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# AIR FORCE

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**USAF Space Almanac**



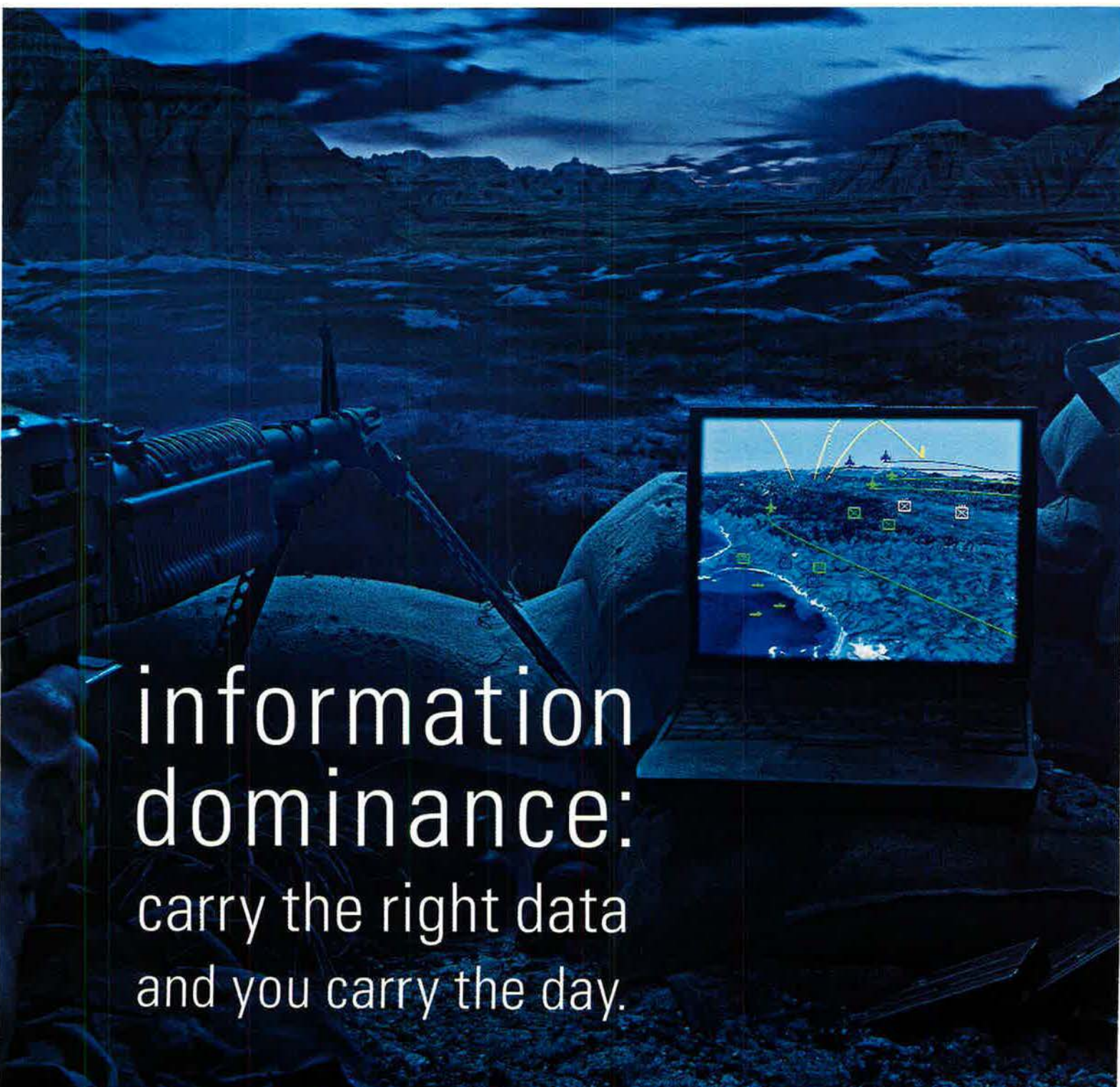


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By John T. Correll, Editor in Chief

## Recasting the Vision

**T**HE Air Force has published its third vision statement in 10 years, and "Global Vigilance, Reach, and Power," brought out June 19, is the best of the lot.

The new vision statement is short, only 12 pages long, with much of that consisting of pictures and graphics. The tone of it is more inspirational than doctrinal.

The easy presentation packages more substance than might be obvious at first glance, though.

This is the definitive statement of how the Air Force sees itself and where it believes it is going. Over the past year, it has undergone numerous rounds of word-by-word scrubbing by the Secretary of the Air Force, the Chief of Staff, and all of the other top leaders.

The Air Force likes to stress the continuity of its vision statements, but, in at least one respect, the new vision departs from "Global Engagement" in 1996. The most famous line in the 1996 vision said that "we are now transitioning from an air force into an air and space force on an evolutionary path to a space and air force."

That suggested the rise of space power meant a corresponding decline in airpower. It was also taken to mean that space programs could and should be paid for at the expense of airpower.

In reality, the demand for military space power is growing—but so is the demand for airpower. It does not make sense to pit one against the other.

The new vision sees air and space as complementary rather than competitive. It describes a force operating in an integrated "aerospace domain" that "stretches from the Earth's surface to the outer reaches of space."

The emphasis is on effects rather than on platforms. The Air Force will develop commanders and leaders "able to employ forces that produce the desired effects, regardless of where platforms reside, fly, or orbit."

■ Despite the similarity in titles, this vision statement is not a return to "Global Reach—Global Power" from

1990. Too often, according to an Air Staff officer who worked on the new vision, the "global reach" element of the 1990 paper was misconstrued as referring only to airlifters and tankers and "global power" was interpreted as meaning fighters and bombers, with everybody else left out.

This time around, inclusiveness is one of the main messages. "Airmen

**It's the effects that count, not where the platforms fly, reside, or orbit.**

from all across the Air Force contribute to our ability to deploy and sustain powerful aerospace capabilities whenever and wherever necessary," the vision says.

It is entirely possible that some future Chief of Staff will wear a space and missile badge rather than pilot's wings.

■ The addition of Global Vigilance in the title makes a more complete definition of what the Air Force actually does. It is also a good fit with "Joint Vision 2020," produced several months ago by the Joint Chiefs of Staff, which elevated information operations to the same level of importance as dominant maneuver and precision engagement.

Vigilance in the new Air Force vision is not limited to intelligence, surveillance, and reconnaissance. It includes aerospace forces on alert and watch everywhere, from ICBM sites to no-fly zones.

■ During the Cold War, the force was built primarily to fight the Warsaw Pact in Europe. Anything else—up to and including the Vietnam War—was a "lesser included contingency" in the preparations for the threat of global war.

In the early 1990s, the emphasis in US military strategy shifted to regional conflict, and the realization

finally set in that the change called for forces tailored specifically for that kind of action.

Accordingly, the Air Force is grouping its combat power into 10 Aerospace Expeditionary Forces, two of which will always be deployed or on call to meet national requirements.

Each AEF can provide intelligence, surveillance, reconnaissance, and command and control of aerospace forces over an area half the size of Texas, plus air superiority and the capability to strike some 200 targets a day.

The vision statement promises to expand the battlespace an AEF can cover and increase the number of targets it can strike. The goal is the capability to deploy the first AEF in 48 hours, "fast enough to curb many crises before they escalate," and up to five AEFs within 15 days.

However, the new vision statement may not have the last word in one important area. In December, a Congressionally mandated commission will report back on the best way to organize the military space effort. Advocates of a separate military service for space are hoping for a radical solution.

The nation would be better served by recognizing—and adequately funding—the integrated aerospace concept. The Air Force provides about 90 percent of the assets for a huge military space program but still gets the same share of the defense budget it did before the space program began. It is not reasonable to expect more without additional resources. Furthermore, the Air Force has now made an unequivocal commitment to space.

"Global Vigilance, Reach, and Power" encompasses "global vigilance to anticipate and deter threats, strategic reach to curb crises, and overwhelming power to prevail in conflicts and win America's wars."

It is billed as looking ahead to 2020. Whether it will hold up that long remains to be seen. What can be said is that it seems to have all of the bases covered, and it has the Air Force pegged exactly right. ■



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## Forgotten War

Your article "The Forgotten War" [June, p. 28] brought back memories, [especially when] I turned to [the chronology] under April 12, 1951. I was bombardier in the deputy lead ship that day in a formation of four B-29s. Our target was a bridge at Sinuiju, North Korea.

The weather was beautifully clear. We turned on the bomb run but something was not right. As we got nearer to the target, we were being blown off course to the right. As we passed adjacent to the bridge, our fighter cover—two F-86s—joined us; we had been briefed for 12. We turned back to the IP. It seems the lead bombardier had his secondary clutch engaged and the corrections for drift were not going to the autopilot. One of the crew called our attention to the airfield across the Yalu River in China, and you could see the MiGs taking off four at a time. We finally arrived back at our IP and turned on the run again, and, looking up, we could see about 20 contrails. Our fighter cover dropped their wing tanks and bored up into the enemy formation. Just then, two MiGs went through our formation from the rear, and you could see flame coming out of the right wing of our No. 4 plane.

We never did get that bridge but turned back south to get away from the fighters. Probably the only thing that saved us that day was that the enemy commander sent down two MiGs at a time and as they came down they were shot down by either our cover or our gunners. Our tail gunner, Earl Kanop, was credited with one MiG, and I got rid of our bombs over Pyongyang. [We] plotted a course for home.

We learned that one of the other planes had augged in just north of the 38th parallel, and the other had crash-landed just to the south of it. We were the only ones to get home after that fiasco. The other two crews were picked up by helicopter and returned to [base].

Maj. Fred W. Butler Jr.,  
USAF (Ret.)  
Lompoc, Calif.

As one who served with the 19th Bomb Group, Kadena AB, Okinawa (1952–53), I wish to commend you for your excellent article on our "Forgotten Victory." As one of only two [USAF] members on the Korean War Veterans Memorial Board, [retired] Col. Floyd Cherry and I had to point out to our colleagues from the other branches that [Far East Air Forces] played a very significant role, as reflected in the [Walter] Boyne article.

When going through USAF archives for selection of scenes to be depicted on the wall at our memorial (dedicated in July 1995), I came across a picture of one of the 19th BG crews with their B-29 prior to takeoff on their 50th mission. I submitted it for the wall, and [the image is] placed there in the Air Force section.

Mike McKeivitt  
Washington, D.C.

No criticism intended, however I have never read or seen pictures of the 502nd [Tactical] Control Group, [Air Control and Warning] Tactical Air Direction Post, or, as they were later known, Target Direction Post, in any history of the air war in Korea. Yet there were three sites just behind the lines that operated during 1952 and 1953.

My unit, the 608th AC&W, Det. 1 of the 5C2nd, helped drop 2,425 tons of explosives during the major battle for Old Baldy in July 1952. The 502nd received the Distinguished Unit Citation on July 8, 1953. It was the second citation for the 502nd.

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

These units during training in the States were known as radar bomb scoring sites, using an early Army radar set known as the SCR 584 in conjunction with the MSQ-1 plotting van. Later the radar was upgraded to the Air Force MPS-9. I also believe improved versions of these sets were used in Vietnam, according to Tuskegee Airman [retired] Lt. Col. Charles Lane of Omaha, Neb.

John H. Schuck II  
Plymouth, Minn.

The article gives a good overview of what our forces went through in that conflict. However, I was there and I think what our Air Force personnel went through while not in the air fighting battles would make a good story.

I was on a ship halfway across the Pacific on June 27, 1950, when we received word we were at war. I was assigned to Itazuke AB [Japan] and given the job of maintaining the landing field, which was separated from the base by three miles.

The field consisted of an asphalt runway with 2 inches of asphalt on a base that was 11 inches above the water table; [there was] a flowing well under the south end. The F-80s' high pressure, narrow tires kneaded the runway so badly that I had to continually remove and replace [the asphalt].

I did this at night by working one-half of the runway while the other half was being used by F-82s. I was in the control tower directing my men by radio. Yes, there were accidents.

[Later] at Pohang Dong [South Korea], my arrival with equipment and preconstructed tent frames and floors was greeted with glee, as our crews had been living in tents in the mud.

War is hell and our heroes are those who fought the battles (I flew B-24s in Europe in 1944). But we have many unsung heroes who provided the support that made them capable of winning the war.

Col. Elmer J. Romigh Jr.,  
USAF (Ret.)  
San Antonio



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## Newsweek and the 14 Tanks

This letter responds to two articles by Stephen P. Aubin. The first, "How *Newsweek* Missed the Target," appeared May 19 on AFA's Web site. A fuller and somewhat different version, "*Newsweek* and the 14 Tanks," appeared in the July issue of *Air Force Magazine*.

Aubin has a problem. He hasn't seen the documents, so he doesn't know what he's talking about.

Responding to *Newsweek's* story of the suppressed Kosovo report, Aubin first parroted USAFE's initial line: no such study. The Air Force having abandoned that, Aubin, too, has to switch. The study not only exists, he now says, but was widely circulated. Both stories can't be true; and in fact neither is. Yes, the study exists. No, USAFE didn't circulate it. Aubin is wrong: The GAO wasn't given it.

Aubin's history is wrong, too. SACEUR sent the team into Kosovo precisely to check out Serb claims of minimal damage to the VJ [Yugoslav army]. USAFE wanted to survey fixed targets, but had zero interest in mobiles. After a SACEUR/USAFE tussle, the team split—some looking at fixed, some at mobiles. (Aubin quotes Lt. Col. David Duvall. Wrong man. Duvall ran the fixed targets group.)

The mobiles group anticipated briefing their report round NATO. It was killed. SACEUR's actual words to CINCUSAFE [Gen. John P.] Jumper were: "I can't go to Javier Solana and all those political leaders and people who have said we destroyed this [much equipment] and say 'Um, we made a mistake. You know, we just went around and took a hasty look on the ground and we didn't see a whole helluva lot.'"

Those are the facts. None of Aubin's huffing and puffing—"Not since CNN's Tailwind fiasco," etc.—changes them.

Defending the higher figures then concocted by [Brig. Gen. John] Corley's team, Aubin again shifts ground. He claimed in his May 19 Web response that each pilot's mission report (misrep) of a kill "had to be corroborated by multiple sources." Corley certainly said that in his Sept. 16, 1999, SHAPE presentation. He

even claimed: "Frankly, more than 85 percent of the time three or more sources were present." But, as *Newsweek* pointed out, that wasn't true. So Aubin now says the misrep itself counted as a source which only "had to be corroborated by at least one other source" to give the "multiple sources" Corley claimed.

That's a huge climb-down; but the new version isn't true either. Corley & Co. asserted flatly to *Newsweek* that "the misrep was a point of departure. We never used the mission report from the pilot as a source of validation" of a kill. And: "We call it an empty claim. ... To validate that claim we had to get something else ... multiple sources, two other validating sources." But in reality: "assessed hits based on multiple sources ... represent 45 percent of the total assessed hits." (No names, I'm afraid. The Air Force insisted the long session be on background. So much for Aubin's jibe about *Newsweek's* unnamed sources.)

Bottom line: Fewer than half the "validated" kills were backed by "multiple sources." Worse: Among the 55 percent backed by only a single datum point, just over four in 10 had as lone source a bomb flash picked up by IR sensors on the DSP satellite. Which confirms only that the pilot dropped a bomb; in most cases it says nothing about what, if anything, the bomb hit.

"Corley's team was conservative in its approach," says Aubin. Huh? Take artillery. NATO pilots claimed 857 hits on Serb artillery positions. The Joint Analysis Center (JAC)—NATO's scorekeeper—estimated that, at most, the pilots might have struck 341. But, their report says, the on-site team "did not consider 'artillery positions' because USAFE/IN could not confirm the position contained actual equipment." USAFE didn't know what had been down there. Yet Corley and his team "confirmed" that artillery pieces had actually been struck in 389 positions. How?

Or take Corley's claim of 93 confirmed tank kills. USAFE documents show that Corley's team actually managed to construct a case for 77 only. Then, in a final flurry, 16 strikes initially logged as multiple hits were

reclassified as separate kills. That's "conservative"?

Aubin tries to rebut *Newsweek's* "accusation that the Air Force was flying too high" by pleading that laser-guided bombs work fine from 15,000 feet. But LGBs were only a tiny fraction of the munitions used against mobile targets. Take tanks: NATO pilots claimed 181 hits. USAFE considered 124 of these plausible; the JAC figured 110. Against these NATO had dispatched 956 munitions. Just 40 were PGMs: 27 laser-guided bombs and 13 Mavericks. The other 916 were inaccurate dumb bombs.

Altitude also bedeviled target ID, as the team found: "Many locations reported to have a tank or APC kill had numerous destroyed [military and civilian] vehicles. ... It is reasonable to assume a number of the military vehicles [we] counted, and even many civilian vehicles, were incorrectly identified ... as APCs or tanks."

Aubin's explanation for the missing equipment? The Serbs removed it. Please. That's been the Air Force line ever since Allied teams in World War II Normandy first catalogued massive discrepancies between pilot claims and kills found.

- The Kosovo team visited virtually every site where NATO pilots had claimed a kill. Not merely did they find few bombed-out hulks; though they scoured the sites and craters, they found no debris either. That the Serbs might remove damaged vehicles is plausible. That they would vacuum every crater is not.

- The VJ had no heavy lifting gear in Kosovo. Their only option would have been to drag damaged tanks to the nearest road. The team looked for drag marks, but reported "no evidence of equipment removal such as tracks, HET [heavy equipment transporter] marks, or the presence of V-bar equipped tanks used to tow a disabled vehicle." Corley misrepresented this at his Sept. 16 presentation: "The team further discovered that equipment had been towed out of bomb-damaged revetments to the main road and transported away. The ground earth scarring is clearly evident in multiple



examples." A distortion that adds weight to the charge of suppression.

