of procurement forms and a bag of money.

Shopping From Scratch

By Amy D. Griswold, Editorial Assistant

WHEN the US launched Operation Desert Shield, Air Force logisticians faced a major, immediate challenge in meeting the needs of tens of thousands of airmen streaming into Saudi Arabia and other Gulf locales. By all accounts, they proved up to the test.

Nowhere is this more evident than in the case of those assigned to the Directorate of Contracting of Central Command Air Forces, this year's winner of the Thomas P. Gerity Award, the highest honor AFA bestows on those in the logistics field. Lt. Col. Bradley R. Busch, director of Contracting, Hq. USCENTAF, accepted the award at AFA's National Convention in Washington, D. C., last September.

Colonel Busch and his staff of eight contracting officers are responsible for finding and providing contract support for all CENTAF activities in southwest Asia. In Operation Desert Shield, the first contracting officers arrived in Saudi Arabia on August 7, 1990, just five days after Iraqi forces invaded Kuwait, which prompted the massive American deployment to the region.

At that time, recalls Colonel Busch, he was on temporary duty elsewhere, "so by the time I got back, they had left, and I caught the next plane that was going over there." On August 13, the Colonel arrived in Riyadh, the capital of Saudi Arabia, and set to work organizing his team's responses.

The scene was, at best, sobering. "When we arrived," recalls Colonel Busch, "there was no logistics structure at all. From a logistics standpoint, this was the worst nightmare, in that we were 8,000 miles from home and there were no permanent [US-operated] air bases over there or [US-operated] army bases or anything."

He went on, "We'd never been allowed to go in there to do any site surveys or market surveys, so we really went in blind. . . . We had no idea who to buy from or what was available, so we basically had to start from scratch."

These initial difficulties quickly began to fade once the Air Force's contracting officers got a chance to learn what was available in the immediate area. Colonel Busch was pleasantly surprised to discover

that much of what he needed to procure was readily available within the Saudi economy or from the markets of nearby countries.

"We were at twenty-five locations in six different countries," he explains, "and virtually everywhere we were—well in some cases it might be fifty, sixty, or seventy miles away—there was a town that had almost everything we needed."

Faster and More Efficient

Access to such supplies was important to the war effort, even though the Air Force had adequate quantities of most basic goods in its prepositioned war reserve materiel stocks located in Oman. In the early weeks of the deployment, at least, purchasing food, water, transportation, and construction equipment in the local economy proved to be a faster and more efficient way of providing necessities than bringing in the tents, kitchens, and other stores from prepositioned stocks.

Moreover, the Air Force was permitted to focus its precious airlift on hauling critical combat-related items: munitions, spare parts, fueling equipment, and the like.

Colonel Busch says that the peacetime way of doing things was turned inside out, a fact that he lamented. In a peacetime exercise, the contracting team arrives on the scene perhaps two weeks in advance, securing contracts for basic necessities. By the time the combat units arrive, everything they will need is already in place. "When the actual deployment came down during Desert Shield, it went just the opposite," says Colonel Busch. "All the flying units came in first, and . . . they would be followed a day or so later by their support teams."

This undoubtedly worked a hardship. The Colonel remarks, "If you arrive and there's nothing there after an eighteen hour flight . . . even the pilots would like to have someplace to get out and go lie down for a while. You can only sleep in an airplane so long, especially in an F-16."

However, Colonel Busch praises the flexibility of the "whole logistics community that was able to make that adjustment and support the beddowns."

By the end of August, a few support units had arrived in Saudi Arabia with some contracting personnel. Colonel Busch latched on to these individuals to supplement his staff of eight in Riyadh, bringing the total at any given time to between twelve and fifteen contracting officers. In order to meet the needs of the combat forces arriving without their own support personnel, Colonel Busch divided the corps of Riyadh-based contracting officers

into small teams. He would then send those teams out to the bed-down locations, some of which were "just a patch of runway and some sand and maybe a source of water."

A day or two before the scheduled arrival of a flying squadron, the contracting officers would travel to the beddown location, often aboard a Saudi C-130, and contract with local vendors so that flying unit personnel would have a place to sleep, eat, and get ready to go into action. In some cases, billeting was available at Saudi bases. Otherwise, the teams had to rent or lease living compounds and warehouses.

In the early weeks it was hard work just to keep pace with the deployment. "At some points we were bedding down up to seven units at one time," Colonel Busch recalls. Between August 7 and September 30, 1990, more than 1,300 contracting actions worth some \$18 million were written in Riyadh alone.

After November 1, when the government of Saudi Arabia offered to pick up the tab for fuel, transportation, water, food, and facilities, Colonel Busch and his staff were faced with a new problem: arranging to transfer the management of 141 contracts from American to Saudi hands.

"That was a real bugaboo," Colonel Busch observes. Transferring "an American contract that was written in accordance with our federal acquisition regulations . . . over to make it become a Saudi contract" created "all kinds of problems" with payments, invoices, and the renegotiation of prices.

"You Just Can't Do That"

The biggest problems came from trying to switch contract responsibility in mid-deployment—after the contracts already had been written and the equipment was in use. Says Colonel Busch, "You can't just turn it in and have the Saudis write contracts with their contractors and start from scratch. You just can't do that when you're in the middle of a deployment."

Colonel Busch's liaison team worked fourteen to sixteen hours a day to hand over the contract responsibilities, but it was not until early February that the transfer was complete. "If we ever do this again," says the Colonel, "we would

hope that the . . . host nation that we go into would take up that responsibility from the get-go."