■ NATO intel analysts reckon they monitored perhaps 90 percent of the Serb withdrawal. Analysts have pored over the imagery. They've identified a few damaged vehicles, but nothing on the scale posited by USAFE.

Aubin's final assertion is that since the "combined effects" of military and other actions brought victory, "the number of tanks destroyed" is irrelevant as a metric. Rubbish. If airpower is poor at finding and destroying scattered mobile targets in difficult terrain covered by multiple air defenses—the challenge in Kosovo—let us acknowledge that and either improve Air Force capabilities or resolve not to fight such battles again. Aubin does nobody a service, least of all the Air Force, by trying to fudge the problem.

John Barry  
Newsweek National Security  
Correspondent  
Washington, D.C.

#### From Stephen P. Aubin:

Newsweek's John Barry and Evan Thomas claim that NATO aircraft, during the 78 days of Operation Allied Force, struck a mere 14 tanks, 18 APCs, and 20 artillery pieces. That is the crux of "The Kosovo Cover-Up" (*Newsweek*, May 15), but it is untrue. They were wrong when they reported it then, and they are wrong now. NATO aircraft struck 93 tanks, 153 APCs, and 389 artillery pieces. At least.

Barry and Thomas based their claims largely on what they termed a "suppressed" NATO report. The claims, in essence, were three: NATO airpower didn't hit much. NATO covered up that fact. And NATO invented higher numbers. Barry's letter repeats all three claims. They are false.

I will take each in turn, but I'll first deal with a somewhat minor Barry claim—that I initially denied the existence of a NATO report. I didn't, as is plain from the text. I denied the existence of a "suppressed" NATO report, and still do.

1. *Newsweek* asserts NATO airpower didn't hit much. The claim rests largely on the so-called "suppressed report" containing low figures. Barry doesn't tell you the true nature of the document. It was a working draft report prepared in July 1999 by SHAPE's Munitions Effectiveness Assessment Team (MEAT). It presents results of a postwar Kosovo ground survey—a snapshot

of a cold battle area, nothing more. It makes no pretense to being the last word on the war. It will never yield the whole picture. For that, one must go to the final SHAPE report, NATO's Kosovo Strike Assessment, which *Newsweek* essentially ignored. More on that below.

What Barry has in his possession is a document that lists only the number of vehicle hulks found in Kosovo at least one and as many as three months after the strikes took place. *Newsweek's* claim that the ground survey represents the totality of NATO's successes is, on its face, ludicrous.

2. Whatever Barry claims, nobody "killed" any study. The "mobiles" part of the MEAT draft report is still very much alive. It and the final report are archived in Europe and Washington and at Air Force Historical Research Agency, Maxwell AFB, Ala. They are available to anyone who has a proper security clearance.

Moreover, the draft report has been widely circulated. It was provided to the US Army, Center for Naval Analyses, Office of the Secretary of Defense, and General Accounting Office.

In advancing his "suppression" claim, Barry suggests the existence of factions, one focused on fixed targets, the other on mobiles. In reality, there was one Munitions Effectiveness Assessment Team. The leader of the Kosovo Strike Assessment, Brig. Gen. John Corley, USAF, said the same team member names are found on both fixed-target and mobile-target working drafts.

Lt. Col. Michael (not "David," as Barry says) Duvall was deputy leader for the entire team, not just for fixed targets. He noted to me that team members were divided each day into "fixed" and "mobile" survey groups. Team members were interchangeable and came from all over, not just from USAFE, as Barry suggests.

3. *Newsweek* evidently believes NATO conspired to produce inflated strike data, arguing that NATO airpower did not kill 93 tanks, 153 APCs, and 389 artillery pieces.

What is the source of these figures? It is NATO's Kosovo Strike Assessment, the fruit of a nine-week-long, round-the-clock effort by 200 personnel. Its sources of information included not only the MEAT draft but also national satellite images, cockpit video, UAV video, and other intelligence. Data were correlated to establish what happened. For some reason, Barry simply refuses to accept use of such sources to confirm or disprove strike claims.

It is true that 55 percent of NATO's validated "successes" are based on a pilot's mission report and one additional source. Barry implies they are weak cases. However, these strikes make up what Corley calls the "definitive" category; the second source was strong enough to erase all doubt.

Each remaining NATO "success" (45 percent of total) also began with a pilot mission report. However, validation required at least two more sources. This caused confusion. Corley, in his September 1999 SHAPE briefing, did say three or more sources were available "85 percent of the time." I asked Corley about this discrepancy and, as it turns out, the 85 percent remark refers only to the 45 percent requiring two or more additional sources. Corley concedes that his statement was not very clear.

As Barry says, Corley's team did validate 77 tank strikes. However, these 77 were *in addition* to the 26 hulks of the MEAT draft report. It turned out, however, that 10 tanks were double counted. Basic arithmetic—add 26 and 77, subtract 10—yields the figure of 93 tanks. There was no "final flurry" to add 16 fraudulent tank kills, as Barry claims.

Barry also confuses readers about NATO's use of dumb bombs and precision munitions. When a Serb vehicle or vehicles (tanks, for instance) were in the open and risk of collateral damage was low, NATO might use a profusion of dumb bombs. NATO tended to use PGMs to hit single vehicles hidden near civilians. USAFE credits 81.7 percent of tank kills to PGMs, the rest to dumb bombs. The fact is, though, that either type can be "accurate," even from 15,000 feet. It depends on the nature and location of the target.

Barry scoffs at the idea that the Serbs "cleaned" the battlefield and greatly reduced the number of vehicle carcasses left in view. Yet Corley, in his SHAPE briefing, showed actual video of Serb transport vehicles hauling out APCs and other equipment covered by tarps. Barry's "NATO intelligence analysts," who are said to have "monitored perhaps 90 percent of the Serb withdrawal," were monitoring only Serb equipment still in Kosovo at the end of the 78-day campaign. By definition, they didn't see what was already gone. The Serbs had ample opportunity to move equipment during gaps in NATO surveillance.

There was no "Kosovo Cover-Up." Barry and Thomas were used by individuals whose desire to discredit airpower is obvious. ■



**Publisher**  
John A. Shaud

**Editorial** [afmag@afa.org](mailto:afmag@afa.org)

**Editor in Chief**  
John T. Correll

**Executive Editor**  
Robert S. Dudney

**Senior Editor**  
John A. Tirpak

**Associate Editor**  
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Arlington, Va. 22209-1198  
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## Letters

### Nine Myths

I have just read "Nine Myths About Kosovo" [June, p. 50] by Rebecca Grant. I think her detailed defense of air operations in Kosovo misses the point.

First, the overall impact of this article is to say that airpower can win by itself. The US military is a joint force. It has been for years. The history, as Grant points out, goes back to World War I. We have a specialized aviation component in the Army, the Navy and USMC have air arms, and we have a great USAF. Airpower is a full partner in winning wars, and everyone recognizes that. I have never heard a single soldier say he does not want airpower as part of the team. Warfare is a team effort and that is the thrust of joint doctrine.

I am not sure why Grant insists on trying to prove that airpower can win solo. It makes no sense to me unless it is a bargaining position for Pentagon budget battles. If that is the aim, joint doctrine would hold that promoting solo ventures undermines war-fighting effectiveness by having DoD build forces that are less than optimal for the range of missions we face.

I have been in combat and I cheered every friendly aircraft that flew overhead. I blessed every contribution they made that paved the way for me. I am grateful for every allied life they saved. If we need to halt someone so we can hold-deploy-win, and airpower can take the lead in some circumstances, I will be the first to stand up and salute, but insisting that any arm can go it alone is a flight of fancy.

Doctrinal debates are healthy, but USAF and its supporters are doing her and all of us a disservice by arguing they don't need to be part of the team.

Lt. Col. Richard R. Caniglia  
US Army  
Pentagon

After reading the article, my initial reaction was, so what? It would have been far better had she addressed the truly relevant issues of whether the employment of forces supported a valid national security objective and whether the use of such forces really accomplished any lasting results.

In Kosovo and Yugoslavia our airmen carried out their orders in an exceptional manner. And, yes, we did inflict damage on the Yugoslav army, didn't have too much of a problem with decoys, etc. But so what? For what end was all this energy expended?

The entire population of Kosovo was driven from their farms and cities, their homes were looted and de-

stroyed, and once the bombing stopped the region returned once more to the centuries-old ethnic strife that had precipitated the action in the first place. What is different is that the US is spending billions of dollars and spreading our dwindling resources even thinner just to keep the level of violence at a lesser level. That will only last as long as we have troops there, as is also the case in Bosnia.

What really needs to be addressed is the fact that our current civilian leadership is totally inept when it comes to using the military effectively. Perhaps it is the complete absence of previous military experience in the civilian ranks that leads to this state or the need to create a spectacular media event for political purposes. The end result in either case is that our military forces are being sent into battle for dubious reasons, only to be committed to follow-up police actions for years to come.

Our military leadership needs to be more forceful in making sure that we do not end up patrolling a border for 50 years as we are doing in Korea or sending our troops into another Vietnam where incompetent civilian leadership cost 58,000 lives.

Lt. Col. James V. Kelso III,  
USAF (Ret.)  
Peachtree City, Ga.

[The article] contributes little to an understanding of the important issues of our involvement in the Balkans. By ignoring those issues, the author and *Air Force* Magazine help to perpetuate the real myths about the Kosovo operation.

The fact is, our civilian and military leadership could not justify the loss of American lives in a war not supported by Congress or the American people, against a sovereign nation which had not harmed a single American. They chose, instead, to increase the chances of killing innocent civilians, including ethnic Albanians we were supposedly protecting.

Of all the straw men Grant constructed, the myths regarding damage to the Yugoslav military and the effectiveness of their decoys were the most disingenuous. Where are the burned out hulks of all those tanks? I guess those wily Serbs spirited them away without a trace, along with the bodies of the 100,000 victims claimed by our civilian leaders to justify an illegal, immoral war.

Facts: In the year prior to the NATO attack on Yugoslavia approximately 2,000 people on both sides were killed in a low intensity civil war. The mass





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## Letters

exodus of Albanian civilians did not begin until days after the bombing began, as much to escape the bombing as it was a result of being driven out by Serbian forces. If the Serbs are so set on cleansing their country of ethnic Albanians, why is it that nearly 200,000 Albanians live in Yugoslavia proper, many of them refugees who fled to Serbia and Montenegro to escape the NATO bombing?

Facts: Rambouillet was designed to ensure an attack on Yugoslavia. Secretary of State Madeleine Albright publicly stated that the Serbs would sign the "agreement" with no negotiations or be bombed. Even so, the Serbs were ready to accept UN forces in Kosovo but refused to accept the provisions in the agreement whereby NATO forces would have complete access to all of Yugoslavia as a virtual army of occupation.

Facts: Claims that the 78-day bombing campaign forced Milosevic to accept the terms of the Rambouillet agreement are false. The key factors in Milosevic's decision were a loss of support from Russia and the US-NATO backing off from the demand that NATO occupy all of Yugoslavia and a timetable for a vote on independence for Kosovo.

Operation Allied Force is a sad chapter in our history; we should not make matters worse by distorting the facts.

Col. George Jatras,  
USAF (Ret.)  
Sterling, Va.

### From Rebecca Grant:

Operation Allied Force accomplished its objectives: to wage an aerospace campaign and inflict enough damage on key targets, both fixed and mobile, to get the Yugoslav army out of Kosovo and the refugees back in. When Rambouillet failed, the diplomats were out of options—don't forget, the Russians were co-sponsors of the peace talks. By late March 1999, airstrikes were NATO's only option. The campaign got off to a rough start but NATO's airmen ultimately made it work. They proved they were not "summer soldiers and sunshine patriots" even though it must have been difficult to do a tough job to help out people they did not know in a place that few of us could find on a map. Milosevic and his army gave in, and diplomacy got another chance. The peacekeepers on the ground will be at the job for years. But without Operation Allied Force, NATO would still be trying to help Albania, Macedonia, and Bosnia deal with more

than half a million refugees while Milosevic gloated over occupied Kosovo. As Gen. Michael E. Ryan, USAF Chief of Staff, has said, airpower may not be able to do everything, but there are very few things that can be done without it.

### Recruiting and Retention

The Air Force is off the mark with their monetary incentive programs, notably the Aviator Continuation Pay. [See "The Recruiting and Retention Problems Continue," June, p. 64.] I am an Air Force pilot with 5,000 hours in three different commands. In my 15 years of service, I have never met anyone who decided to remain on active duty based on ACP. Those who stay, stay because they still find the Air Force satisfying and rewarding.

The Air Force cannot compete with civilian sector pay, benefits, or lifestyle. The bonus may decrease the pay gap a bit, but USAF can never offer the lifestyle or other fringe benefits associated with the airlines.

When the economy is doing well and airlines are hiring, the scales are tipped toward the civilian sector, and pilots leave regardless of the bonus. During the airline hiring slump in the early 1990s the bonus take rate peaked above 80 percent, while during the recent hiring boom the bonus take rate was at a low of 28 percent, [despite] the fact that the bonus had almost doubled in the same time period.

Increasing the initial pilot training commitment to 15 years, as the French have, would create an atmosphere of staying for the long haul. From Day 1, pilots would be thinking USAF career instead of airline career.

Bottom line: The ACP program is a waste of money that has not affected retention. Rather, it has sent a negative message to the Air Force community that aviators are the only ones who count. Bonus money would be better spent on the quality-of-life programs that would benefit the entire Air Force.

Maj. Dale R. Huhmann,  
Assistant Air Force Attaché  
France

As a participant in the Fiscal 1978 Air Staff Training Program, I saw many of my fellow trainees, allegedly the best and brightest the Air Force had to offer, leave in disillusionment and frustration. As a staff officer in the mid-1980s working rated force management issues at the Air Force Military Personnel Center, I saw the impact of low retention and the measures the Air Force took to combat it.



As a junior captain for a major airline, I now fly with many former military officers (separates and retirees) who have chosen to leave the service for a civilian career. During the longer legs, the topic of "why I got out" inevitably arises. The common element in all these experiences, and a major perceptual blind spot for the Air Force, is a lack of effective leadership.

As early as 1978, senior Air Force leaders correctly identified ineffective leadership as a major factor in the decision for separation of many rated officers. However, back then they simply stopped at measures purportedly designed to enhance the capability of those already in leadership positions. Today, the lack of effective leadership is not even publicly acknowledged as a problem by senior Air Force leaders. Yet, time after time, from former officers flying my right seat, ranging from mid-level captains to retired colonels, I hear stories of mistreatment and disrespect at the hands of officers who are "on the way up."

As the force continues to shrink, the importance of retaining every member possible increases. Yet, we persist in promoting the very people who, by their demonstrated behavior, are contributing to the problem. As a result, perhaps it is time to closely examine both how we promote and who.

Lt. Col. Peter M. McCarthy,  
USAF (Ret.)  
San Antonio

### Outdated Avionics

The June edition has an otherwise fine article [*"The Problem of Outdated Avionics," p. 70*] on the obsolescence problems faced by USAF in avionics.

I am certain that the intent was to identify the venerable 80286 microprocessor, but it was nowhere near as fast as 286 MHz. Actually, in the view of a good many folks, the old 286 is a workhorse well-suited to a number of avionics applications, many of which do not need the computational speed of today's premium microprocessors now running at up to 1 GHz (with a 2 gig coming down the line). Certainly very few flight control systems need that much speed, although there are a good many avionics applications requiring a lot of computational power.

The component obsolescence problem is far from limited and is a plague experienced by all services with both depot repair programs and reprovements. Most firms are more interested in making money with consumer products than satisfying the limited number of obsolescent device replacements; thus the cost can be very high to set up a line.

It is interesting to note that Lockheed Martin and their subcontractors on the F-22 program are experiencing the obsolescence problem with avionics even before they have a contract to mass produce the aircraft. This is borne out by contracts issued specifically to tackle obsolete component problems. There is no doubt in my mind that the same will be true for the [Joint Strike Fighter] before a production contract is let to either Lockheed Martin or Boeing. Clearly, avionics being developed now for those aircraft will suffer obsolescence problems at [Initial Operational Capability], unless somebody is really watching the store.

Hank Morris  
Ventura, Calif.

I was very pleasantly surprised today, reading your article, to find out that we have almost caught up with current technology, in that we have 286 MHz processors in the B-2. Although today's processors run at up to 1 GHz, processors did not exceed 200 MHz until approximately three years ago.

Unfortunately, we do not have the luxury of any such speed. I have also heard the processors on the B-2 compared to IBM 286 processors (which ran at about 8–10 MHz), but they are not even that capable. The processors on board the B-2 are best compared to the old Commodore 128 computer, which ran at 2 MHz and which I owned one of in the mid-1980s. This same basic processor is also the brains in the B-52 and B-1 fleets.

Lt. Col. Ken Charpie  
Wright-Patterson AFB, Ohio

### Unfriendly Skies

Having read "Flying the Unfriendly Skies of America" [*June, p. 76*], I was not surprised to see that the airspace structure in the US is as screwed up today as it ever was. I was the chief flight planner for two F-111 wings between 1985 and 1991 and have experience dealing with the way Europe (especially the UK) and America deal with military low-level training flights.

In the UK, we were told where not to fly (cities, noise sensitive areas, airfields, etc.). There was enough flexibility in their system that we could train effectively, even in that congested country. Sure, there were noise complaints, but everybody suffered pretty equally and they were generally good sports in putting up with the jet noise. We just used the noise sensitive areas as threat sites to be avoided.

In the US, we apparently are still

told where we can fly. For those who aren't familiar with the low-fly structure, it consists of a number of narrow corridors that have had to pass muster with the FAA, tree huggers, and other special interest groups. To top it all off, the training [isn't] very good. There are only so many times you can get good training out of a patch of terrain you know so well that you don't need a map to navigate it. It's the difference between driving to work and driving someplace you've never been before.