The lack of a portable, automated tracking system posed another major problem. "We were doing everything manually," notes Colonel Busch. "We'd go over there with nothing but a suitcase full of forms and a bag of money, and that's fine for short deployments and exercises but not for a long-term thing like this."

Shuffling through thousands of forms to track purchase requests and vendors made the contracting officers long for a computer-based system. The automated tracking systems at US bases, however, all are based on huge mainframe computers, far too big to sling over a shoulder and take along. Evidently, it was not possible at the time to install such a system on a lightweight laptop or notebook computer.

The length of the Saudi deployment, however, gave the logisticians time to address this need. The contracting office worked with the logistics management center to develop a new program, the Deployable Contract Automated Tracking System installed on laptop computers and now in use by contracting officers still working in Saudi Arabia.

Colonel Busch and his team were quick to make use of information they picked up along the way. The lack of market surveys at the beginning was quickly overcome by development of vast quantities of information.

"We now have all that data," reports Colonel Busch. "In fact, we had it all shipped here to Shaw [AFB, S. C.,] and we've got it here in a big warehouse. One hundred thousand purchase orders or contracts . . . and still growing."

The raw data will be sorted, analyzed, and used to form a computerized vendor database capable of spitting out lists of vendors for specific items in each locale.

Colonel Busch and his officers developed a CENTAF operational contracting guide, with answers to questions contracting officers faced in those first weeks in Riyadh. The guide includes Arabic phrases and business customs that contracting officers need to know if they are to work smoothly with Arab contractors. ■

By John L. Frisbee, Contributing Editor

Veterans Day, 1967

We all have reason to celebrate November 11, but no one more than Col. Ralph Hoggatt.

IN AIR warfare, the latest technology is not always the best—at least for such specialized tasks as counter-insurgency and special operations, in which the Air Force first became deeply involved during the Vietnam War. Needed for those missions was a maneuverable aircraft with plenty of unrefueled time-on-target, persuasive firepower, a large diversified ordnance load, and the ability to survive heavy battle damage. These were found in the Douglas A-1 Skyraider, developed for the Navy toward the end of World War II. The A-1's role quickly expanded to search-and-rescue (SAR) missions under the call sign "Sandy."

Among the A-1 pilots were many older men with the experience and judgment gained from thousands of hours in the cockpit. One of them was forty-four-year-old Lt. Col. Ralph Hoggatt, who had been a B-24 pilot during World War II and a C-124 and C-133 aircraft commander and instructor. He was serving as a research psychologist when tapped for southeast Asia duty in 1967. Before completing his tour at Udorn RTAFB, Thailand, he would fly 204 combat missions, half of them over North Viet-

nam, with the 602d Fighter Squadron (Commando), later designated the 602d Special Operations Squadron.

Colonel Hoggatt had been at Udorn for less than three months; had flown seventy-four missions, forty-three over the North; and had earned a Thirteenth Air Force "Well Done," when, on November 11, 1967 (appropriately, Veterans Day), he and his wingman, Maj. William Griffith, were scrambled on a SAR mission. An F-4C crew was down near Mu Gia Pass, some 180 miles east of Udorn. The A-1Es, two to cover the HH-3E Jolly Green Giant helicopters and two for fire suppression with Hoggatt as on-scene commander, made voice contact with one survivor at 7:30 a.m. in a heavily defended enemy staging area.

Ralph Hoggatt led the rescue force down through a hole in the ragged 500-foot ceiling. He told the Jolly Greens to hold in a relatively safe area while he located the survivor and suppressed enemy fire with his four 20-mm cannon. Major Griffith circled above to spot enemy gun positions. Almost immediately, his aircraft was hit and burst into flames.

When Colonel Hoggatt saw his wingman's parachute, he temporarily suspended his search for the F-4 pilot and attacked guns surrounding Griffith, whose parachute was caught in a tree thirty feet above the ground. Arriving jet fighters could give only intermittent support through breaks in the overcast. It was essentially one

A-1E against many AA guns, automatic weapons, and small arms.

When enemy fire diminished, Colonel Hoggatt called in a Jolly Green, which was driven off by 37-mm guns. On a second try, with Hoggatt's supporting fire, the HH-3 lowered Airman Roy Taylor on a forest penetrator. It took Taylor several minutes to cut Griffith free while the Jolly Green hovered 100 feet above, a fat target for the guns below. Finally both men were hauled aboard the damaged helicopter, and Hoggatt helped cover their successful withdrawal.

Colonel Hoggatt's A-1 had taken many hits. There was no telling how long it would hold together. Nevertheless, as the Jolly Greens disappeared to the west, he turned back to continue searching for the F-4 survivor. More A-1Es were on the way to join him, and if he remained in the area he could show them the general location of the downed pilot and of the enemy guns. Hoggatt stayed with the SAR force until low fuel forced his return to base. The search continued throughout the day, but the F-4 crew was never rescued.

Ralph Hoggatt approached Udorn with only a few minutes' worth of fuel remaining. There were gaping holes in his aircraft's engine cowling, wings, underbelly, and upper fuselage, which was streaked with oil and hydraulic fluid. He was unable to lower his landing gear and had to sweat out those last few gallons of fuel while the runway was being foamed for his first-ever crash landing. Miraculously, as he rounded out for touchdown, his landing gear dropped into place.

Lt. Col. Ralph Hoggatt, now a retired colonel living in San Antonio, Tex., was awarded the Air Force Cross for extraordinary heroism that day when, for nearly an hour, he almost single-handedly faced overwhelming odds in one of the hottest areas of southeast Asia. There were many more SAR missions before he returned to the States, but none more memorable than that one on Veterans Day, 1967. Colonel Hoggatt's heroism brought honor to himself and kept faith with those before him who had forged the Air Force tradition of valor. ■



AFA'S EIGHTH ANNUAL AIR WARFARE SYMPOSIUM

"Air Warfare—Changing Patterns in a Changing World"

January 30–31, 1992 The Buena Vista Palace Hotel, Orlando, Florida (800) 327-2990

Keynoter

Gen. John M. Loh, Commander, TAC

Invited Speakers

Gen. Merrill A. McPeak, Chief of Staff, USAF

Gen. George L. Butler, Commander in Chief, SAC

Gen. Charles C. McDonald, Commander, AFLC

Gen. Robert C. Oaks, Commander in Chief, USAFE

Gen. Ronald W. Yates, Commander, AFSC

Gen. Jimmie V. Adams, Commander in Chief, PACAF

Lt. Gen. Joseph W. Ashy, Commander, ATC

In conjunction with Tactical Air Command, we are sponsoring our eighth annual Orlando symposium on air warfare, entitled "Air Warfare—Changing Patterns in a Changing World." This symposium will provide an in-depth exploration of all aspects of air warfare requirements in the context of the changing nature of national security strategy, organizational changes in the US Air Force, emergence of high-technology threats in many potential theaters of operations, and extraordinary budget constraints.

For more information call Jim McDonnell at (703) 247-5810 or Dottie Flanagan at (703) 247-5805.

Golf Tournament

AFA's Central Florida Chapter will sponsor a golf tournament on Walt Disney World's Magnolia Course (and others as needed) on Wednesday, January 29. Contact Bob Ceruti at (407) 365-1519.

Gala

The Central Florida Chapter will also sponsor its eighth annual black-tie Gala. Proceeds will benefit AFA's Aerospace Education Foundation as well as AFROTC, scholarships, and other aerospace education activities.

For more information contact Marty Harris at (407) 356-4810.

Exhibits and Displays

For each Gala table purchased, companies will be allowed 100 square feet of exhibit space. Exhibits will be on display during the two-day Symposium and Gala.

For more information on exhibits, contact Pat Teevan at (703) 247-5836.

Registration Form

"Air Warfare—Changing Patterns in a Changing World"

Registration closes Monday, January 20, 1992. No refunds can be made for cancellations after that date.

Mail this form to:

Air Force Association
Attn. Miss Flanagan
1501 Lee Highway
Arlington, VA 22209-1198

For AFA use only

Fee paid Registration confirmed

Name (Print)	Title	
Affiliation		
Address		
City	State	Zip
Telephone	Area Code	Number

My check covering the Symposium fee for AFA individual or Industrial Associate member of \$315, payable to the Air Force Association, is enclosed. The fee includes one (1) reception/buffet ticket and one (1) sandwich-lunch ticket. **Note: Fee for nonmember is \$340.**

— Mark here if an extra guest reception/buffet and/or lunch ticket is desired. Enclose \$120 for the additional buffet ticket; \$16 for the extra lunch ticket.

It takes the right props to train an RAF pilot. Shorts Tucano



If it can win over the Royal Air Force, the Shorts Tucano turbo-prop has got to be a cut above the rest.

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But the Tucano is only one of the ways in which Shorts is making its mark in the military contracts field. Shorts manufactures the C-23 Sherpa freighter aircraft in use with the United States forces, and is also an acknowledged pioneer and leader in close-air defence systems. On the civilian side Shorts is a major force in the commuter aircraft industry and a key supplier of aerostructures for the world's largest aircraft manufacturers.

Now, with the high-performance Tucano, Shorts is helping a new generation of the world's most skilled jet pilots get off the ground.

While keeping the cost down to earth.



SHORTS



By Daniel M. Sheehan, Assistant Managing Editor

State Conventions

The Great Lakes Region's largest state organization, Ohio AFA, held its annual convention in Youngstown, Ohio, this year, hosted by the **Steel Valley Chapter**. Delegates from all over Ohio gathered at Youngstown Municipal Airport to conduct business, formulate policy, attend briefings, and tour the facilities. Youngstown MAP is home of the 910th Tactical Airlift Group (AFRES) and the 757th Tactical Airlift Squadron (AFRES), and some of the delegates and their guests took the opportunity to get a close look at some of the AFRES aircraft on base. Maj. Gen. Donald R. Jenkins, AFRES (Ret.), former commander of the 757th TAS, was the guest of honor and featured speaker at the convention's banquet. Among the delegates and guests who heard the General's speech were 910th TAG Commander Col. James D. Bankers, National Vice President (Great Lakes Region) Cecil H. Hopper, and Ohio State Secretary Capt. John Keytack. In a break from tradition, next year's Ohio Convention will not be held at a military facility but rather in Columbus, Ohio, in conjunction with that city's celebration of the 500th anniversary of its namesake's explorations.

San Antonio was the site of this Year's Texas State Convention. Delegates and friends gathered in the historic city to bestow honors, conduct business, and enjoy an old-fashioned Texas barbecue hosted by the **Alamo Chapter**. North Texas was not forgotten in the festivities as the **Panhandle Chapter** garnered two high honors. Chapter Vice President Barry L. Smith was named Texas Man of the Year, and Chapter President Guy W. Leach picked up the Panhandle Chapter's award as Outstanding Chapter of the Year. Among the many dignitaries who attended the convention were National President O. R. Crawford and his wife Nancy, Executive Director Monroe W. Hatch, Jr., and his wife Delores, National Vice President (Southwest Region) Aaron C. Burleson, Texas State President John Russell, Texas State Vice President



In what may be a first for AFA, the Tri-County Chapter held an airborne meeting. En route from two New Jersey airports to Old Rhinebeck Aerodrome, N. Y., chapter members made radio contact, opened the meeting, and elected a slate of candidates. The new officers are Secretary Jack Lamb, Vice President Tony Alcaro, and President Cy LaManna (from left, with pilot) and Treasurer Nelson Kerr.