What would be a fair system that would promote good low-level training? How about drawing a 200-mile circle around each bombing range? Each day of the week, a different 72-degree arc defines the low-fly area. Each week, shift these arcs 10 degrees or so. That will keep the edges moving and discourage canned routes, which are bad for training and also generate noise complaints. Within 50 miles or so of the bombing range the arc should become a circle to allow for the maneuvering necessary for different attack tactics.

Maj. Jim Rotramel,  
USAF (Ret.)  
Lexington Park, Md.

I have encountered military aircraft flying low overhead while hiking in the serene wilderness many times. Upon looking up, my only comment is, "Thank God they are ours."

Carus DuBose  
Oak Ridge, Tenn.

### What About Rescue?

The graph on p. 12 of the June issue [*"The Chart Page: When the Air Force Goes Gray"*] accurately reflects the attitude of the Air Force brass (and apparently AFA also) regarding rotorwing aircraft in general and Combat Search and Rescue in particular.

The HH-60G is continually being upgraded and the strain of this additional weight is seriously affecting structural integrity and service life. If the [Air Combat Command] commanders really meant what has been stated, that they know CSAR is broken and it will be fixed, then there would be a robusting of existing units through the procurement of additional tankers (either through new purchases or modification of existing C-130s) and helicopters. The Reserve and Guard have the majority of the experience and would thus be an excellent asset to train active duty aircrew and maintenance personnel (as is already being done to a limited extent) by creating reverse associate units.

For the cost of one or two F-22s or JSFs, rescue can receive much needed



assets and system upgrades, which would provide an increased worldwide capability with less strain on this over-extended asset.

Craig Bergman  
Tucson, Ariz.

**Value of JROTC**

I am a proud member of FL-941, Pine Ridge High School's AFJROTC program. In the June issue, p. 89, you will find my picture along with cadet Evie Dunbar. I was extremely delighted to see our accomplishment published for *Air Force Magazine* readers to see.

I am very grateful to those whose idea it was to initiate a JROTC program. Hopefully, they and everyone else know of the life teaching, memorable experiences, and upstanding values that are gained by the youth in these programs.

Cadet Col. Serena Wilson  
Deltona, Fla.

**What's the Real Need?**

Phil Weissburg's letter [*June, p. 4*] states that the B-29 cost the taxpayers less than \$60,000 each. This is a far cry from what I was told when I was flight crew during World War II. The high brass told us that the plane cost \$1 million each, at that time a staggering sum.

This is not to say that Weissburg does not make a good point. But it takes away from his position to not base statistics on actual facts.

Jack Speakman  
Overland Park, Kan.

I find the truly frightening part of Weissburg's letter to be his unawareness. I suppose I can understand how a lay person could believe that any aircraft that drops a bomb is all that is required. In the real world, though, as any one with any military background is aware, this just isn't the case.

As an analogy, a new automobile in the 1940s cost less than \$1,000. A new auto today can cost \$50,000. That is simple inflation. The other issue to mull over is technology. An automobile built in the 1940s provided basic transportation much like a 2000 model automobile does. The question to ask here is, "Are they the same?" Of course they aren't. The improvements in safety, reliability, security, efficiency, and capability in a 2000 vehicle are a quantum leap ahead of those found in a 1940s vehicle.

When a person then considers that technological improvements are also being applied in defense systems fielded by potential adversaries, this

concept becomes even more poignant. Imagine, if you will, that the rest of the drivers on the road aren't necessarily following the same rules of the road that you follow. In fact, to think about it in relative terms, a few of those other drivers out there are enthusiastically trying to kill you. Suddenly the money spent in safety and security features would in all probability become moot.

I suppose in the long run the fault partially lies with the military community. Perhaps we need to do a better job of educating the general public as to what we do and why we do it. Then again, some of the accountability must lie with the general public as well. Unless the civilian population is willing to devote time to actually gathering facts and not just spouting hackneyed, worn-out phrases, these sorts of misconceptions will continue to exist.

Maj. Randall A. Nordhagen,  
USAF (Ret.)  
Altus, Okla.

**True War Machine**

I am writing [about] a letter entitled "True War Machine" [*June, p. 10*] by Maj. Charles "Sammy" Samuel, ANG. I would like to share my experiences as crew chief.

I always had a clean and polished aircraft in my more than 20 years in the Air Force. When I was stationed in Thailand, I had a Wild Weasel F-105 (63-8341). The pilot was Maj. Merlyn Dethlefsen and the Bear was Capt. Mike Gilroy. In April 1967, Dethlefsen found himself in a hornet's nest, surrounded by MiGs, anti-aircraft artillery guns, and surface-to-air missiles. Dethlefsen's aircraft sustained damage but landed safely back at Takhli. He and Gilroy both claimed that they would not have survived if they had not been in an airplane that was clean and polished, [which] allowed them extra speed when they needed it most.

So, as for us crew chiefs who spent endless hours cleaning and polishing, it was for more than looks. It saved lives, saved fuel, and let the pilots do their jobs.

MSgt. Harold Seibel,  
USAF (Ret.)  
Columbus, Wis.

**Kosovo Retro II**

Having just read the June issue, I'd like to reply to the letter written by T. Curtis Goodwin [*"Letters: Kosovo Retro," p. 4*]. He was quick to fire a shotgun blast at intelligence support to the warfighter.

First there is no such thing as intelligence for intelligence sake. I don't

have an intelligence requirement—my commander does and my operators do. My intelligence specialists and I are there to service those requirements.

Goodwin confuses national, theater, and tactical reconnaissance and intelligence. National assets are just that—national resources that also entail priority in tasking, exploitation, and dissemination. The guy stepping to the jet is at the back of the line behind the President, Secretary of Defense, theater commander, [Joint Force Air Component Commander], and the other theater component commanders. Theater assets are assets owned by the theater commander, unless that control is delegated (like targeting) down to the JFACC. The JFACC may do the care and feeding, but they service the collection deck established by the theater/[Joint Task Force] Daily Reconnaissance Board. Now, the air boss does own the [Air Force forces tactical] recce, and he can send those wherever he wants.

Now that we established the recce food chain, which of the five Int brothers (Imint, Sigint, Masint, Humint, or Osint) do you want direct in the cockpit? Remember, now, if you want it raw hot from the sensor you're getting information not intelligence. Do you want every Elint hit? What's the confidence level? Imagery? Oh, the raw stuff is full frame. Do you want a north arrow, mensurated points, annotations of the target area? Then it's not hot off the sensor. Do you want "dot-ology" from the Joint STARS direct or talk to the operator?

How much exploitation and evaluation do you want the flier to do en route to the target? I'm all for giving the operator what he needs rather than what he thinks he needs and that's just both intel and ops getting closer to establish the requirements. Current technology can send an image into the cockpit. You can get Elint into the cockpit, but you need to understand that it's not [radar warning receiver] gear that sees 150 miles. Perhaps what you're really looking for is a data feed where relevant intelligence and threat updates can be provided by the wing since it can flight follow its tasked sorties better than the [air operations center].

The tactical intelligence part is a tougher nut to crack. Right now the experience pool in Air Force intelligence is getting pretty shallow. For Operation Allied Force we ran out of trained targeteers! Will it matter what you put in the cockpit if the talent isn't there to mission plan with and give you



the threat data? Down at the wing/squadron is where the fight begins, where the intel toads build the tactical picture for the aircrews to mission plan with. Theater joint intelligence centers provide the strategic picture for the theater commander, the JFACC's A-2 provides the operational air and missile order of battle, but it's your wing/group intel guys who condense and fuse that information into a tactical picture for the guy stepping to the jet. Coupled with the strain on experienced intel specialists, we're currently without a functioning intelligence system that does Elint and route analysis or passing orders of battle to the fliers' mission planning systems!

So there you have it—my view from the field. Next time, aim before you shoot because there are a lot of us busting our humps out here to see that our operators get the best intelligence available. I take it personally because they're my aircrews, too. You can't brief a combat premission brief and not care; they're your friends and squadron mates.

Maj. Tom Imburgio,  
352nd SOG,  
RAF Mildenhall, UK

**Not a B-36, No**

A B-36? Not in the picture. [See "Flashback: Goblin," June, p. 47.]

Even I know the difference between a B-36 and a B-29.

Lt. Col. Ione Hamman,  
Civil Air Patrol  
London Mills, Ill.

■ *What we failed to do in the caption was identify the aircraft—a B-29—used for the flight tests. The caption was incomplete.—THE EDITORS*

**Tuskegee History**

Please note the error in the text of "Pieces of History: Tuskegee" on p. 96, June issue. The text [says that] nearly all of the 2,000 black fighter pilots in World War II came from the Tuskegee Institute. This is not correct. Actually 992 pilots graduated from Tuskegee Army Air Field. There were 673 single engine pilots, 252 twin engine, five foreign, 51 liaison, and 11 service pilots graduated from the school during its existence.

Tuskegee Institute had nothing to do with the training at Tuskegee AAF where basic, advanced, and other training took place. The institute, now known as Tuskegee University, was very involved with Moton Field where the cadets took their primary training.

Lou Thole  
Cincinnati

■ *We erred. Thanks.—THE EDITORS*

**Corrections**

In the May issue, the numbers for general schedule civilians listed under "The Civilian Force," p. 55, are wrong. USAF informed us June 28 that data provided us earlier was in error. The numbers should be shifted up, so that Grade 1 has 142 civilians, Grade 2 has 272, etc., until Grade 16, which should show zero.

Thanks to Christine B. Saalbach at Air Force Personnel Center, Randolph AFB, Tex., for clarifying the issue with USAF. And, apologies to Dan O'Neil at Tinker AFB, Okla., who tried to set the record straight last month.

Also in May, Air Combat Command failed to include the Aerospace Command and Control, Intelligence, Surveillance, and Reconnaissance Center, Langley AFB, Va., in its organizational chart (p. 82) as a major direct reporting unit. The commander is Maj. Gen. Gerald F. Perryman Jr. It includes two of USAF's six battlelabs—C<sup>2</sup> Battlelab, Hurlburt Field, Fla., and Unmanned Aerial Vehicle Battlelab, Eglin AFB, Fla.

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# The Chart Page

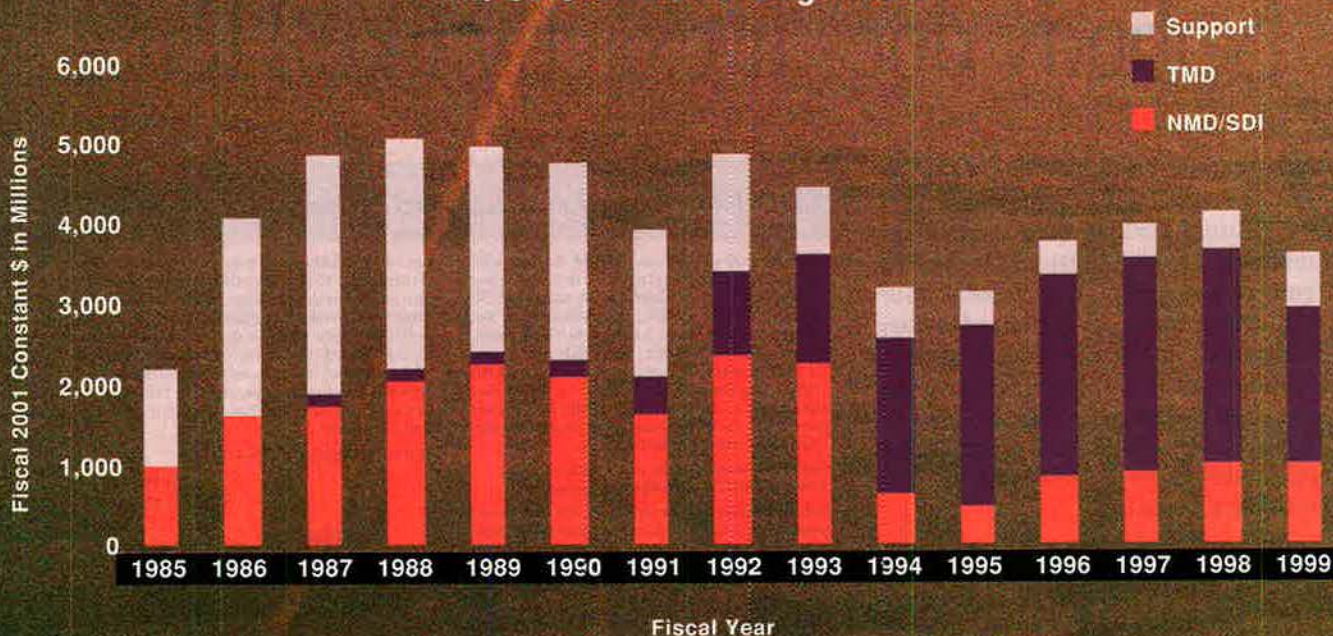
By Tamar A. Mehuron, Associate Editor

## Investment in Missile Defense

*In the period 1985–99, the Strategic Defense Initiative Organization and its successor, the Ballistic Missile Defense Organization, spent some \$61 billion on development of technologies and systems for all types of ballistic missile defense. The funds were allocated to these categories: National Missile Defense, \$22 billion; Theater Missile Defense, \$17 billion; support technology, \$22 billion. (All figures in constant Fiscal 2001 dollars.)*

*The table shows that in the early years, investment focused on National Missile Defense and support technology, which together accounted for virtually all of the nearly \$5 billion budgets of the late 1980s. In the 1990s, with the Clinton Administration de-emphasizing the ballistic missile threat, funding shifted hard to Theater Missile Defense—that is, combating the threat to US deployed forces.*

The SDIO-BMDO Funding Record



Source: BMDO

USAF photo by SRA, Cherie A. Thurlby





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STRIKE FORCE LAUNCHES.  
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2  
0100 HOURS - 250 NM OUT  
CALL FOR RESCUE RECEIVED.  
CV-22 FLIES LOW-ALTITUDE EVASION ROUTES TO PICKUP SITE.

3  
0135 HOURS - 380 NM OUT  
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# Aerospace World

By Peter Grier

## AEF Development On Track

With eight Aerospace Expeditionary Force cycles behind it, USAF is transitioning to the new world of AEFs on schedule and with success, according to Maj. Gen. Carrol H. Chandler, Expeditionary Aerospace Force implementation director at the Air Staff in Washington.

That does not mean that things are going perfectly—or that lessons for future deployments are not being learned almost every day, said Chandler on a recent visit to Davis-Monthan AFB, Ariz. EAF implementation is “a marathon, not a sprint,” he said.

In the field the biggest challenge seems to be training, preparing, and deploying as trained teams in groups known as Unit Type Codes. Airmen are still learning what that means.

Wing commanders are still learning how to balance engagement operations and stay-at-home missions.

Major commands are still facing the challenge of shaping modular UTCs and making them useful.

Component commands “are our key to defining, or asking for, [UTC] capabilities for the warfighting [commanders in chief],” said Chandler.

Most feedback has been positive. But the predictability of the EAF experience is still uneven. Late taskings continue.

“We know there are airmen who have received as little as a week advance notification of deployment. This is not good and is not our goal,” said Chandler.

Air Force leaders are looking at crew ratios to help lessen the strain on low-density, high-demand units. And they are pleased that reserve participation in the AEF concept is right on track.

“The initial plan was for up to 10 percent [Air Reserve Component] contribution—that target has been struck dead center,” said Chandler.

## Ryan Hits Funding Shortfalls

Gen. Michael E. Ryan, Air Force Chief of Staff, asserts that the United States is badly underfunding airpower.

At a June 7 Korean War remem-



USAF photo by MSgt. Val Gempis

**USAF SSgts. Vincent Delorenzo (left) and Matt Nugent study a map at Poha-kuloa Training Area, Hawaii, to coordinate targets for fighter aircraft during close air support training at RIMPAC 2000, a multinational maritime exercise. They are terminal attack controllers from the 25th Air Support Operations Squadron (PACAF), Wheeler Army Airfield, Hawaii.**

brance ceremony, reported by *USA Today*, he said that the same lack of money that hampered US military readiness at the start of that war 50 years ago afflicts today's force.

US military spending in June 1950, at the outbreak of the Korean War, was at its second-lowest point since the Japanese attack at Pearl Harbor in World War II.

The lowest point? Today.

“History teaches us a lot of lessons if we'll just listen,” Ryan said.

Budgets have been so constrained that the Air Force has had difficulty reshaping itself for the post-Cold War era, said Ryan on May 23 at an aerospace power seminar sponsored by DFI International. “We have underfunded the defense side of this nation's capability for some years,” said the Chief.

## Lawmakers Demand Suspension of Anthrax Shots

On May 16 a bipartisan group of 35 members of Congress sent Secretary of Defense William S. Cohen a letter requesting that the Pentagon's

mandatory anthrax inoculation program be suspended until the Pentagon can find an improved vaccine.

On the same day, they received a response not from Cohen, but from Charles Cragin, who signed the letter as acting undersecretary of defense for personnel and readiness.

The lawmakers' letter followed up on a House Government Reform subcommittee report issued Feb. 17. (See “Aerospace World: House Panel Calls for Halt in Anthrax Shots,” April, p. 12.) That report called for DoD to suspend the current program and be more aggressive in researching a second-generation vaccine that would shorten the shot regimen.

They wrote that “anecdotal evidence continues to grow of severe, adverse systemic reactions in recipients of the vaccine.” The lawmakers claim that DoD has ignored questions raised by the National Academy of Science, the General Accounting Office, and even the Pentagon's inspector general.

Cragin, in the Pentagon's response, said that he could not agree to a



## Pentagon Rejects Split Up of JSF Program

The Pentagon has dropped the idea of splitting the Joint Strike Fighter contract and spreading around the work to bolster the fighter industrial base. It's not needed, said officials.

According to DoD, aircraft producers will in the next 20 years have sufficient work—in particular, production of unmanned aerial vehicles and upgrading of older aircraft—to maintain a strong business base.