More than 120 people heard Sen. Lloyd Bentsen (D-Tex.) address a meeting of the Wichita Falls (Tex.) Chapter. Senator Bentsen (center) stressed the challenges of international economic competition. With the Senator are (from left) National President O. R. Crawford, Sheppard TTC Commander Maj. Gen. Dale Tabor, Texas Vice President (North) Bob Seidel, and Chapter President Larry Pritchett.

(West) Eldon Turner, and Air Training Command Senior Enlisted Advisor CMSgt. George T. Moriarty.

Chapter News

Recognizing that the sterling per-

formance of the Air Force Reserve contributed a great deal to the success of Operation Desert Storm, the **San Bernardino Area (Calif.) Chapter** sponsored a Salute to the Reserves to honor personnel of the 445th Military

Airlift Wing (Assoc.) from Norton AFB, Calif. Outstanding performers in five fields received awards: CMSgt. Calvin E. Allen, operations; TSgt. Peter Z. Gutierrez, maintenance; 1st Lt. Kelly J. McPeters, medical; SrA. Tina M. Orosco, personnel; and SSgt. Judy A. Regan, transportation. Lt. Gen. Richard J. Trzaskoma, commander of 22d Air Force, gave the keynote address, and Col. Warren D. Snyder, commander of the 445th MAW, presented the awards. Chapter President Bill Christensen and Chapter Vice President for Veterans Affairs Phil Arvizo presented General Trzaskoma with a first-day cover commemorating the issue of the Gen. H. H. "Hap" Arnold stamp.

Earlier, President Christensen and National Director Ed Stearn traveled to Norton AFB to bid farewell to Brig. Gen. Ralph G. Tourino, outgoing commander of the Ballistic Missile Organization. General Tourino received a National Citation for his fine work as commander prior to his departure for Wright-Patterson AFB, Ohio, where he will assume duties as B-2 Program Director.

National Director Edward J. Monaghan joined with Chapter President Maj. Frederick D. "Dutch" Overly of the **Anchorage (Alaska) Chapter** to present awards at nearby Elmendorf AFB. Col. Don Creighton, vice commander of 11th Air Force, accepted a plaque that will hang permanently in the Elmendorf Officers Club to honor the base's Company Grade Officer of the Quarter. The plaque bears the name of Col. William O. Eareckson, World War II head of 11th Air Force Bomber Command. CMSgt. John Eldridge, senior enlisted advisor for the 21st Combat Support Group, accepted a plaque designed to honor the Airman, NCO, and Senior NCO of the Quarter, respectively. This plaque will hang permanently in the Elmendorf NCO Club and is named after Sgt. Howard Nelson, who did yeoman service as a mechanic during World War II in the Aleutians.

Lt. Col. Ron Sams, assistant deputy commander for Operations, 305th Air Refueling Wing, Grissom AFB, Ind., has been spreading the word around the Hoosier State about the fine performance of Grissom-based troops during Desert Storm. First, he gave an address at the quarterly dinner meeting of the **Central Indiana Chapter** that Chapter President Paul Gorman and Chapter Secretary Ted Eaton termed "outstanding." Later, Colonel Sams, who served in Saudi Arabia as chief of air refueling operations for



Rep. Ike Skelton (D-Mo.) (left) accepts the Distinguished Congressional Service Award from President Crawford (center) and Chairman of the Board Jack C. Price. A member of the Armed Services Committee, Representative Skelton, whose district includes Whiteman AFB, was honored for his "sustained support of a strong national security posture" and "his many initiatives to educate . . . the American public about the need for the B-2 Stealth bomber."

the 1703d Air Refueling Wing—Provisional, addressed a meeting of the **Southern Indiana Chapter**, during which he described some of his 150 combat hours over the Gulf, refueling all types of aircraft, including the F-117. Chapter President Hank Weidner and Chapter Secretary Mark Oliphant echoed their Central Indiana counterparts in their praise for Colonel Sams's speech.

The **Spirit of St. Louis (Mo.) Chapter** mourns the passing of astronaut

James Irwin [see "Aerospace World," November 1991 issue, p. 28], who spoke to the chapter not so long ago. Chapter members credit Colonel Irwin for his inspirational message and his personal warmth, and they send heartfelt condolences to his family.

Have AFA News?

Contributions to "AFA/AEF Report" should be sent to Dave Noerr, AFA National Headquarters, 1501 Lee Highway, Arlington, VA 22209-1198. ■

Bulletin Board

Seeking to purchase green or blue cloth **flight jackets** issued to Air Force personnel in the 1940s and 1950s. **Contact:** Jeff Spielberg, P. O. Box 5178, Santa Monica, CA 90409.

Seeking a Korean War—era patch from the **39th Fighter Interceptor Squadron**, 51st Fighter Group. **Contact:** Jim Hatzebuehler, 3040 Sunlake Blvd., #1910, Huntsville, AL 35824.

Seeking information or photos of **Lt. James "Jimmie" Wendell Sowder**, USAAF, from Covington, Ky., who trained at Randolph AFB and Kelly AFB, Tex. (Class 41-G or 41-H), and was in the 74th Bomb Squadron, 6th Bomb Group, in Guatemala. He died on a mission in July 1942. I would especially like to contact his friends from the 74th Bomb Squadron: 2d Lt. William J. Rivers, Capt. James D. Riel, and John Simpson. **Contact:** Linda Greer, Box 371, Old Ocean, TX 77463.

A national veterans' association is seeking **underage veterans** who lied about their age to enlist in the US military before age seventeen. **Contact:** Jack Britton, 3444 Walker Dr., Ellicott City, MD 21042.

Seeking contact with USAF or civilian personnel associated with the fall 1972 deployment of F-111A aircraft to southeast Asia within **Constant Guard V directives**. I am especially interested in investigations of F-111A losses conducted by the Air Force Inspection and Safety Center. **Contact:** Joseph C. Caffarelli, 195 Prospect St., #102, East Orange, NJ 07017.

Seeking contact with personnel who worked with the **SCR-270/1 radar** at any point since the initial deployment of SCR-271s to the Panama Canal Zone in 1940. **Contact:** Donald A. Helgeson, 9200 Bennett Ave., Evanston, IL 60203.

Seeking information on **MSgt. Billy Martin Gage**, who served in Korea in 1950-51; Bartow AFB, Fla., in 1951-52; and Eglin AFB, Fla., in 1952-54. **Contact:** Bill Gage, 1004 Northcliff Dr., Raleigh, NC 27609.

Seeking information on veterans who served in the **485th Bomb Group** at Smoky Hill AAF, Kan., in 1945-46. Also seeking information on the 485th Missile Wing at Florennes AB, Belgium, from 1985 to 1989. **Contact:** Robert S. Deeds, 6337 Northridge Ln., Apt. 2, Toledo, OH 43612-4757.

Seeking information on the whereabouts of **Garth Woodson Lynn**, who was a member of pilot Class 48-B and served in Korea. **Contact:** Fred Beissner, 680 Village Green Pkwy., Newport News, VA 23602.

Seeking information and photographs of **reconnaissance aircraft**, all types. **Contact:** Capt. Michael Mayer, AFRES, 440 Dixon Landing Rd., Apt. I-102, Milpitas, CA 95035.

The Mascoutah Aerospace Museum is seeking patches, oxygen masks, flight gear, uniforms, pictures, and other **artifacts of Air Force life**. **Contact:** John D. Roy, 1313 W. Main St., Mascoutah, IL 62258.

Collector seeks **aircraft models**, military and civilian, from World War II to the present, including black or gray spotter models, manufacturer models, promo and topping models, and wind tunnel models. **Contact:** Robert Csetri, 3332 Keystone Ave., #9, Los Angeles, CA 90034.

Seeking the whereabouts of **Cpl. Richard Parkhurst**, who was stationed near Theberton, Suffolk, England, in World War II. **Contact:** C. A. Robertson, 53 Ryedale, Wallsend, Tyne & Wear, NE28 8TT, England.

Seeking contact with **Cecil Dewey Jackson** from Atlanta, Ga., who was stationed at RAF Alconbury, England, in 1965-66, where he knew Basya Townson, from Leicester. He also used the name Caesar Conours. **Contact:** Marcus A. Hay, 4 College St., Flat 2, Highfields, Leicester LE2 0JH, England.

Seeking contact with former **USAF Marksmanship Instructors** in southeast Asia during the Vietnam War. **Contact:** MSgt. Don Combs, 9206 Cliffway, San Antonio, TX 78250.

Seeking contact with **James S. Livingwood, Jr.**, and **Anthony J. Corcoran**, B-29 crew members of the 29th Bomb Group, 314th Bomb Wing, 20th Air Force, in World War II. **Contact:** Clem Heddleson, 9619 Carriage Rd., Kensington, MD 20895.

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 cannot acknowledge receipt of letters to "Bulletin Board." We reserve the right to condense letters as necessary. Unsigned letters are not acceptable. Items or services for sale or otherwise intended to bring in money will not be used. Photographs cannot be used or returned.—THE EDITORS

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WORLD'S LARGEST MAKER OF AEROSPACE REPLICAS

For a history of **explosive ordnance disposal**, I am seeking photos, stories, unit histories, log-books, journals, and other material from EOD personnel, retired or active-duty. **Contact:** CMSgt. Marshall "Doc" Dutton, USAF (Ret.), 150 Grand View Ave., Valparaiso, FL 32580.

Seeking information about the pilot who shot down three aircraft in the Aleutian Islands in 1942 using a **P-39, nose number 31**, now in the Air Force Museum at Wright-Patterson AFB, Ohio. **Contact:** Lt. Col. Leslie Spoons, USAF (Ret.), 2415 McKinley Ave., Apt. 44, El Paso, TX 79930.

Seeking a history of the **387th Bomb Group**, which was stationed at Chipping Ongar, England, from 1943 to 1945. They were known as the "Tiger Tails" and served with 8th Air Force before being assigned to 9th Air Force in late 1943. **Contact:** Don Goodenow, 3128 Sunnybrook Dr., Charlotte, NC 28210.

Seeking an **SR-71 baseball cap** from the 9th Strategic Reconnaissance Wing, Beale AFB, Calif. The emblem on the cap must be of the SR-71 or the unit that operated the Blackbird. Also seeking contact with aircrew who flew the SR-71 and have patches, scarves, or other memorabilia to trade. **Contact:** Rodney King, 10 Paul Roos St., Rynfield, Benoni 1501, Republic of South Africa.