The last two US fighter-makers—Boeing and Lockheed Martin—are locked in a hot, winner-take-all battle to build JSFs.

Some in Congress, concerned about the industry's health, wanted to change the JSF program to allow competitive production. Lawmakers feared that the JSF loser would be forced out of the military airplane business entirely. Recent Congressional action to bring about those changes also would slow it down.

This worried DoD officials. Pentagon acquisition chief Jacques Gansler told a June 22 news conference that Congress had no justification for further delay and that maintaining the JSF schedule is "critical."

Gansler said he is "very confident that we will [buy] unmanned vehicles [in] significant volume in the future." Some of these will be combat aircraft, he noted, and this will represent a substantial amount of work for airframe houses.

He predicted service-life extensions and modifications for the Navy F/A-18, long-term foreign military sales of the latest models of the Air Force F-16, and work on the USAF F-22 program. All would contribute to the industry's business base.

"We have quite a bit of work in those plants," Gansler reported. "It was for that reason that I didn't think industry base considerations should drive this decision as much as the pure economics of it."

### Big Bucks

The contract, which Gansler pegged at \$200 billion to \$400 billion—will remain a winner-take-all contest.

On the same day, Defense Secretary William Cohen released the text of a letter to Rep. Jerry Lewis (R-Calif.), the chairman of the House Appropriations defense subcommittee. The letter explained the Pentagon's desire to press on with the program and presented its findings on the industrial base issue.

Gansler said DoD analysts, after several months of review, could find no cost benefits to splitting up the JSF's contract, despite substantial "empirical evidence" that competition yields lower cost and better product performance. While competition has worked well on engines and missiles, Gansler said, it has never been attempted "on something this large" or as complex as an entire modern combat aircraft.

Weighing against the notion of competitive production were two key factors: the high cost of building duplicate tooling and the inefficiency of building JSFs in small lots in two separate locations. Moreover, said Gansler, the need to set up and qualify a second source would bring costly delays.

Even so, the Pentagon commissioned RAND to make an independent study of the issue. The study, which will have no DoD input, is due by year's end.

The Pentagon's decision does not preclude all competition. Gansler said there is competition on many levels of subcontracts, such as for the engines. "There are other ways of bringing in competition," he added.

The JSF program managers at Boeing and Lockheed Mar-

tin have said they would likely award the loser a share of the work to take advantage of expertise and industrial capacity.

Gansler said it is critical to stick with the timing of the program because that is the only way to meet the needs of the Air Force, Marine Corps, and Navy. In any new delay, said Gansler, the Air Force would be hardest hit.

Starting in 2009, there will be a "rapid falloff" of F-16s, as the fleet surpasses its design service life of 6,000 hours per airplane, Gansler said. Even on the present schedule, the JSF won't be fielded in numbers until 2011, and so the Air Force will still have to spend "a couple of billion dollars on upgrading the F-16s" to keep them going long enough.

The Air Force has a stated requirement for 1,763 of the new aircraft.

The Marine Corps passed on a chance to buy the F/A-18E/F, deferring a replacement buy so it could buy 609 models of a short takeoff and vertical landing JSF variant, which is also to be a supersonic fighter. The Marines are to receive the first JSFs, in 2010, since the AV-8Bs the service now flies will have run through their already extended service lives by then.

The Navy's slightly larger version of the JSF, of which 480 are planned, would not start arriving in the fleet until after 2012.

"That's the reason why it's so important not to let the schedule slip," Gansler explained. "Dollar reductions [by Congress], of course, result directly in schedule slips."

### Timing Is "Critical"

Both industry and the Pentagon estimate an overseas market for the JSF at about 3,000 aircraft, making it, according to Cohen's letter, "critical to the modernization of our ally forces for coalition warfare."

Gansler said tri-service procurement of highly similar aircraft will yield \$15 billion in development savings and many additional billions of savings stemming from reduced support and training costs.

In addition, said Gansler, the JSF's huge production run will bring about a low unit cost. That, coupled with the fighter's high combat capability, will make JSF unbeatable in the foreign military sales arena. Foreign competitors will find it "almost impossible" to stay up in the global market. Said Gansler, "It's just going to be awfully difficult to come up with an airplane in this price range—this stealthy, and with advanced avionics, and with all these [new] weapons on it."

Unit cost of the JSF will be \$30 million to \$35 million, depending on the variant, said Gansler.

The two contractors will submit their proposals in November, and the Pentagon plans to select a winner next spring. Flying demonstrators—not full-up prototypes—will be tested this summer, with testing continuing into next spring. Besides stealth, manufacturing processes and materials, the demonstrators will prove the companies' approach to achieving short takeoff and vertical landing in a supersonic airplane, what Gansler called the most challenging design feature.

Britain is a full partner on the program, and British officials will sit on the source selection committee choosing a winner. Though Britain's largest military supplier, BAE Systems, is partnered with Lockheed Martin, Gansler said he expects London to be impartial in its choice, basing its decision on performance and cost rather than British industrial base considerations.

Gansler said the JSF may be the last manned fighter built by the United States.

—John A. Tirpak

suspension, which he said would jeopardize thousands of military men and women.

More than 400,000 military personnel have received the shots. Some 620 have complained of side effects,

according to DoD. Though there are no conclusive figures on how many military members have refused to take the shots, some opponents of the program put the number at around 300.

On May 31, five of the 35 lawmakers sent another letter to Cohen. They called Cragin's letter inadequate, saying he ignored most of the facts they presented. Dan Burton (R-Ind.), John Conyers (D-Mich.), Bob Filner



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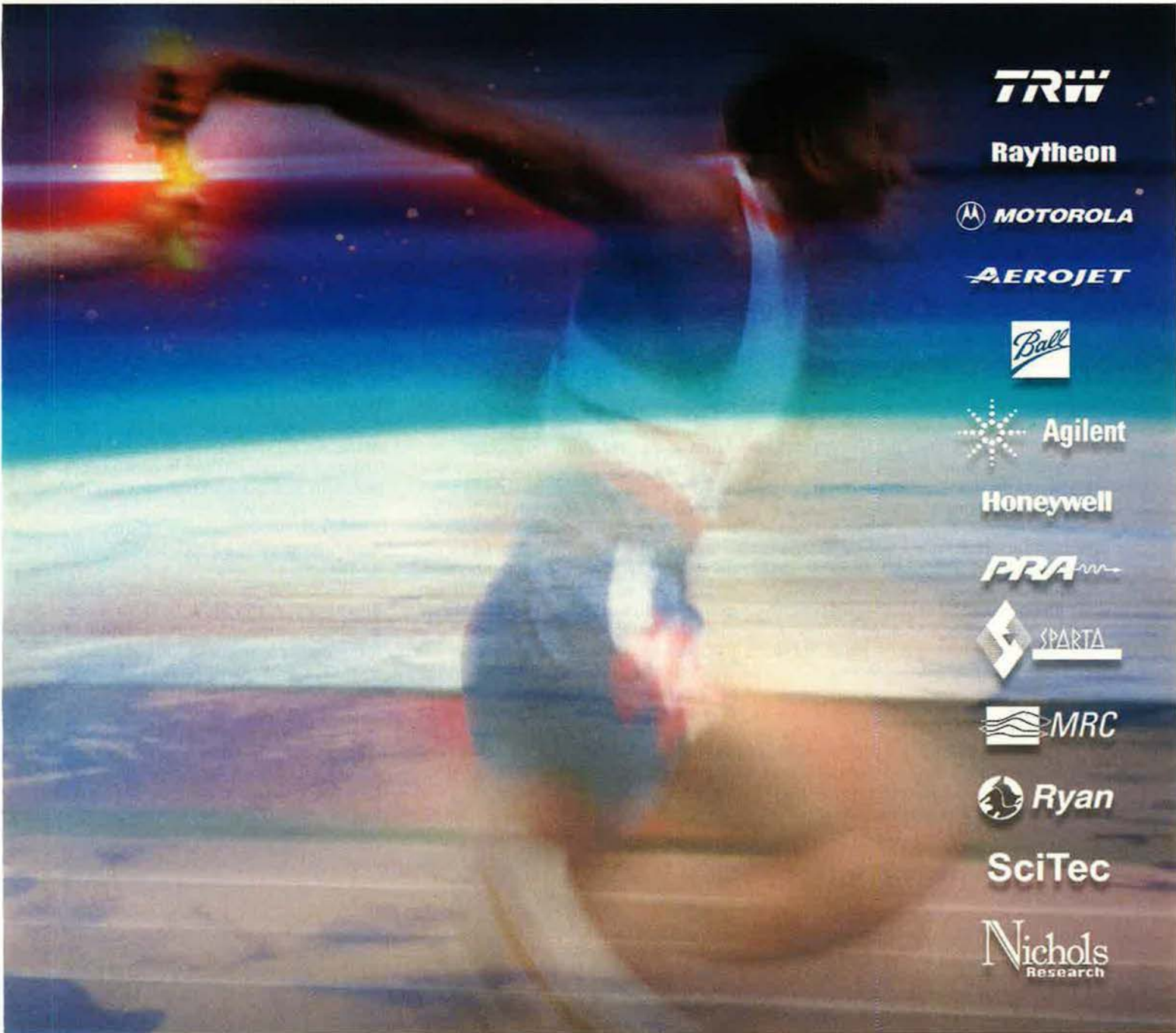
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## US Says it Plans no Troop Reductions in Korea

Despite signs of a political thaw on the Korean peninsula, US forces there aren't going anywhere anytime soon.

That's the word from top US military and diplomatic officials in the wake of the historic and unprecedented June meeting between South Korean President Kim Dae Jung and North Korean President Kim Jong Il.

They say that the US military presence in South Korea—currently about 37,000 US Air Force and US Army troops—remains critical to the security of the region, and no reductions are contemplated at this time.

Pentagon spokesman Ken Bacon said that, even if reunification occurs, South Korean President Kim wants US troops to stay as a regional stabilizing force.

Secretary of State Madeleine K. Albright publicly emphasized that the US troops would not be withdrawn any time soon. With South Korea's foreign minister at her side, she said talk of reducing or withdrawing American troops was "not appropriate" and "premature."

Foreign Minister Joung Binn Lee, responding to a question stated, "American forces will be needed here even after the establishment of a peace regime on the Korean Peninsula." He noted that South Korean President Kim made it very clear that US troops play a vital role for stability.

(D-Calif.), Jack Metcalf (R-Wash.), and Christopher Shays (R-Conn.) have asked that Cohen respond personally this time.

The House Appropriations Committee report on the Fiscal 2001 defense budget, released June 1, included a provision for an additional \$1 million to accelerate development of an alternative vaccine. However, the appropriators did not ask for a program suspension.

### Tiger Team to Study C-5 Readiness

Recent declines in the mission capability rate of the C-5 Galaxy have led Air Force leaders to form a tiger team that will attempt to find ways to improve the availability of the mammoth airlifter.

Policies and processes, not people, will be the issue, said officials.

"Let there be no question that this is about what is wrong and not about who is wrong," said William Cromer, deputy director, Warner Robins Air Logistics Center C-5 System Program Office.

The team will split into two groups and deploy to a dozen US bases over the summer. It hopes to develop the most complete picture of C-5 operations, maintenance, and logistics ever compiled.

Members will try to identify problems, offer solutions, and make recommendations for both short- and long-term improvements.

"With major modernization and re-engining projects approaching in the next several years, what we implement now through this effort will help us move smoothly through those future phases without a dip in C-5 availability," said Cromer.

### Tricare Dental Plan Improved

Tricare's 2001 dental program will feature lower premiums, expanded service, and greater availability when it begins early next year.

In April the Department of Defense awarded a five-year, \$1.8 billion contract to United Concordia Co., current administrator of the Tricare family member dental plan. Changes under the plan will take effect Feb. 1, 2001.

"One of the most significant changes is that reserve component members and their families will be eligible to enroll," said Navy Capt. Lawrence D. McKinley, the Tricare Management Activity's senior consultant for dentistry.

Premiums for active duty family members will drop from current levels during the first two years of the contract. They may rise thereafter "but will remain very reasonable," said McKinley.

The \$21.33 family rate will be reduced to \$19.08 in the first year, for instance.

Other improvements will include an increase in the annual maximum for general dentistry from \$1,000 to \$1,200 and expansion of coverage for diagnostic and preventative services.

### Service Moves to Further Cut Smoking

The Air Force has decided to adopt some new anti-tobacco programs in its effort to eventually make the service smoke-free.

Twenty years ago more than half of the Air Force's personnel smoked. Today that percentage is down to 29 percent. But progress in driving the number still lower has stalled since 1995, convincing service health officials that they need to intensify their approach.

"We'd like to continue to see a downward trend and help to keep educating and informing people of the adverse effects of tobacco use," said Lt. Col. Wayne Talcott, DoD Alcohol Abuse and Tobacco Use Reduction Committee co-chairman.

The new programs and policies include a smoking ban in all Department of Defense facilities by 2002, tobacco cessation studies for basic



In filming an Air Force recruiting commercial at Edwards AFB, Calif., cameramen from MJZ Productions use a crane to get an overhead shot of an F-117 Nighthawk stealth fighter. A national television ad campaign is one method USAF is using to reach potential recruits.

USAF photo by John Foster



trainees that help educate them on the effects of smoking over a long period of time, and a joint-service project to train smoking cessation facilitators.

The Air Force banned smoking in basic training in 1986. It began smoking cessation classes for smokers in 1980.

"Our No. 1 goal is prevention. ... We hope to catch those who are thinking about smoking or using tobacco products and deter them," said Talcott.

### **Sea-Based Missile Defense Unlikely**

Sea-based assets are not part of the Pentagon's plan for national missile defense—at least not for now.

Pentagon officials say they realize that interceptors and radars based on ships might someday add another protective layer to their system of systems. But development of such equipment would take time, and right now the Defense Department needs to move as quickly as possible.

"Much more work needs to be done on the elements of a possible sea-

based supplement to a land-based system," said Pentagon spokesman Ken Bacon.

Navy officials have been quietly planning for a future in which their developing regional theater missile-defense systems are upgraded for national missile defense duties.

But right now even those theater systems are experiencing development pains. Problems with the kinetic kill warhead are threatening to delay the Navy's Theater Wide missile defense project and could increase its costs.

The problem is that the materials used in the kill warhead's thrusters have not been able to withstand the tremendous temperatures they generate, reported *Defense News* on June 19. The high temperatures stem from the fact that the warhead must travel at tremendous speed to catch ballistic missile targets.

### **USAF Faces Civilian Employee Shortage**

In five years more than 45 percent of the Air Force's civilian employees will be eligible for retirement—mean-

ing that service leaders need to start planning now if they are to avoid a manpower shortage in the near future.

Air Force Materiel Command anticipates having to hire 26,000 people between now and 2007, for instance.

"This is just as serious a problem as the overall Air Force blue-suit recruitment issue," said Gen. Lester L. Lyles, AFMC commander. "The civilian work force—constituting 60 percent of our people—is part of our total force equation."

The civilian workforce has already shrunk substantially over recent years due to service downsizing. Ten years ago the Air Force employed roughly 260,000 civil service personnel. That number has shrunk to about 165,000 today.

Many of those who left were more junior personnel, leaving the Air Force top-heavy with senior civilians. Fully one-third of Defense Department civilians as a whole are now over 51.

Air Force leaders hope a new force-shaping and sustaining strategy will help them maintain the right mix of youth and experience in the years ahead.

To gain more accessions, the Air Force is looking at strategies such as greater investment in interns and other developmental trainees, to provide stability in sustainment efforts. A key here, too, is "to be more competitive in our hiring practices to recruit the best-qualified people in the current economy," said Roger Blanchard, assistant deputy chief of staff for personnel.

At AFMC, officials say they are now engaged in a significant recruitment effort. However, they stress that the Air Force needs legislation to ease hiring practices.

"The one instrument I need most, and has the broadest application, is a streamlined hiring authority," said Leif Peterson, director of civilian personnel for AFMC. "We have dated hiring authorities now that are time-consuming and cumbersome. We need one that addresses the competitive marketplace but still complies with public policy requirements and is responsive to the competition we now face."

### **Airborne Laser Gets Funds**

When defense spending and authorization bills are wrapped up later this year it is likely that Congress will have restored most, if not all, of the \$92 million the Air Force cut from the Airborne Laser program to pay operational bills.

In the Senate, both the authoriza-

## **"Elementary Logic" for Serbian Leaders**

On June 8, the Brookings Institution in Washington, D.C., held a seminar on Operation Allied Force, NATO's air war against Yugoslavia. Army Gen. Wesley Clark, Supreme Allied Commander Europe, delivered the keynote address, part of which postulated a major land-force role in NATO's victory. Excerpts:

"In the summer of 1998, ... we looked at about a dozen ground options. Two involved forced entry into Yugoslavia. One, an entry into Kosovo. One, an entry into Serbia itself. We estimated at the time it would be about 75,000 combat troops for the Kosovo operation and about 200,000-plus combat troops to go all the way in. This was on the shelf. It was one of the concept plans that was used, reviewed by NATO leadership, and it was always present in our thoughts. ...

"The strategy was to announce a threat, make a threat. If that didn't work, to carry out the threat of air. If that didn't work, to move to the next level, and that next level would have been ground.

"As we were working in early April, beginning our SHAPE assessment very privately in my headquarters, we had on the ground already 11,000 troops with the ACE [Allied Command Europe] Rapid Reaction Corps in Macedonia. By late April, we had Task Force Hawk and ACE Mobile Force—Land on the ground in Albania, with the US V Corps headquarters. ... And by early June, we'd announced the buildup of the forces to fill out the full 50,000-plus requirement of the Kosovo force. So we had forces flowing again into Macedonia. ...

"I would suggest it was elementary logic for Milosevic to conclude that something bad—very bad—was going to happen to his forces in Kosovo, and relatively soon. ... It had nothing to do, in my view, with declaratory statements; it had everything to do with the capabilities of the force on the ground. ...

"Some people thought that ground forces really didn't play. Let me just talk for a moment about Task Force Hawk. ... It had a corps headquarters, two dozen Apache helicopters, and a bunch of other helicopters with it. It was a mixed heavy-light brigade on the ground with tanks. It had multiple-launch rocket systems—155 mm, 105 mm artillery; key elements from the corps headquarters; very robust logistics and communications. It was a full joint strike force. It was a lot more than 24 helicopters.

"It deployed in less than 30 days from a virtual standing start into a restricted airfield in adverse weather in the midst of a humanitarian crisis. It was trained and ready to go by the required date, and it had strategic impact. ... These ground forces signaled resolve, demonstrated capabilities, stabilized both Albania and Macedonia, enhanced the targeting of fielded forces, gave credibility to the ground threat, and then let us go quickly into [Kosovo] at the end of the fighting."



## Korean War Death Figure Adjusted

Fifty years after the beginning of the Korean War, the Pentagon has issued a clarification emphasizing that 33,686 US troops died in that conflict—not 54,246, as is commonly reported.

Sources from the *Encyclopedia Britannica* to the Korean War Memorial in Washington repeat the higher figure. The mistake stems from a government statistician who at some point in the past took the number of combat deaths in Korea—33,686—and added the number of non-battlefield deaths—20,560—that occurred in the US military during the Korean War years.

But most of those non-battlefield deaths occurred far from Asia, at US or European bases and in training exercises. The number of non-battlefield deaths that took place in the Korean theater of operations is 2,830.

If nothing else, the clarification highlights how much safer day-to-day military operations have become. About 17,000 US military members died outside the Korean theater between 1950 and 1953. That's about double today's peacetime death rate, even after adjusting for the different number of troops involved.

"We have made incredible strides in reducing the number of non-combat accidental deaths, training deaths, and things of that sort in recent years," said Pentagon spokesman Rear Adm. Craig Quigley June 6.

tion and money legislation have the \$92 million added back. The funding increase is needed to keep ABL on track at least through its first planned intercept test, according to Senate aides.

House versions have added about \$10 million less back to the ABL account. They also include language that would transfer authority for the ABL program from the Air Force to the Ballistic Missile Defense Organization—the better, say House ABL proponents, to protect it from further Air Force-directed reductions.

That is a change Air Force leaders hope will be eliminated in House-Senate conference.

"This program was born in the Air Force, brought up in the Air Force, and deserves to be fielded by the Air Force," said Chief of Staff Gen. Michael Ryan in a letter to the chairman of the House Armed Services Committee, Rep. Floyd D. Spence (R-S.C.).

### F-15s: Buy New or Buy Old?

A Boeing study commissioned by the Air Force concludes that the cost of building an F-15 can be cut by half—making it less expensive to build new Eagles than maintain old ones.

According to the study's figures, as reported by *Jane's Defence Weekly* on June 14, the Air National Guard would save between \$6.5 billion and \$8.9 billion over 20 years by buying 115 new redesigned F-15Cs instead of taking old ones from the Air Force and upgrading them, as current plans call for.

The cost savings would stem from improved manufacturing processes and from using less-expensive ma-

terials and components in some instances. The F-15C+ would replace a boron composite with another, slightly heavier material that is only one-tenth as expensive, for instance.

### Britain Plans to Lease C-17s

The United Kingdom's Ministry of Defense announced its intention to lease four Boeing C-17 Globemaster III airlifters for the Royal Air Force beginning in 2001.

At first, aircrew training and maintenance support will be handled by the contractor and the US Air Force.

The order might give a boost to

Boeing's offer to sell the US an additional 60 C-17s at a discount of about 25 percent. Currently, the Air Force has 120 C-17s on order.

It may also persuade other US allies to purchase the giant, modern airlifter. Countries which have reportedly expressed interest include France, Germany, Canada, and Australia.

### Portugal Joins F-16 Consortium

Portugal joined the F-16 Multinational Fighter Program in a signing ceremony held at NATO headquarters June 9.

Belgium, Denmark, Netherlands, Norway, and the United States are the other members of the program, which was founded to develop and produce the Fighting Falcon. Its goal now is joint work on long-term upgrades and sustainment of each nation's F-16 fleet.

"The addition of Portugal into the [Multinational Fighter Program] improves the affordability and continued superior performance of upgraded F-16s well into the 21st century," said Secretary of Defense William Cohen.

For its next move, the group will explore a multinational purchase of precision guided munitions. Such a group buy should reduce PGM unit costs.

"Since the Kosovo campaign, the US has pressed its NATO allies to



ANG Lt. Col. Graham Buschor, 106th Rescue Wing (Francis S. Gabreski IAP, N.Y.), in his flight suit, poses next to actor George Clooney, star of the blockbuster movie "Perfect Storm," and Coast Guardsman Lt. Cmdr. Chris Fortney (far left) and Capt. Lawrence Brudnicki. Buschor copiloted a rescue helicopter forced to ditch in the sea during the October 1991 storm depicted in the movie. Brudnicki and Fortney helped rescue him four hours later.



improve their precision strike capabilities in order to better share the responsibilities in the event of a future air operation," said Cohen.

### US, Russia Clash on Missile Defense

The June summit between President Clinton and Russian President Vladimir Putin only served to highlight the deep differences between the US and Russia on the pressing question of missile defense.

Putin rejected Clinton's call for a change in the 1972 Anti-Ballistic Missile treaty that would allow the US to build a ground-based defense against incoming nuclear warheads. He surprised US officials by floating his own proposal, in return: mutual construction of a defense designed to attack ballistic missiles in their boost phase.

While some US experts said there could be intriguing technical aspects to the Russian proposal, most dismissed it as more politics than policy.

"At this point, it's an idea that does not, at least to me, appear to be feasible or desirable for protecting us against the kinds of threats that are emerging," said Secretary of Defense William Cohen, after Russian Defense Minister Igor Sergeev out-



USAF photo by SrA. Suzanne M. Jenkins

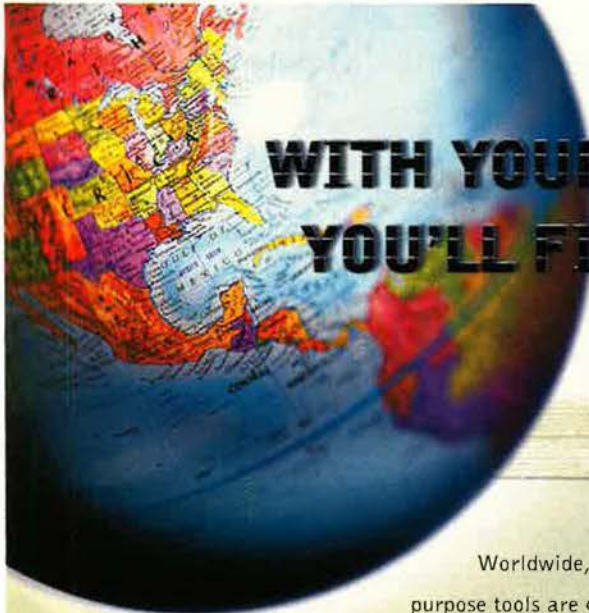
**A1C Rick Mayo of the 31st Civil Engineering Squadron at Aviano AB, Italy, practices explosive ordnance removal tactics to stay proficient in the skills needed for this dangerous task.**

lined the plan to NATO officials on June 9.

Details of the Russian plan remain sketchy. According to Cohen, it would consist of two main elements.

The first would be a layer of defenses intended to protect the US

and Russian homelands by destroying rogue state missiles in their vulnerable, slow-rising boost phase. This would require basing interceptor missiles near their possible targets. North Korea, for example, could be deterred by the placement of defenses in South



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**C-141 pilot 1st Lt. Kara Sandifur, washes part of the Korean War Memorial on The Mall in Washington, D.C. Air Force Reserve Command personnel from the 459th Airlift Wing, Andrews AFB, Md., and their families have been helping to clean the Vietnam Veterans Memorial Wall and Korean War Memorial for about a year.**

Korea or on ships in the Sea of Japan.

The second layer would use theater ABM systems to protect Europe. Such defenses, designed primarily to counter short- and medium-range weapons, are allowed under the terms of the ABM pact.

Construction of the European layer could proceed apace with currently planned equipment. But the boost phase defenses, if they are to be effective, could take quite a bit longer. It is doubtful they could be ready by 2005, the current deadline for construction of the Clinton Administration's planned first defense phase.

"We are willing to listen to proposals about a boost-phase intercept system, but our understanding is that it requires a great deal of technical challenge," said Cohen.

Pentagon officials consider it a victory of sorts to get Russia to talk about any kind of missile defense, whether its form is acceptable to the US or not. For the Kremlin to do so means that it implicitly acknowledges that there is a threat to the world at large from the missile programs of North Korea, Iraq, Iran, and other nations of concern.

But summit results clearly showed that the Kremlin does not share Washington's sense of urgency about this developing threat.

**USAF Faces Severe Hurricane Season**

Air Force bases located in the hur-

ricane-prone eastern region of the US are girding themselves for an extra-difficult hurricane season this year, say Air Force officials.

A typical hurricane season (June 1 through Nov. 30) features nine storms that become severe enough to earn names and six full-blown hurricanes, with two hurricanes rated Category 3 or higher. But due to changing ocean current cycles, forecasters expect this year to be particularly severe, with 11 named storms and seven hurricanes, with three Category 3 superstorms.

That means that base evacuations may be more likely this summer. Last year the Air Force evacuated people and aircraft from 25 installations that were located in Hurricane Floyd's predicated Atlantic coast path.

"One life lost is too many, and in the case of an aircraft, a single aircraft may cost between \$15 [million] and \$150 million," said Col. Michael A. Neyland, Air Force deputy director of weather. "On the other hand, it might only cost \$1 million to evacuate a base."

Floyd, a Category 4 storm, caused \$2 million in damage to Seymour Johnson AFB, N.C. Its 155 mph winds were just the sort of weather that the service wants to protect itself against.

But winds are not the only prob-

**Initiatives Address Retention Concerns**

The Air Force has approved 11 retention initiatives culled from suggestions made by focus groups at 11 bases and intends to put them in practice as soon as possible.

The initiative list is the culmination of a retention summit effort that began in January and has progressed through worldwide focus groups and senior leadership briefings.

"We learned people were primarily concerned about issues such as Tricare, spouse employment, retraining, and lack of communication from leadership," said Lt. Col. Jan Middleton, chief of USAF retention policy, personnel.

Approved initiatives include:

- A retention tool kit, which will be an online service that gives commanders and supervisors ready access to the latest retention information.
- Establishment of full-time career assistance advisors at all bases.
- Allocation of funds to partially subsidize child care at on-base licensed homes to provide an extension of available child care hours to match longer hours active duty members must often work.
- Development of a campaign to emphasize the history and tradition of the Air Force.
- A comprehensive review of all education benefits.
- Support of legislation to give a tax break to working spouses when a military member is transferred overseas.

Another eight initiatives were recommended but need additional work.





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lem. Flooding from heavy rainfall or storm surge can be more damaging to buildings than wind. And hurricanes often create weather conditions that are conducive to tornado development.

"Hurricane Andrew's devastation of south Florida, including Homestead AFB, was worsened by tornadoes spawned by the hurricane," says Lt. Col. Harold A. Elkins, chief of the weather operations division at the Pentagon.

**Air Force Dedicates B-2 to America**

A July 14 USAF ceremony at Langley AFB, Va., was selected for the official naming of the newest USAF B-2 stealth bomber—*Spirit of America*.

Plans called for putting on display the 21st and final B-2 stealth bomber, which would give spectators a rare opportunity to get a close-up look at the advanced aircraft.

The name of the last aircraft marked a departure of sorts for the Air Force. Nineteen of the previous 20 B-2s were named after states. One is called *Spirit of Kitty Hawk*, but it represents the state of North Carolina.

**The Regrets of Jane Fonda**

She still hasn't actually apologized. Instead, Jane Fonda now informs us that she feels just awful about her posing for the infamous 1972 photo with North Vietnamese soldiers.

The photo depicted the screen actress and anti-war activist seated in a North Vietnamese air defense battery as if on guard to shoot down any intruding US aircraft. The event left her indelibly branded as "Hanoi Jane."

"I will go to my grave regretting the photograph, ... which looks like I was trying to shoot at American planes," she said.

Fonda, 62, revealed her thoughts to television personality Oprah Winfrey, who interviewed the aging actress for the July-August issue of *O, The Oprah Magazine*.

What did she regret about her appearance in the photo?

"It hurt so many soldiers," said Fonda. "It galvanized such hostility. It was the most horrible thing I could possibly have done. It was just thoughtless."

**Navy, Boeing Shake Hands on Super Hornet Deal**

The Navy awarded Boeing an \$8.9 billion contract to build a total of 222 F/A-18E/F Super Hornets over five years.

Boeing announced the deal June 16. The Super Hornet is the Navy's latest carrier-based fighter.

Boeing said the Navy will purchase 36 aircraft this year, 41 next year, and 48 in each of the following three years.

The new fighter is "the cornerstone of the future of naval aviation," said Adm. Jay Johnson, Chief of Naval Operations.

Boeing now has orders for 284 Super Hornets of which 22 have been delivered on time or ahead of schedule. The Navy plans to buy a minimum of 548 of the aircraft.

**News Notes**

■ President Clinton has approved establishment of a Kosovo Campaign Medal to honor service members who participated in the air war against Serbia. To be eligible, personnel must have supported the operation for 30 consecutive days or 60 nonconsecutive days, among other criteria.

■ A C-130 crew from the 517th Air-lift Squadron, Elmendorf AFB, Alaska, was recently awarded the Lt. Gen. William H. Tunner Award for exemplary airmanship. In bad weather, the crew landed a Hercules with two blown engines at the tiny Canadian town of The Pas, Manitoba, where they became local celebrities as they waited a week for parts.

■ A USAF F-16 fighter crashed June 21 in Canada and its pilot ejected, suffering minor injuries. The pilot, of the 388th Fighter Wing, Hill AFB, Utah, was taking part in Exercise Maple Flag at Cold Lake Air Weapons Range in Canada when the mishap occurred. The Air Force convened a flight safety board of investigations to determine the cause of the crash.

■ MSgt. Robert W. Runyon, currently assigned to the 9th Reconnaissance Wing at Beale AFB, Calif., was recently selected as the 2000 Air Force First Sergeant of the Year. He was recognized for his leadership

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**E7 Analog Walnut Clock.** 4" x 6" with engraving plate. Accurate quartz movement. **\$46**

**E8 AFA Executive Desk Top Clock.** 8" x 5.25" solid walnut with AFA brass medallion and 4.25" engraving plate. Accurate quartz movement. **\$54**

**E9 AFA Cherry Wedge Wood Clock.** 5" x 4" **\$43**

**E10 (Not shown) AFA Brass Medallion.** (As seen on E8 clock) **\$15**





## Air Force Names 12 Outstanding Airmen

The Air Force on June 16 announced its top enlisted members—the 12 Outstanding Airmen of the Year for 2000.

The 12 are authorized to wear the Outstanding Airman of the Year ribbon with bronze service star device. Each will be honored at the Air Force Association's National Convention this September in Washington, D.C.

The selectees are:

**SMSgt. Tim C. Bosch,**  
Pacific Air Forces.

**SMSgt. Cathryn L. Casto,**  
Air Combat Command.

**SrA. Cyril R. Charity Sr.,**  
Air National Guard.

**SMSgt. Daniel F. Cooler,**  
Air Intelligence Agency.

**MSgt. Rocky D. Dunlap,**  
Air Mobility Command.

**SrA. John M. Jordan,**  
Air Force Special Operations  
Command.

**TSgt. Matthew M. Marshall,**  
US Air Forces in Europe.

**SSgt. Susan A. Robinson,**  
Air Force Materiel Command.

**MSgt. Paul S.N. Sanchez,**  
Air Force Pentagon Communica-  
tions Agency.

**SSgt. Tammy M. Stiles,**  
Air Mobility Command.

**SrA. Michael M. Solyom,**  
Air Education and Training  
Command.

**SSgt. Jasmin D. Wiltshire,**  
Air Force Space Command.

while assigned to the 24th Mission Support Squadron, Howard AFB, Panama, where he was instrumental in guiding Howard from fully operational base to caretaker status.

■ The Air National Guard named its airmen of the year June 12. They are: MSgt. Richard Gonzales, Western Air Defense Sector, McChord AFB, Wash., First Sergeant of the Year; MSgt. Jim Marklevits, 184th Bomb Wing, McConnell AFB, Kan.,

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Senior Noncommissioned Officer of the Year; SSgt. Lizdeth Means, 161st Military Personnel Flight, Phoenix, Ariz., NCO of the Year; and SrA. Cyril Charity Sr., 113th Security Police Squadron, Washington, D.C., Airman of the Year.

■ 2nd Lt. Shelley Hoenle, an architect with the 78th Engineer Group at Robins AFB, Ga., has been chosen by Notre Dame's School of Architecture and the Millennium Gate Foundation as one of a 12-person team that will produce a Millennium Gate for Washington, D.C. The site for the gate is Barney Circle, where Pennsylvania Avenue crosses the Anacostia River via the Sousa Bridge.

■ A joint South Korea-US Air Force investigative team determined that the pilot of an A-10 Thunderbolt II followed proper procedure in an emergency bomb drop into the sea

at the Koon-ni Range, South Korea, on May 8. Nearly 3,400 local reports of household damage and numerous reports of livestock miscarriages attributed to the jettisoning were unfounded, according to the 23-member team.

■ An Air Force captain assigned at Yongsan Army Garrison, South Korea, was apprehended May 23 for suspicion of possession of an illegal substance. Investigators confiscated approximately two kilograms of cocaine.