For a book, I am seeking contact with anyone who worked on or around the **F-86 Sabre** in Korea during the Korean War or with the 1st Fighter Group at March AFB, Calif., in 1949-50. **Contact:** Robert F. Dorr, 3411 Valewood Dr., Oakton, VA 22124.

Seeking staff members or graduates of the **USAAF Air Intelligence School** at Harrisburg, Pa., from 1942 to 1944. **Contact:** W. S. Taylor, 5053 S. 22d St., Arlington, VA 22206.

Seeking contact with former Ferrying Command personnel who were involved in the **Alaska Military Highway** of the Northwest Staging Route between Montana and Alaska through Edmonton, Canada, from 1942 to 1945 to invite them to the Alaska Highway Commemorative Symposium, June 3-7, 1992, in Edmonton. **Contact:** David A. Kales, P. O. Box 1013, Edmonton, Alberta T5J 2M1, Canada.

Seeking the whereabouts of **William C. Tait**, who was stationed at Haneda Service Annex, Japan, in 1948-50 and reenlisted in the Army in 1951 to serve in Korea. **Contact:** Dennis L. Dagen, HC Box 14, Warroad, MN 56763.

Seeking contact with **USAFE NCO Academy** graduates. Also seeking contact with USAF/USN/USMC personnel who participated in **Project Blue Straw/Blue Shield** (JTG-4) from September through December 1965. **Contact:**

MSgt. Thomas W. Young, Sr., USAF (Ret.), 830 W. Amsden St., Denison, TX 75020.

Seeking contact with any personnel assigned to the **8th Motor Vehicle Squadron**, 8th Fighter-Bomber Wing, 5th Air Force, stationed at Suwon AB, Korea, in 1950-52. **Contact:** CMSgt. Howard V. Alston, USAF (Ret.), 120 Adams St., #4, Pocatello, ID 83202.

Collector would like to trade **USAF squadron and competition patches**, especially William Tell and Gunsmoke. **Contact:** Ken A. McLaren, 1171 Ambleside Dr., #304, Ottawa, Ontario K2B 8E1, Canada.

Seeking contact with **Lawrence A. Grider**, crew chief of the B-17G *Cock-o-the-Sky* with the 710th Bomb Squadron, 447th Bomb Group, in World War II. **Contact:** W. G. Russell, 521 Russell Ln., Weatherford, TX 76087.

Seeking information on **1st Lt. George H. Tate**, USAF, from Connecticut, who was stationed at Schilling AFB, Kan., in 1955. **Contact:** Robin Ann Ward, Box 176, Lucas, KS 67648.

Seeking information on **President Kennedy's trip to Texas in November 1963**, especially Air Force support of the assassination investigation. **Contact:** Capt. J. N. Sheppard, USAF, General Delivery, APO AE 09080.

For a history of the base, I am seeking information on **Francis E. Warren AFB, Wyo.**, from 1947 to the present. I especially need information on Air Training Command, Atlas and Minuteman missile deployment, and pacifist opposition to any missile deployment. Also seeking information on community relations between the base and the city of Cheyenne. **Contact:** Capt. Phillip J. Crouch, 102 Colorado Ave., Jacksonville, AR 72076. ■

Unit Reunions

"Curtain Raiser" Competitors

Competitors in the first SAC Missile Combat Competition, "Curtain Raiser 1967," are planning to hold a reunion April 25-29, 1992, during the 1992 SAC Missile Combat Competition, at Vandenberg AFB, Calif. **Contact:** Mike Kenderes, P. O. Box 5509, Vandenberg AFB, CA 93437. Phone: (805) 866-6184.

U-2/TR-1 Pilots

U-2/TR-1 pilots and navigators will hold a reunion September 25-27, 1992, in Tucson, Ariz. **Contact:** Lt. Col. James E. Cain, USAF (Ret.), 11361 E. Hash Knife Cir., Tucson, AZ 85749. Phone: (602) 749-9746.

2d Bomb Wing

Members of the 2d Bomb Wing will hold a reunion May 26-29, 1992, in San Antonio, Tex. **Contact:** Col. John B. Boynton, USAF (Ret.), 9425 Sumac Ln., Garden Ridge, TX 78266. Phone: (512) 651-6614.

8th Air Force

Veterans of the 8th Air Force will hold a fiftieth-anniversary reunion January 27-February 1, 1992, in Savannah, Ga. **Contact:** 8th Air Force 50th Anniversary, P. O. Box 23606, Savannah, GA 31403-3606.

55th Strategic Recon Wing

The 55th Strategic Reconnaissance Wing will hold a reunion in conjunction with the Boeing Co.'s B-29 Superfortress fiftieth-anniversary celebration August 12-15, 1992, at the Westin Hotel in Seattle, Wash. Past and present members and assigned and attached units are invited. **Contact:** Bruce M. Bailey, 1611 S. Aida Ave., Tucson, AZ 85710.

92d AMU/TFS

Members of the 92d Aircraft Maintenance Unit/92d Tactical Fighter Squadron stationed at RAF Bentwaters, England, between 1984 and 1988 will hold a reunion August 9-15, 1992, at Walt Disney World, Fla. **Contacts:** Dave Schoff, 1209 Gregory Dr., San Angelo, TX 76905. Phone: (915) 655-0884. Dee Blackburne, 320 Wilson Dr., Mountain Home, ID 83647-1570. Phone: (208) 587-9785.

302d Tactical Airlift Wing

Members of the 302d Tactical Airlift Wing have

scheduled a reunion for August 21-23, 1992, in Columbus, Ohio. **Contact:** Paul R. Priday, 7755 Harriot Rd., Plain City, OH 43064.