■ Maj. Michael Lee, an Air Force Reserve Command F-16 pilot from the 93rd Fighter Squadron, Homestead ARS, Fla., accepted the 1999 Joe Bill Dryden Semper Viper Award this spring. The award is sponsored by Lockheed and recognizes exceptional airmanship skills. Lee is the first reservist so honored.

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■ Larry Keith Hamilton, a C-5 electrician from Robins AFB, Ga., recently received DoD's Value Engineering Award. Hamilton won the honor for designing a test device for the C-5 anti-skid system that will save taxpayers approximately \$26 million a year.

■ SMSgt. Clint Allen of the Aeronautical Systems Center, Wright-Patterson AFB, Ohio, won a gold medal at the US Racquetball Association National Tournament in Houston this spring. Allen triumphed in the age-40-and-over "A" division.

■ An aircrew from the Kentucky ANG helped rescue a civilian pilot whose Cessna plunged into the Atlantic 360 miles off the coast of Por-

tugal on May 17. The pilot, Alex Haynes of Seattle, was not harmed in the crash but could have been endangered by hypothermia in chilly ocean waters.

■ A team from the US Air Force Academy won the second annual Birchall Cup at the Royal Military College of Canada, Kingston, Ontario, recently. The cup, named in honor of a Canadian air hero of World War II, recognizes student airmanship achievement.

■ *Consumer Reports* magazine has named Tricare Senior Prime, the Defense Department's demonstration version of a Medicare Health Maintenance Organization, as a top value in the cities in which it is of-

fered. The magazine rated HMOs in 30 cities, including two of DoD's six Senior Prime test sites—Denver and Seattle.

■ USAF successfully launched a rocket made of parts from scrapped missiles from Vandenberg AFB, Calif., on May 28. The rocket, intended to be used in creating the nation's missile defense system, was cobbled together from three stages from different old Minuteman II ICBMs.

■ USAF MSgts. Bruce W. McGrath and Thomas R. Greenwood have been honored by the German armed forces for their support of Kosovo operations flown by German forces from a UK air base. The pair were awarded the German Armed Forces Medal of Honor. ■

## Senior Staff Changes

**RETIREMENTS:** Robert S. Dickman, John A. Gordon, John W. Meincke, Lloyd W. Newton, Glenn C. Waltman.

**NOMINATIONS:** To be Major General: Paul W. Essex.

**PROMOTION:** To Lieutenant General: William T. Hobbins, Tome H. Walters Jr. To ANG Brigadier General: Bruce S. Assay.

**CHANGES:** Brig. Gen. Barbara C. Brannon, from Dir., Medical Readiness & Nursing Svcs., Bolling AFB, D.C., to Cmdr., 89th Medical Gp., AMC, Andrews AFB, Md. ... Maj. Gen. Walter E. Buchanan III, from Cmdr., 325th FW, AETC, Tyndall AFB, Fla., to Spec. Asst., DCS, Air & Space Ops., USAF, Pentagon ... Brig. Gen. Richard L. Comer, from Dep. Commanding Gen., USSOCOM, Ft. Bragg, N.C., to Vice Cmdr., AFSOC, Hurlburt Field, Fla. ... Brig. Gen. John D.W. Corley, from Dir., Studies & Analysis, USAFE, Ramstein AB, Germany, to Mission Area Dir., Global Power, Asst. SECAF for Acq., Pentagon ... Lt. Gen. Robert H. Foglesong, from Cmdr., 12th AF, ACC, Davis-Monthan AFB, Ariz., to DCS, Air & Space Ops., USAF, Pentagon.

Brig. Gen. Michael C. Gould, from Cmdr., 97th AMW, AETC, Altus AFB, Okla., to Cmdr., Cheyenne Mountain Ops. Ctr., NORAD/USSPACECOM, Cheyenne Mountain AFS, Colo. ... Brig. Gen. Elizabeth A. Harrell, from Cmdr., 81st Tng. Wg., AETC, Keesler AFB, Miss., to Dir., Log. and Security Assistance, EUCOM, Stuttgart-Vaihingen, Germany ... Lt. Gen. William T. Hobbins, from Dir., Ops., USAFE, Ramstein AB, Germany, to Cmdr., 12th AF, ACC, Davis-Monthan AFB, Ariz. ... Lt. Gen. (sel.) Raymond P. Huot, from Mission Area Dir., Global Power, Asst. SECAF for Acq., Pentagon, to IG, OSAF, Pentagon ... Brig. Gen. Raymond E. Johns Jr., from Cmdr., 62nd AW, AMC, McChord AFB, Wash., to Dep. Dir., Strategic Planning & Policy, PACOM, Camp H.M. Smith, Hawaii.

Brig. Gen. David L. Johnson, from Vice Cmdr., AFSOC, Hurlburt Field, Fla., to Dir., Weather, DCS, Air & Space Ops., USAF, Pentagon ... Brig. Gen. Christopher A. Kelly, from Dep. Dir., Strategic Planning & Policy, PACOM, Camp H.M. Smith, Hawaii, to Vice Cmdr., 15th AF, AMC, Travis AFB, Calif. ... Brig. Gen. Robert H. Latiff, from Cmdr., Cheyenne Mountain Ops. Ctr., NORAD/USSPACECOM, Cheyenne Mountain AFS, Colo., to Vice Cmdr., ESC, AFMC, Hanscom AFB, Mass. ... Brig. Gen. Edward L. Mahan Jr., from Sys. Prgm. Dir., Integrated C<sup>2</sup> Sys., ESC, AFMC, Hanscom AFB, Mass., to Cmdr., AF Security Assis-

stance Ctr., AFMC, Wright-Patterson AFB, Ohio ... Maj. Gen. Teddie M. McFarland, from Vice Cmdr., ESC, AFMC, Hanscom AFB, Mass., to Prin. Asst. Dep. Under SECAF, Intl. Affairs, Pentagon ... Brig. Gen. Roosevelt Mercer Jr., from Dep. Dir., Ops., AFSPC, Peterson AFB, Colo., to Cmdr., 81st Tng. Wg., AETC, Keesler AFB, Miss. ... Brig. Gen. John G. Pavlovich, from Dep. Dir., Nuclear & Counterproliferation, USAF, Pentagon, to Dep. Dir., Ops., AFSPC, Peterson AFB, Colo. ... Brig. Gen. Quentin L. Peterson, from Dir., Trnsp., DCS, Instl. & Log., USAF, Pentagon, to Cmdr., 97th AMW, AETC, Altus AFB, Okla. ... Maj. Gen. John F. Regni, from Dir., Personnel Resources, DCS, Personnel, USAF, Pentagon, to Cmdr., 2nd AF, AETC, Keesler AFB, Miss. ... Maj. Gen. Lee P. Rodgers, from Command Surgeon, AMC, Scott AFB, Ill., to Cmdr., 59th Medical Wg., AETC, Lackland AFB, Tex.

Brig. Gen. James G. Roubesh, from Cmdr., 89th Medical Gp., AMC, Andrews AFB, Md., to Command Surgeon, AMC and TRANSCOM, Scott AFB, Ill. ... Maj. Gen. Randall M. Schmidt, from Spec. Asst. to Cmdr., USAFE, Ramstein AB, Germany, to Dir., Ops., USAFE, Ramstein AB, Germany ... Brig. Gen. Toreaser A. Steele, from Cmdr., 17th Tng. Wg., AETC, Goodfellow AFB, Tex., to Dir., Personnel Resources, DCS, Personnel, USAF, Pentagon ... Brig. Gen. Gregory L. Trebon, from Spec. Asst. to CINC, USSOCOM, MacDill AFB, Fla., to Dep. Commanding Gen., USSOCOM, Ft. Bragg, N.C. ... Lt. Gen. Tome H. Walters Jr., from Prin. Asst. Dep. Under SECAF, Intl. Affairs, Pentagon, to Dir., Defense Security Cooperation Agency, Arlington, Va. ... Brig. Gen. Gary A. Winterberger, from Dir., P&P, AETC, Randolph AFB, Tex., to Cmdr., E-3A Component, NATO Airborne Early Warning Force, Geilenkirchen, Germany.

**SENIOR EXECUTIVE SERVICE RETIREMENTS:** Sandra G. Grese, Gerald L. Yanker.

**SES CHANGES:** James D. Bankers, to Air Cmdr., 22nd AF, AFRC, Dobbins ARB, Ga. ... John J. Batbie Jr., to Dir., Mobilization & Reserve Affairs, EUCOM, Stuttgart-Vaihingen, Germany ... Kenneth K. Dumm, to Associate Dir., Intel., DCS, Air & Space Ops., USAF, Pentagon ... Billy W. Mullins, to Dir., Nuclear Weapons & Counterproliferation Agency, DCS, Air & Space Ops., USAF, Pentagon ... James A. Papa, to Dir., Engineering & Technical Mgmt., AFMC, Wright-Patterson AFB, Ohio ... Kenneth I. Percell, to Dep. Dir., P&P, AFMC, Wright-Patterson AFB, Ohio. ■





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On the following pages appears a variety of information and statistical material about space—particularly military activity in space. This almanac was compiled by the staff of *Air Force Magazine*, with assistance and information from R.W. Sturdevant, Air Force Space Command History Office; Steve Garber, NASA History Office; Tina Thompson, editor of *TRW Space Log*; Phillip S. Clark, Molniya Space Consultancy; Joseph J. Burger, Space Analysis and Research, Inc.; and US and Air Force Space Command Public Affairs Offices.

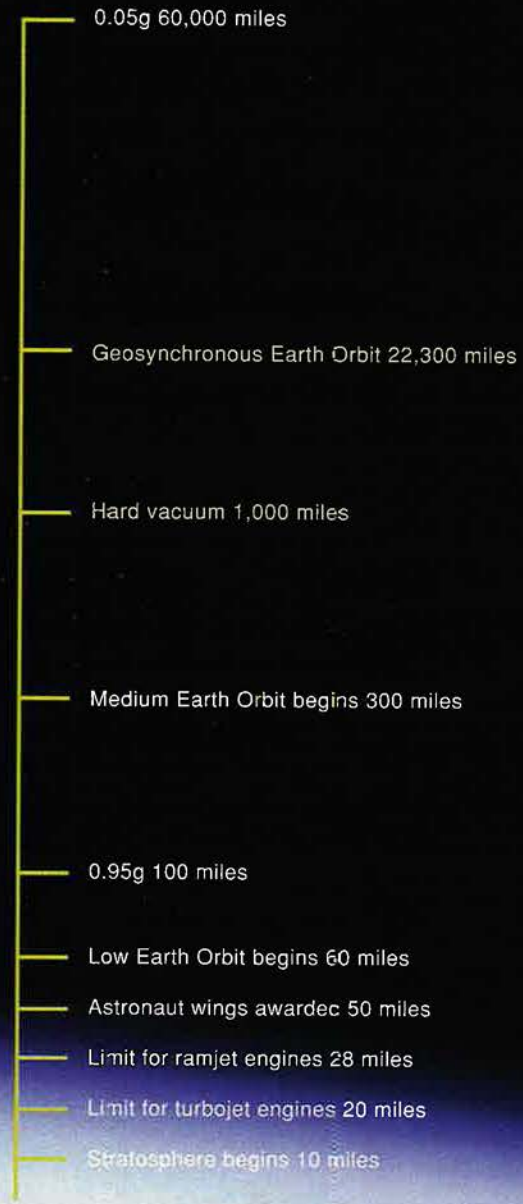
Figures that appear in this section will not always agree because of different cutoff dates, rounding, or different methods of reporting. The information is intended to illustrate trends in space activity.

# Space Almanac 2000

Compiled by Tamar A. Mehuron, Associate Editor



# Earth



Space facts from NASA and DoD sources.

Digital Image © 1996 Corbis; original image courtesy NASA.



# Introduction

## What's Up There

As of May 31, 2000

Country/Organizat on	Satellites	Space Probes	Debris	Total
USA	741	46	2,359	3,146
CIS (Russia/former USSR)	1,335	35	1,666	3,036
Iridium	88	0	0	88
Japan	66	4	20	90
Intl. Telecom Sat. Crg.	56	0	0	56
Globalstar	52	0	0	52
Orbcomm	35	0	0	35
France	31	0	11	42
People's Republic of China	27	0	304	331
European Space Agency	24	2	144	170
India	20	0	0	20
United Kingdom	17	0	0	17
European Telecom Sat. Org.	17	0	0	17
Canada	16	0	0	16
Germany	13	2	1	16
Indonesia	10	0	0	10
Intl. Maritime	9	0	0	9
Erazil	9	0	0	9
Luxembourg	9	0	0	9
Italy	8	0	1	9
NATO	8	0	0	8
Sweden	8	0	0	8
Arab Sat. Comm. Org.	7	0	0	7
Australia	7	0	0	7
South Korea	7	0	0	7
Mexico	6	0	0	6
Spain	6	0	0	6
Argentina	4	0	0	4
Czech Republic	4	0	0	4
Thailand	4	0	0	4
Asia Sat. Telecom Co.	3	0	0	3
Israel	3	0	0	3
Norway	3	0	0	3
France/Germany	2	0	0	2
Malaysia	2	0	0	2
Philippines	2	0	0	2
Turkey	2	0	0	2
Chile	1	0	0	1
China/Brazil	1	0	0	1
Denmark	1	0	0	1
Egypt	1	0	0	1
Intl. Space Station	1	1	0	2
Portugal	1	0	0	1
Republic of China (Taiwan)	1	0	0	1
Sea Launch (Launch Demo)	1	0	0	1
Singapore/Taiwan	1	0	0	1
South Africa	1	0	0	1
Total	2,672	90	4,506	7,267



In 1919, Robert H. Goddard, known as the father of modern rocketry, published "A Method of Attaining Extreme Altitude" while studying for his doctorate. The paper laid the theoretical foundation for future US rocket development. It also mentioned that a rocket could be flown to the moon as a demonstration. He was dismissed by the public as a "crackpot."



Russian Konstantin Tsiolkovsky worked on rocket design and theory in the early 20th century. In his writings he proposed space exploration by rocket, liquid propellants, multistage rockets, and space stations.



German scientist Hermann Oberth contributed to the theory and design of rockets. In 1923, he published a work that proved flight beyond the atmosphere was possible. In 1929, he wrote *The Road to Space Travel*, which proposed liquid-propelled rockets, multistage rockets, space navigation, and re-entry systems.



On Oct. 13, 1936, Lt. John Sessums of the Army Air Corps visited Robert H. Goddard to officially assess the military value of Goddard's work. He reported that he found little military value but believed that rockets would be useful to drive turbines.



## Worldwide Launches by Site, 1957-99

Launch Site	Nation	Launches
Plesetsk	Russia	1,458
White Sands Missile Range, N.M.	US	1,121
Tyuratam/Baikonur	Kazakhstan	1,054
Vandenberg AFB, Calif.	US	568
Cape Canaveral AFS, Fla.	US	556
Poker Flat Research Range, Alaska	US	278
JFK Space Center, Fla.	US	115
Kapustin Yar	Russia	84
Kourou	French Guiana	123
Tanegashima	Japan	30
Shuang Cheng-tzu/Jiuquan	China	24
Wallops Flight Facility, Va.	US	27
Uchinoura	Japan	23
Xichang	China	25
Indian Ocean Platform	Kenya	9
Sriharikota	India	9
Edwards AFB, Calif.	US	5
Hammaguir	Algeria	4
Taiyuan	China	11
Yavne	Israel	3
Woomera	Australia	2
Svobodny	Russia	2
Gando AFB, Canary Islands	Spain	1
Barents Sea	Russia	1
Pacific Ocean Platform	Sea Launch	2
<b>Total</b>		<b>5,535</b>

### Space on the Web

(Some of the space-related sites on the World Wide Web)

#### Defense

	Web address
US Space Command	<a href="http://www.spacecom.af.mil/usspace">www.spacecom.af.mil/usspace</a>
Air Force Space Command	<a href="http://www.spacecom.af.mil/hqafspc">www.spacecom.af.mil/hqafspc</a>
21st Space Wing	<a href="http://www.spacecom.af.mil/21sw">www.spacecom.af.mil/21sw</a>
30th Space Wing	<a href="http://www.vafb.af.mil">www.vafb.af.mil</a>
45th Space Wing	<a href="http://www.pafb.af.mil">www.pafb.af.mil</a>
50th Space Wing	<a href="http://www.schriever.af.mil">www.schriever.af.mil</a>

#### Industry

Boeing Space Systems	<a href="http://www.boeing.com/defense-space/space">www.boeing.com/defense-space/space</a>
Hughes Space & Communications	<a href="http://www.hughespace.com">www.hughespace.com</a>
Lockheed Martin Astronautics	<a href="http://www.ast.lmco.com">www.ast.lmco.com</a>
Orbital Sciences	<a href="http://www.orbital.com">www.orbital.com</a>
Rotary Rocket	<a href="http://www.rotaryrocket.com">www.rotaryrocket.com</a>
Space Systems Loral	<a href="http://www.ssloral.com">www.ssloral.com</a>
TRW	<a href="http://www.trw.com/seg/products.html">www.trw.com/seg/products.html</a>

#### NASA

Integrated Launch Manifest (Launch forecast for shuttle and NASA payloads on ELVs)	<a href="http://www-pao.ksc.nasa.gov/kscpao/schedule/mixfleet.htm">www-pao.ksc.nasa.gov/kscpao/schedule/mixfleet.htm</a>
Jet Propulsion Laboratory Mission and Spacecraft Library	<a href="http://leonardo.jpl.nasa.gov/msl">leonardo.jpl.nasa.gov/msl</a>
Mars Global Surveyor	<a href="http://mars.jpl.nasa.gov/mgs">mars.jpl.nasa.gov/mgs</a>
NASA Human Space Flight	<a href="http://spaceflight.nasa.gov">spaceflight.nasa.gov</a>
Space Center Houston	<a href="http://spacecenter.org">spacecenter.org</a>

#### Other

European Space Agency	<a href="http://www.esa.int">www.esa.int</a>
Florida Today (Current and planned space activity)	<a href="http://www.flatoday.com/space">www.flatoday.com/space</a>
Space and Technology	<a href="http://www.spaceandtech.com">www.spaceandtech.com</a>

## Space and Missile Badges



Space/Missile Badge



Astronaut Pilot\*



Missile Badge



Missile Badge with Operations Designator

\*The astronaut designator indicates a USAF rated officer qualified to perform duties in space (50 miles and up) and who has completed at least one operational mission. Pilot wings are used here only to illustrate the position of the designator on the wings.



# The Year in Space

## July 8, 1999

Former Apollo astronaut Pete Conrad, who became third person to walk on moon, dies in motorcycle accident near Ojai, Calif.

## July 20

After lying undisturbed on the ocean bottom for 38 years, astronaut Gus Grissom's Mercury capsule, Liberty Bell 7, is recovered.

## July 23-27

Air Force Col. Eileen Collins becomes first woman to command shuttle mission when *Columbia* (STS-93) places Chandra X-Ray Observatory, world's most powerful X-ray telescope, in orbit.

## July 31

Controlled crash of NASA's Lunar Prospector into crater near moon's south pole fails to confirm presence of water ice.

## Aug. 27

Funding shortages compel Russia to leave 13-year-old Mir space station unmanned.

## Sept. 3

NASA announces SeaWinds radar instrument aboard QuikScat satellite performs technological first by tracking massive iceberg B10A, a potential threat to international shipping.

## Sept. 23

NASA's Mars Climate Orbiter, first interplanetary weather satellite, fails to enter Martian orbit because confusion between metric and English units causes navigation error.

## Sept. 24

Space Imaging Corp.'s Ikonos, capable of 1-meter resolution, enters orbit and becomes world's first commercial, high-resolution Earth-imaging satellite.

## Oct. 2

First critical test of National Missile Defense (NMD) system succeeds when Exoatmospheric Kill Vehicle strikes Minuteman II target 140 miles above Pacific Ocean.

## Oct. 9

First launch succeeds from Boeing-led international Sea Launch platform, floating on Pacific Ocean approximately 1,400 miles southeast of Hawaii. (Payload: DirecTV communications satellite.)

## Oct. 26

In first maneuver of its kind for International Space Station (ISS), flight controllers boost orbit to avoid dangerous space junk.

## Nov. 20-21

China launches, monitors, controls, and lands its first unmanned spaceship, the experimental Shenzhou.

## Nov. 23

Atlas IIA Centaur from Cape Canaveral AFS, Fla., sends US Navy's 10th UHF Follow-On communications satellite—third and final Block 3—into orbit.

## Dec. 3

NASA's Mars Polar Lander disappears in failed attempt at soft landing near Red Planet's south pole.

## Dec. 10

Powerful Ariane 5 rocket completes first commercial mission, lofting into orbit ESA's X-Ray Multi-Mirror satellite.

## Dec. 11

Brazil's second attempt to launch an indigenous booster fails when rocket's second stage fails to ignite just minutes into flight from Alcantara Launch Center near Sao Luis.

## Dec. 12

Air Force Titan II launches first Block 5D3 Defense Meteorological Satellite Program (DMSP) satellite into polar orbit from Vandenberg AFB, Calif.

## Dec. 18

Atlas IIAS booster from Vandenberg launches NASA's Terra, world's first satellite to monitor Earth's "vital signs" or "state of health" on daily, global scale.

## Dec. 19-27

Shuttle *Discovery* (STS-103), commanded by Air Force Col. Curtis L. Brown Jr., replaces failed gyroscopes and completes other repairs on Hubble Space Telescope.

## Dec. 30, 1999-Jan. 15, 2000

US and Russian military personnel jointly man warning center at Peterson AFB, Colo., to ensure that possible computer malfunctions resulting from Y2K rollover do not spark nuclear missile exchange.

## Jan. 18

Last-second sensor malfunction in missile interceptor results in failure of first fully integrated flight test of prototype NMD system.

## Jan. 20

Air Force launches 11th Defense Satellite Communications System (DSCS) III satellite—first in final group of four modified under Service Life Enhancement Program (SLEP) to provide high-speed, jam-resistant communications service.

## Jan. 26

Inaugural flight in US Air Force Orbital Suborbital Program uses Minotaur booster—two-stage Minuteman II with two Orbital Sciences Corp. Pegasus upper stages.

## Feb. 9

Russia performs successful maiden flight of new Reusable Launch Vehicle (RLV) Fregat, which has engines that can be switched on and off several times in orbit.

## Feb. 11-22

Shuttle *Endeavour* (STS-99) collects radar images to provide world's most accurate, most detailed, three-dimensional topographical maps of Earth.

## Feb. 14

Near Earth Asteroid Rendezvous (NEAR) spacecraft becomes first man-made object to orbit asteroid—433 Eros.

## Feb. 22

Stardust spacecraft begins first collection of interstellar dust particles for return to Earth in 2006.

## Feb. 27

Russia completes experiment simulating

long-duration mission aboard ISS; three crew members emerge after 240 days of isolation in two sealed compartments.

## March 12

Russian-Ukrainian rocket carrying British communications satellite falls into Pacific after liftoff in third attempt to use floating Sea Launch platform.

## March 17

Iridium LLC abandons quest for new backers; bankruptcy judge authorizes mobile phone company to cut off service to 55,000 customers and burn up its 66 satellites in Earth's atmosphere.

## March 25

NASA's Image satellite, first spacecraft dedicated to imaging Earth's magnetosphere, launches atop Delta II from Vandenberg and deploys four 820-foot wire antennas, making it longest artificial object in space.

## April 4

Russian cosmonauts blast off in privately funded venture to resuscitate Mir space station as a tourist destination.

## April 6

Powerful, fast-moving solar storm disturbs Earth's magnetic field, posing significant threat to satellites, communications, navigation systems, and power grids as sun reaches peak in 11-year storm cycle.

## May 1

More precise Global Positioning System (GPS) navigation signals previously available to military users only is opened to civilians, thereby allowing 10 times greater accuracy.

## May 8

After three consecutive Titan IV rocket failures at Cape Canaveral, Titan IVB successfully launches DSP missile warning satellite into geosynchronous orbit.

## May 12

Mir crewmen Sergei Zalyotin and Alexander Kaleri apply cosmic version of "superglue" to test its ability to seal cracks in skin of aging space station.

## May 19-29

Shuttle *Atlantis* (STS-101), piloted by Air Force Col. Scott J. Horowitz, completes mission to service ISS, including replacement of faulty batteries, and to boost station into higher orbit.

## May 28

Air Force launches from Vandenberg a rocket built from parts of scrapped Minuteman II ICBMs to determine if such a hybrid might be used as cheaper target for NMD program.

## June 4

NASA sends 17-ton Compton Gamma Ray Observatory into deliberate, controlled crash toward Pacific Ocean, ending highly successful, nine-year mission.

## June 22

Scientists announce that images from NASA's Mars Global Surveyor suggest possibility of current sources of liquid water at or near surface of Red Planet. ■



# Military & Civilian Space Budgets

## US Space Funding, Current Dollars

(Millions, as of Sept. 30, 1999)

FY	NASA	DoD	Other	Total
1959	\$261	\$490	\$34	\$785
1960	462	561	43	1,066
1961	926	814	69	1,809
1962	1,797	1,298	200	3,295
1963	3,626	1,550	259	5,435
1964	5,016	1,599	216	6,831
1965	5,138	1,574	244	6,956
1966	5,065	1,689	217	6,971
1967	4,830	1,664	216	6,710
1968	4,430	1,922	177	6,529
1969	3,822	2,013	141	5,976
1970	3,547	1,678	115	5,340
1971	3,101	1,512	127	4,740
1972	3,071	1,407	97	4,575
1973	3,093	1,623	109	4,825
1974	2,759	1,766	116	4,641
1975	2,915	1,892	106	4,913
1976	4,074	2,443	143	6,660
1977	3,440	2,412	131	5,983
1978	3,623	2,738	157	6,518
1979	4,030	3,036	177	7,243
1980	4,680	3,848	233	8,761
1981	4,992	4,828	233	10,053
1982	5,528	6,679	311	12,518
1983	6,328	9,019	325	15,672
1984	6,858	10,195	392	17,445
1985	6,925	12,768	580	20,273
1986	7,165	14,126	473	21,764
1987	9,809	16,287	462	26,558
1988	8,322	17,679	737	26,738
1989	10,097	17,906	560	28,563
1990	11,460	15,616	512	27,588
1991	13,046	14,181	697	27,924
1992	13,199	15,023	769	28,991
1993	13,064	14,106	698	27,868
1994	13,022	13,166	601	26,789
1995	12,543	10,644	629	23,816
1996	12,569	11,514	750	24,833
1997	12,457	11,727	728	24,912
1998	12,321	12,359	744	25,424
1999	12,459	13,385	830	26,674
<b>Total</b>	<b>\$265,870</b>	<b>\$280,737</b>	<b>\$14,358</b>	<b>\$560,965</b>

## US Space Funding, Constant Dollars

(Millions, as of Sept. 30, 1999)

FY	NASA	DoD	Other	Total
1959	1,241	2,329	162	3,731
1960	2,154	2,616	201	4,971
1961	4,277	3,760	319	8,355
1962	8,190	5,916	912	15,017
1963	16,323	6,978	1,166	24,467
1964	22,317	7,114	961	30,393
1965	22,568	6,914	1,072	30,553
1966	21,874	7,294	937	30,105
1967	20,004	6,892	895	27,790
1968	18,143	7,871	726	26,740
1969	15,095	7,950	558	23,602
1970	13,412	6,345	435	20,192
1971	11,129	5,426	456	17,011
1972	10,477	4,800	331	15,609
1973	10,066	5,282	355	15,702
1974	8,585	5,495	361	14,442
1975	8,470	5,497	308	14,275
1976	10,765	6,455	378	17,598
1977	8,202	5,751	312	14,265
1978	8,283	6,260	359	14,902
1979	8,628	6,500	379	15,507
1980	9,295	7,643	463	17,400
1981	9,130	8,830	426	18,385
1982	9,222	11,142	519	20,884
1983	9,882	14,084	508	24,473
1984	10,249	15,236	586	26,071
1985	9,976	18,393	836	29,204
1986	9,997	19,710	660	30,367
1987	13,368	22,196	630	36,193
1988	11,049	23,472	978	35,499
1989	12,987	23,031	720	36,738
1990	14,191	19,337	634	34,162
1991	15,563	6,917	831	33,312
1992	15,176	17,273	884	33,333
1993	14,690	15,862	785	31,336
1994	14,281	14,439	659	29,379
1995	13,446	11,411	674	25,531
1996	13,195	12,088	787	26,071
1997	12,831	12,079	750	25,659
1998	12,478	12,517	754	25,749
1999	12,459	13,385	830	26,674
<b>Total</b>	<b>\$493,667</b>	<b>\$432,488</b>	<b>\$25,493</b>	<b>\$951,648</b>

Figures may not sum due to rounding. NASA totals represent space activities only. "Other" category includes the Departments of Energy, Commerce, Agriculture, Interior, and Transportation; the National Science Foundation; the Environmental Protection Agency; and other agencies. (Note: NSF recalculated its space expenditures since 1980, making them significantly higher than reported in previous years.) Fiscal 1999 figures are preliminary.

## NASA Spending on Major Space Missions

FY 2001 Proposal, Current Dollars

Project Office	Millions
Human spaceflight	\$5,499.9
Space science	2,398.8
Earth science	1,405.8
Aerospace technology	1,193.0
Space operations	529.4
Life and microgravity sciences	302.4
Safety and mission assurance	47.5
<b>Total</b>	<b>\$11,376.8</b>



In October 1946, a V-2 rocket launched from White Sands Proving Ground, N.M., carried a camera that took motion pictures of the Earth at approximately 65 miles altitude.



On March 7, 1947, a US Navy V-2 rocket from White Sands took the first photograph at 100 miles altitude.



## Space Leaders

(As of July 1, 2000)

### Commanders in Chief, US Space Command

Gen. Robert T. Herres	Sept. 23, 1985–Feb. 5, 1987
Gen. John L. Piotrowski	Feb. 6, 1987–March 30, 1990
Gen. Donald J. Kutyna	April 1, 1990–June 30, 1992
Gen. Charles A. Horner	June 30, 1992–Sept. 12, 1994
Gen. Joseph W. Ashy	Sept. 13, 1994–Aug. 26, 1996
Gen. Howell M. Estes III	Aug. 27, 1996–Aug. 13, 1998
Gen. Richard B. Myers	Aug. 14, 1998–Feb. 22, 2000
Gen. Ralph E. Eberhart	Feb. 22, 2000–

### Directors, National Reconnaissance Office

Joseph V. Charyk	Sept. 6, 1961–March 1, 1963
Brockway McMillan	March 1, 1963–Oct. 1, 1965
Alexander H. Flax	Oct. 1, 1965–March 11, 1969
John L. McLucas	March 17, 1969–Dec. 20, 1973
James W. Plummer	Dec. 21, 1973–June 28, 1976
Thomas C. Reed	Aug. 9, 1976–April 7, 1977
Hans Mark	Aug. 3, 1977–Oct. 8, 1979
Robert J. Hermann	Oct. 8, 1979–Aug. 2, 1981
Edward C. Aldridge Jr.	Aug. 3, 1981–Dec. 16, 1988
Martin C. Faga	Sept. 26, 1989–March 5, 1993
Jeffrey K. Harris	May 19, 1994–Feb. 26, 1996
Keith R. Hall (acting)	Feb. 27, 1996–March 27, 1997
Keith R. Hall	March 28, 1997–

### Commanders, Air Force Space Command

Gen. James V. Hartinger	Sept. 1, 1982–July 30, 1984
Gen. Robert T. Herres	July 30, 1984–Oct. 1, 1986
Maj. Gen. Maurice C. Padden	Oct. 1, 1986–Oct. 29, 1987
Lt. Gen. Donald J. Kutyna	Oct. 29, 1987–March 29, 1990
Lt. Gen. Thomas S. Moorman Jr.	March 29, 1990–March 23, 1992
Gen. Donald J. Kutyna	March 23, 1992–June 30, 1992
Gen. Charles A. Horner	June 30, 1992–Sept. 13, 1994
Gen. Joseph W. Ashy	Sept. 13, 1994–Aug. 26, 1996
Gen. Howell M. Estes III	Aug. 26, 1996–Aug. 14, 1998
Gen. Richard E. Myers	Aug. 14, 1998–Feb. 22, 2000
Gen. Ralph E. Eberhart	Feb. 22, 2000–

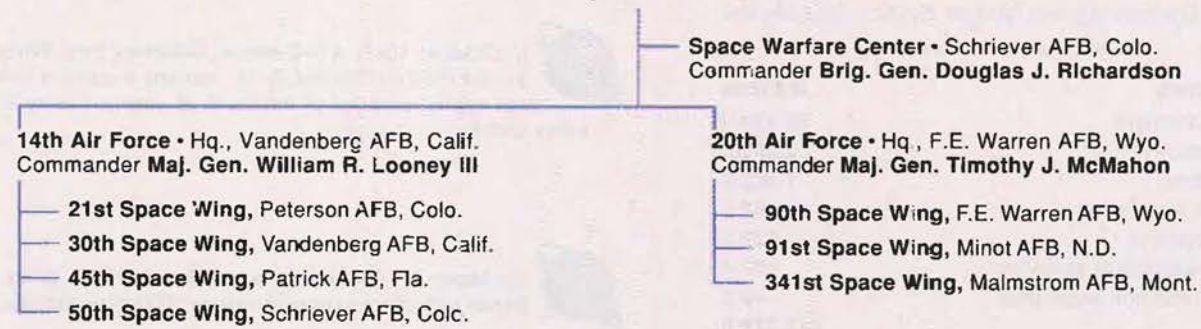
### Directors, NASA

T. Keith Glennan	Aug. 19, 1958–Jan. 20, 1961
James E. Webb	Feb. 14, 1961–Oct. 7, 1968
Thomas O. Paine	March 21, 1969–Sept. 15, 1970
James C. Fletcher	April 27, 1971–May 1, 1977
Robert A. Frosch	June 21, 1977–Jan. 20, 1981
James M. Beggs	July 10, 1981–Dec. 4, 1985
James C. Fletcher	May 12, 1986–April 8, 1989
Richard H. Truly	May 14, 1989–March 31, 1992
Daniel S. Goldin	April 1, 1992–

## Air Force Space Command Headquarters, Peterson AFB, Colo.

(As of July 1, 2000)

Commander  
**Gen. Ralph E. Eberhart**





## Major Military Space Commands

	Personnel	Budget, FY2001	Activities
<b>Unified Command</b> US Space Command Peterson AFB, Colo.	989	\$48.5 million	Responsible for placing DoD satellites into orbit and operating them; supports unified commands with space-based communications, weather, intelligence information, navigation, and ballistic missile attack warning; enforces space superiority through protection, prevention, negation, and surveillance; ensures freedom of access to and operations in space and denies same to adversaries; applies force from or through space; plans for and executes strategic ballistic missile defense operations; supports NORAD by providing missile warning and space surveillance information; advocates the space and missile warning requirements of the other unified commands; responsible for DoD's computer network defense mission.
<b>Service Command</b> Air Force Space Command Peterson AFB, Colo.	33,600	\$1.8 billion	Operates military space systems, ground-based missile-warning radars and sensors, missile-warning satellites, national launch centers, and ranges; tracks space debris; operates and maintains the USAF ICBM force (a component of US Strategic Command). Budget includes funding for 11,000 contractor personnel and operations and maintenance for seven bases and 40 worldwide sites.
Naval Space Command Dahlgren, Va.	463	\$94.2 million	Operates assigned space systems for surveillance and warning; provides spacecraft telemetry and on-orbit engineering; develops space plans, programs, concepts, and doctrine; advocates naval warfighting requirements in the joint arena. Budget includes funding for more than 400 contractor personnel and operations and maintenance of headquarters, component commands, and field sites.
Army Space Command Colorado Springs, Colo.	606	\$50.0 million	Manages joint tactical use of DSCS through the 1st Satellite Control Battalion; operates the Army space support teams; operates the Joint Tactical Ground Stations through the 1st Space Battalion; operates the Army National Missile Defense Element; manages the Army Astronaut Program.