392d Bomb Group

Members of the 392d Bomb Group, 8th Air Force (World War II), will hold a reunion June 1-13, 1992, in King's Lynn, England. **Contact:** Keith Roberts, 26631 Dorochea, Mission Viejo, CA 92691.

446th Bomb Group

Members of the 446th Bomb Group ("The Bungalow Buckaroos"), 8th Air Force (World War II), will hold a reunion August 28-31, 1992, at the Valley Forge Hilton Hotel in King of Prussia, Pa. **Contact:** Marvin H. Speide, 708 Dianne Ct., Rahway, NJ 07065.

474th Tactical Fighter Wing

F-111 aircrews, officers, and assigned and attached units of the 474th Tactical Fighter Wing stationed at Nellis AFB, Nev., or Takhli RTAFB, Thailand, will hold a reunion September 17-20, 1992, in Las Vegas, Nev. **Contact:** Lt. Col. William G. Meyer, USAF (Ret.), 3676 Monte Verde St., Las Vegas, NV 89121. Phone: (702) 458-5736.

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.

556th Bomb Squadron

Members of the 556th Bomb Squadron, 387th Bomb Group, will hold a reunion June 3-7, 1992, in San Diego, Calif. **Contact:** Paul R. Priday, 7755 Harriot Rd., Plain City, OH 43064.

556th Recon Squadron

The 556th Reconnaissance Squadron, which

served at Yokota AB, Japan, between 1967 and 1972, has scheduled a reunion for April 3-5, 1992, at the Ramada Hotel-San Remo in Las Vegas, Nev. **Contact:** Maj. Jerry Goodenough, USAF (Ret.), 4814 Maple, Bellaire, TX 77401. Phone: (713) 665-2491 or (713) 668-9966.

Cavalcade of Wings

For the purpose of celebrating the fiftieth anniversary of Kirtland AFB, N. M., in 1992, the Bombardiers Inc., the Cavalcade of Wings, and former Kirtlanders are seeking military and civilian personnel who served from 1940 on at Kirtland AFB. **Contacts:** Harry M. Davidson, 1408 Jefferson, N. E., Albuquerque, NM 87110. Phone: (505) 256-7212. Lt. Col. Robert C. Lory, USAF (Ret.), 398 Antelope Cir. S. E., Albuquerque, NM 87123-3518. Phone: (505) 298-3896. Sam Erisman, 801 Amherst Dr. N. E., Albuquerque, NM 87106. Phone: (505) 255-4780.

V Bomber Command

For the purpose of holding a reunion in June 1992, I am seeking members of the V Bomber Command (5th Bomber Command) who served with 5th Air Force in the southwest Pacific. **Contact:** Louis J. Buddo, Box 35372, Louisville, KY 40232.

12th Bomb Squadron

Seeking former members of the 12th Bomb Squadron, 341st Bomb Wing, stationed at Dyess AFB, Tex. (August 1956-July 1961), who are interested in holding a reunion in 1992 in Abilene, Reno, or Las Vegas. **Contact:** William E. Krueger, 3700 Elizabeth Ave., #84, Olympia, WA 98501.

Class 69-04

I would like to hear from members of Pilot Training Class 69-04 (Williams AFB, Ariz.) who would be interested in planning a reunion in the fall of 1992. **Contact:** Greg Leppert, 413 Paine Ct. S. E., Olympia, WA 98503. Phone: (206) 456-4672.

303d Bomb Group

Seeking former members of the 303d Bomb Group for a fiftieth-anniversary reunion in 1992. **Contact:** Carlton M. Smith, 3219 Cobblestone Dr., Santa Rosa, CA 95404. Phone: (707) 546-3655. ■

Books

By Frank Oliveri, Associate Editor

Arms and the Man: Dr. Gerald Bull, Iraq, and the Supergun, by William Lowther. This book tells the story of a brilliant Canadian gun scientist whose dealings in the world arms trade led to his murder in Brussels on March 22, 1990. At the time of his death, Dr. Bull was building the so-called "supergun," a huge cannon, for Iraqi dictator Saddam Hussein. The weapon could have launched satellites or shot nuclear or chemical weapons at targets up to 1,000 kilometers away. This book attempts to shed light on who murdered Dr. Bull and points out that a number of governments had an interest in seeing him dead. Presidio Press, 31 Pamaron Way, Novato, CA 94949. Including photos and index, 298 pages. \$24.95.

Avoiding War: Problems of Crisis Management, edited by Alexander L. George. Starting with the premise that a crisis can be handled well or poorly, Mr. George provides principles and strategies to help governments improve crisis management skills. The editor and other analysts touch on a wide variety of issues and on historical topics ranging from World War I to the Korean War and the 1962 Cuban missile crisis, hoping that analysis of past crises will help policymakers cope with global challenges. Westview Press, Inc., 5500 Central Ave., Boulder, CO 80301. Including notes and index, 590 pages. \$59.95.

Beyond Guns & Butter: Recapturing America's Economic Momentum After a Military Decade, by Glenn R. Pascall and Robert D. Lamson. This book attempts to present a "bipartisan" program to increase US economic competitiveness while protecting national security. An inefficient defense budget weakens defense capabilities by draining resources, wasting skilled and technical manpower and making the US less competitive internationally. The book includes an agenda for accelerating the American economy while providing the means for defending the nation. Brassey's, Inc., 8000 Westpark Dr., McLean, VA 22102. Including index, 144 pages. \$23.95.

The Changing Face of the World's Navies: 1945 to the Present, by Bruce W. Watson. Postwar international politics, the emergence of a bipolar, East-West world, and rapid technological change have combined with refined strategies to change the face of the world's navies. Mr. Watson traces and analyzes these developments over the past decades and concludes that historical theories of seapower still apply, although those "theories [are]

often derided in the nuclear age." Brassey's Inc. Including photos and index, 281 pages. \$30.00.

Hitler Slept Late and Other Blunders that Cost Him the War, by James P. Duffy. Rather than attributing the outcome of World War II to Allied strength, this book attributes Germany's defeat to Hitler's blunders, documenting the German Führer's errors and their effects on the war. The author claims that Hitler had thrown away victory and led Germany into defeat even before the US entered the war. To the list of Hitler's well-known defects are added the German leader's inability to develop a concrete, long-range plan and his belief in the power of his own will. Praeger Publishers, 1 Madison Ave., New York, NY 10010. Including bibliography and index, 176 pages. \$19.95.

In Mortal Combat: Korea, 1950-1953, by John Toland. A Pulitzer Prize-winning author, Mr. Toland relies on hundreds of participant interviews and other primary sources to tell the story of US involvement in this "limited" war. He also interviewed Korean participants, including senior military officers. Among the book's revelations are Mao Zedong's prediction of the date and place of Gen. Douglas MacArthur's Inchon landing, the nature of Mao's relationship with Joseph Stalin, Russia's indifference to the war after planning the initial attack on South Korea, and the treatment of prisoners of war. William Morrow and Co., Inc., 1350 Ave. of the Americas, New York, NY 10019. Including maps, photos, and index, 624 pages. \$25.00.

Means of Escape, by Philip Caputo. Mr. Caputo, the Pulitzer Prize-winning author of *Rumor of War*, writes of his life as a war correspondent: captured in Lebanon by Palestinian guerrillas and tortured in a refugee camp, wounded by machine-gun fire, taking part in clandestine missions with Afghan *mujahedeen* guerrillas. Throughout the narrative, Mr. Caputo attempts to explain and understand the nature of violence and chaos, seeking not only to document the events but also "to capture something of what they felt like." HarperCollins Publishers, 10 E. 53d St., New York, NY 10022. 405 pages. \$25.00.

Silent Warfare: Understanding the World of Intelligence, by Abram N. Shulsky. This book provides a wealth of basic information and explanations on topics ranging from covert action and intelligence collection to analysis and counterintelligence, while describing the kinds of

information and organizations involved. Mr. Shulsky attempts to provide a kind of handbook for the international intelligence business. He also discusses the relationship of intelligence agencies to democratic government. Macmillan Publishing Co., Front & Brown Sts., Riverside, NJ 08075. Including notes and index, 222 pages. \$19.95.

The Vietnam Wars: 1945-1990, by Marilyn B. Young. This comprehensive look at US involvement with Vietnam from the end of World War II to the present describes the interconnections of that involvement with developments on the US domestic front and attempts to outline "decisive reasons and irrationalities" of the Vietnam wars. HarperCollins Publishers. Including photos, bibliography and index, 394 pages. \$11.00.

Other Titles of Note

Beyond the Uniform: A Career Transition Guide for Veterans and Federal Employees, by W. Dean Lee. As the US reduces the size of its military force, timely information on preparing the family for change, money management, "demilitarizing" one's résumé, tax deductions, and life insurance. John Wiley & Sons Inc., 605 Third Ave., New York, NY 10158-0012. Including index, 215 pages. \$12.95.

Desert Victory: The War for Kuwait, by Norman Friedman. An assessment of strategy, US weapons performance, and political motivations in the Persian Gulf War. Naval Institute Press, 2062 Generals Hwy., Annapolis, MD 21401. Including photos and index, 435 pages. \$24.95.

Farther and Faster: Aviation's Adventuring Years, 1909-1939, by Terry Gwynn-Jones. Aviation's advances in its formative years, studied in terms of speed and distance, and the airplane's practical advances as a novelty, war machine, and means of civil transport. Smithsonian Institution Press, 470 L'Enfant Plaza, Washington, DC 20560. Including photos and index, 333 pages. \$29.95.

The Saga of the American Civil War: None Died in Vain, by Robert Leckie. Anecdotes and analysis of numerous battles and individuals of the Civil War. HarperCollins Publishers. Including bibliography and index, 682 pages. \$15.00.

Yank: The Story of World War II as Written by the Soldiers, by the editors of "Yank" and the "Army Weekly." Stories by the soldiers who took part in almost every operation of the war, complemented by telling photos and drawings. Macmillan Publishing Co. Including photos and drawings, 262 pages. \$16.95. ■

Bob Stevens'

"There I was..."



SCENE: MOONLESS NIGHT OVER THE PERSIAN GULF. IT'S BLACKER THAN THE INSIDE OF A COW. FLAK COMES UP and THERE'S LOTS OF RADIO CHATTER. THEN YOUR FLIGHT BREAKS UP and YOU'RE SURROUNDED BY LOSTNESS. YOU ARE ABOUT TO EXPERIENCE ONE OF THOSE RANDOM MOMENTS OF STARK TERROR SO COMMON IN AIR COMBAT...



BLINDMAN BLUE FLIGHT, THIS IS GASBAG CONTROL. I SHOW MANY UN-FRIENDLY BOGIES IN YOUR AREA!

ROG. WE'RE RTB.



BLINDMAN BLUE FLIGHT, THIS IS LEAD. I'M IN A PORT ORBIT, ALPHA 4, ANGELS 22. CLOSE IT UP and JOIN ON ME!!

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WE'RE JOINED ON YOU NOW!



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