## Air Force Space Acquisition Organizations

**Air Force Materiel Command** • Wright-Patterson AFB, Ohio  
 Commander **Gen. Lester L. Lyles**

**Space and Missile Systems Center** • Los Angeles AFB, Calif.  
 Commander **Lt. Gen. Eugene L. Tattini**

- Defense Meteorological Satellite SPO<sup>1</sup>
- Launch Programs SPO
- Advanced Systems SPO
- Satellite and Launch Control SPO
- Space Based Laser Project Management Office
- Space & Missile Test & Evaluation Directorate, Kirtland AFB, N.M.

USAF Program Executive Officer for Space  
**Brent R. Collins**

- MILSATCOM<sup>3</sup>
- Space Based Infrared System<sup>3</sup>
- Evolved Expendable Launch Vehicle<sup>3</sup>
- ICBM/National Missile Defense
- Navstar Global Positioning System JPO<sup>2,3</sup>

USAF Mission Area Director for Space & Nuclear Deterrence  
**Brig. Gen. Brian A. Arnold**

<sup>1</sup>System Program Office

<sup>2</sup>Joint Program Office

<sup>3</sup>Program offices located at Los Angeles AFB, Calif.



**National Imagery and Mapping Agency (NIMA)**

Headquarters: Bethesda, Md.  
 Established: Oct. 1, 1996  
 Director: Army Lt. Gen. James C. King

**Mission, Purpose, Operations**

Provide timely, relevant, and accurate imagery intelligence and geospatial information to support national security objectives. This DoD-chartered combat support agency is also a member of the Intelligence Community and has been assigned, by statute, important national-level support responsibilities.

**Structure**

Major facilities in Virginia, Maryland, Washington, D.C., and Missouri, with the NIMA College located at Ft. Belvoir, Va. Also, customer support teams and technical representatives stationed around the world at major customer locations.

**Personnel:** Classified

**Central Intelligence Agency (CIA) Office of Development and Engineering**

Headquarters: Washington, D.C.  
 Established: 1973  
 Director: Dennis Fitzgerald

**Mission, Purpose, Operations**

Develop systems from requirements definition through design, testing, and evaluation to operations. Works with systems not available commercially. Disciplines include laser communications, digital imagery processing, real-time data collection and processing, electro-optics, advanced signal collection, artificial intelligence, advanced antenna design, mass data storage and retrieval, and large systems modeling and simulations. Work includes new concepts and systems upgrades.

**Structure:** Classified

**Personnel:** Classified

**National Aeronautics and Space Administration (NASA)**

Headquarters: Washington, D.C.  
 Established: 1958  
 Administrator: Daniel S. Goldin

**Mission, Purpose, Operations**

Explore and develop space for human enterprise, increase knowledge about Earth and space, and conduct research in space and aeronautics. Operate the space shuttle and lead an international program to build a permanently occupied space station, for which assembly began in 1998. Launch satellites for space science, Earth observations, and a broad range of technology Research and Development. Conduct aeronautical R&D.

**Structure**

Ten centers around the US: Johnson Space Center, Houston; Marshall Space Flight Center, Huntsville, Ala.; Kennedy Space Center, Fla.; Glenn Research Center, Cleveland; Langley Research Center, Hampton, Va.; Ames Research

Center, Mountain View, Calif.; Dryden Flight Research Center, Edwards AFB, Calif.; Stennis Space Center, Bay St. Louis, Miss.; Jet Propulsion Laboratory, Pasadena, Calif.; and Goddard Space Flight Center, Greenbelt, Md.

**Personnel**

Civilians ..... 15,300

**National Oceanic and Atmospheric Administration (NOAA)**

Headquarters: Washington, D.C.  
 Established: Oct. 3, 1970  
 Administrator and Undersecretary for Oceans and Atmosphere: D. James Baker

**Mission, Purpose, Operations**

Provide satellite observations of the global environment by operating a national system of satellites. Explore, map, and chart the global ocean and its resources and describe, monitor, and predict conditions in the atmosphere, ocean, and space environment. Its National Environmental Satellite, Data, and Information Service processes vast quantities of satellite images and data. Its prime customer is NOAA's National Weather Service, which uses satellite information in creating forecasts.

**Structure**

National Environmental Satellite, Data, and Information Service  
 National Weather Service  
 National Ocean Service  
 National Marine Fisheries Service  
 Office of Oceanic and Atmospheric Research  
 NOAA Corps  
 Office of Sustainable Development and Intergovernmental Affairs  
 Coastal Ocean Program

**Personnel**

National Environmental Satellite, Data, and Information Service ..... 833  
 Other NOAA employees ..... 11,767  
 Total ..... 12,600

**National Reconnaissance Office (NRO)**

Headquarters: Chantilly, Va.  
 Established: September 1961  
 Director: Keith R. Hall

**Mission, Purpose, Operations**

Design, build, and operate reconnaissance satellites to support global information superiority for the US. It has operated hundreds of satellites since it was formed in 1960 and officially recognized in 1961. Responsible for innovative technology; systems engineering; development, acquisition, and operation of space reconnaissance systems; and related intelligence activities. Supports monitoring of arms control agreements, military operations and exercises, natural disasters, environmental issues, and worldwide events of interest to the US.

**Structure**

NRO is a DoD agency, funded through part of the National Foreign Intelligence Pro-

gram, known as the National Reconnaissance Program. Both the Secretary of Defense and Director of Central Intelligence have approval of the program. Three offices and four directorates report up to the level of the director. Offices are management services and operations, corporate operations, and operational support. Directorates are signals intelligence systems acquisition and operations, communications systems acquisition and operations, imagery systems acquisition and operations, and advanced systems and technology.

**Personnel**

Staffed by CIA (39 percent), USAF (39 percent), Navy/Marines (6 percent), Army (1 percent), and DoD civilians (15 percent). Exact personnel numbers are classified.

**National Security Agency (NSA)**

Headquarters: Ft. Meade, Md.  
 Established: 1952  
 Director: USAF Lt. Gen. Michael V. Hayden

**Mission, Purpose, Operations**

Protect US communications and produce foreign intelligence information. Tasked with two primary missions: an information systems security mission and a foreign intelligence information mission. To accomplish these missions, the director's responsibilities include: prescribing security principles, doctrines, and procedures for the government; organizing, operating, and managing certain activities and facilities to produce foreign intelligence information; and conducting defensive information operations.

**Structure**

Established by a Presidential directive in 1952 as a separately organized agency within DoD under the direction, authority, and control of the Secretary of Defense, who serves as the executive agent of the US government for the signals intelligence and communications security activities of the government. A 1984 Presidential directive charged the agency with an additional mission: computer security. An operations security training mission was added in 1988. The Central Security Service was established in 1972 by a Presidential memorandum to provide a more unified cryptological organization within DoD. The NSA director also serves as chief of the CSS.

**Personnel:** Classified

**Other Agencies**

The White House Office of Science and Technology Policy; Defense Advanced Research Projects Agency; Ballistic Missile Defense Organization; US Space Command and the component commands of the Air Force, Navy, and Army; NORAD; and the FAA's Office of Commercial Space Transportation.





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## US Space Launch Sites

### Orbital Sites

#### Cape Canaveral AFS, Fla.

**Location:** 28.5° N, 80° W. USAF's East Coast launch site.

**Mission/operations:** Launches satellites into geosynchronous orbit via ELVs. Hub of Eastern Range operations for civil and commercial space launches and military ballistic missile tests.

**Launches:** 3,242 (since 1950).

**Launch vehicles:** Athena I, II; Atlas II, III, V; Delta II, III, IV; Titan IV.

**History:** Designated simply as Operating Sub-Division #1 in 1950, it became Cape Canaveral Missile Test Annex and, for a time, Cape Kennedy AFS, then it became Cape Canaveral again in 1974.

**Acres:** 15,700.

#### John F. Kennedy Space Center, Fla.

**Location:** 28° N, 80° W.

**Mission/operations:** NASA's primary launch base for space shuttle.

**Launches:** 115.

**Launch vehicles:** Pegasus, space shuttle, Taurus.

**History:** NASA began acquiring land across the Banana River from Cape Canaveral in 1962. By 1967, its first launch complex—Complex 39—was operational. KSC facilities were modified in the mid to late 1970s to accommodate the space shuttle program.

**Acres:** 140,000 (land and water).

#### Vandenberg AFB, Calif.

**Location:** 35° N, 121° W. USAF's West Coast launch site.

**Mission/operations:** Satellite (weather, remote sensing, navigation, communications, and reconnaissance) launches into polar orbits via ELVs; sole site for test launches of USAF ICBM fleet; basic support for R&D tests for DoD, USAF and NASA space, ballistic missile, and aeronautical systems; facilities and essential services for more than 60 aerospace contractors on base.

**Launches:** 568.

**Launch vehicles:** Athena I; Atlas II, III, V; Delta II, III, IV; Pegasus; Taurus; Titan II, IV.

**History:** Originally Army's Camp Cooke, turned over to Air Force January 1957. Renamed Vandenberg AFB Oct. 4, 1958.

**Acres:** 98,400.

#### Wallops Flight Facility, Va.

**Location:** 38° N, 76° W.

**Mission/operations:** East Coast launch site for Orbital Sciences' Pegasus and Taurus missions and NASA's suborbital sounding rockets.

**Launches:** 27.

**Launch vehicles:** Pegasus, Taurus.

**History:** Established in 1945, it is one of world's oldest launch sites.

**Acres:** 6,166.

#### Spaceport Florida Authority

**Location:** 28.5° N, 80° W.

**Mission/operations:** State-operated launch facilities—launch complexes 20, 37, 41, and 46—at Cape Canaveral; handles suborbital and orbital launch vehicles for equatorial and high-inclination (i.e., space station) missions; owns and manages separate multiuser launch control facility, research payload support facility, and a hangar facility for RLV systems.

**Launches:** 10.

**Launch vehicles:** Athena I, II; Minuteman III; Taurus; Terrier.

**History:** Established in 1939.

#### Spaceport Systems Intl. Commercial Spaceport

**Location:** 34.57° N, 120.63° W.

**Mission/operations:** Polar and near-polar LEO launches from Vandenberg; payload processing and launches for commercial, NASA, and USAF customers; small to medium launch vehicles up to 1 million pound thrust; payload processing facility for small and heavy satellites.

**Launches:** One (Jan. 26, 2000).

**Launch vehicles:** MM II—Delta III class.

**History:** SSI, a limited partnership formed by ITT and California Commercial Spaceport, Inc., achieved full operational status of the spaceport in May 1999.

#### Alaska Spaceport

**Location:** 57.5° N, 153° W.

**Mission/operations:** Commercial launch facility for polar and near-polar launches of communications, remote sensing, and scientific satellites up to 8,000 pounds.

**Status:** Construction of Kodiak Launch Complex was scheduled for completion on June 2000. Funding secured by Alaska Aerospace Development Corp., Alaska's spaceport authority. KLC will be the only

non-federally run commercial launch range in US. Complex designed for all indoor processing of payload and launch vehicles.

**Launches:** Two.

**Launch vehicles:** Suborbital.

**Acres:** 3,100.

#### Virginia Space Flight Center

**Location:** 38° N, 76° W. (South end of Wallops Flight Facility)

**Mission/operations:** State-owned, commercially operated launch facility for access to inclined and sun-synchronous orbits; recovery support for ballistic and guided re-entry vehicles; vehicle and payload storage and processing facilities; two commercially licensed launchpads and suborbital launch rails for commercial, military, scientific, and experimental launch customers.

**Operator:** DynSpace Corp.

**Launches:** Nine (since 1995).

**Launch vehicles:** Athena I, II; Minotaur; Pegasus; Taurus.

### Suborbital Sites

#### Poker Flat Research Range, Alaska

**Location:** 65° N, 147° W.

**Mission/operations:** Launches primarily to investigate aurora borealis and other middle- to upper-atmosphere phenomena; military, NASA, and civilian launches.

**Operator:** Owned by University of Alaska and operated by its Geophysical Institute, under contract to NASA's Goddard Space Flight Center and Wallops Flight Facility.

**Launches:** 278.

**Launch vehicles:** Various.

**History:** Established 1968. Only US launch facility in polar region.

**Acres:** 5,280 in the range, 12 million in impact area.

#### White Sands Missile Range, N.M.

**Location:** 32° N, 106° W.

**Mission/operations:** Conducts suborbital sounding rocket launches.

**Launches:** 1,121.

**Launch vehicles:** Various.

**History:** Established July 9, 1945, as White Sands Proving Ground, where test flights with captured German World War II V-2 rockets were conducted.

**Acres:** 2.2 million.

Note: Number of launches from 1957–99, except where noted.



## Military Functions in Space

### Communications

Provide communications from National Command Authorities to Joint Force Commander. Provide communications from JFC to squadron-level commanders. Permit transfer of imagery and situational awareness to tactical operations. Permit rapid transmission of JFC intent, ground force observations, and adaptive planning.

### Computer Network Defense

Coordinate and direct the defense of DoD computer systems and computer networks. Monitor incidents and potential threats and coordinate across DoD to stop or contain damage and restore network operations.

### Environmental/Remote Sensing

Use space systems to create topographical, hydrographic, and geological maps and charts and to develop systems of topographic measurement.

### Space Environment/Meteorological Support

Operate ground-based systems and direct NOAA on the operations of space-based DMSP weather satellite systems to provide solar/geophysical support to the warfighter. Provide data on worldwide and local weather systems affecting combat operations.

### Missile Defense

Employ space assets to support identification, acquisition, tracking, and destruction of ballistic and cruise missiles launched against forward deployed US forces, allied forces, or US territory.

### Navigation

Operate GPS network. Enable commanders to determine precise locations of friendly and enemy forces and targets. Permit accurate, timely rendezvous of combat forces. Map minefields and other obstacles.

### On-Orbit Support

Track and control satellites, operate their payloads, and disseminate data from them.

### Reconnaissance and Surveillance

Identify possible global threats and surveillance of specific activity that might be threatening to US or allied military forces or US territory. Reduce effectiveness of camouflage and decoys. Identify "centers of gravity" in enemy forces. Accurately characterize electronic emissions.

### Space Control

Control and exploit space using offensive and defensive measures to ensure that friendly forces can use space capabili-

ties, while denying their use to the enemy. This mission is assigned to USCINCSpace in the Unified Command Plan.

### Spacelift

Oversee satellite and booster preparation and integration. Conduct launch countdown activities. Operate Eastern and Western Ranges to support ballistic and spaceflight missions.

### Strategic Early Warning

Operate satellites to give national leaders early warning of all possible strategic events, including launch of ICBMs. Identify launch locations and impact areas. Cue area and point defense systems.

### Tactical Warning/Attack Assessment

Discharge the NORAD mission calling for use of all sensors to detect and characterize an attack on US or Canadian territory. US Space Command carries out similar tactical warning in other theaters.

### Force Application

US Space Command is identifying potential future roles, missions, and systems which, if authorized by civilian leadership for development and deployment, could attack terrestrial and space targets from space in support of national defense.



In 1945, American Arthur C. Clarke wrote an article for the British magazine *Wireless World*, outlining how global communications could be provided using three satellites positioned evenly around the equator at an altitude of 26,000 miles. His altitude was off by about 4,000 miles, but his theory, otherwise, was correct.



In November 1945, the Navy Committee for Evaluating the Feasibility of Space Rocketry, established by the Navy Bureau of Aeronautics a month earlier, recommended high priority for satellite development and estimated cost between \$5 million and \$8 million.



In a report to the Secretary of War in November 1945, Gen. Henry H. "Hap" Arnold, Commanding General, Army Air Forces, predicted that strategic bombers would eventually be replaced by long-range ballistic missiles that would need to be launched from true space stations, capable of operating outside the Earth's atmosphere.



In the period 1945–48, the US Army carried out Operation Paperclip, the transfer of 492 German and Austrian rocket scientists, their equipment, and documents to the US.



AAF established a think tank, known as Project RAND, in March 1946 as a department of Douglas Aircraft Corp. to study national security scientific issues, including Earth satellites. In May 1946, RAND produced a study, "Preliminary Design of an Experimental World-Circling Space Ship."



## US Military vs. Civilian Launches

(As of Dec. 31, 1999)

Year	Military	Civilian	Total
1957	0	0	0
1958	0	7	7
1959	6	5	11
1960	10	6	16
1961	19	10	29
1962	31	21	52
1963	26	12	38
1964	32	25	57
1965	28	35	63
1966	32	41	73
1967	24	34	58
1968	20	25	45
1969	16	24	40
1970	15	14	29
1971	10	22	32
1972	11	20	31
1973	8	15	23
1974	6	18	24
1975	7	21	28
1976	7	19	26
1977	9	15	24
1978	8	24	32
1979	4	12	16
1980	5	8	13
1981	5	13	18
1982	6	12	18
1983	7	15	22
1984	12	10	22
1985	6	11	17
1986	3	3	6
1987	6	2	8
1988	6	6	12
1989	13	5	18
1990	13	14	27
1991	9	9	18
1992	12	16	28
1993	13	10	23
1994	12	14	26
1995	9	18	27
1996	11	22	33
1997	9	28	37
1998	7	27	34
1999	7	23	30
<b>Total</b>	<b>500</b>	<b>691</b>	<b>1,191</b>

## US Satellites in Orbit and Deep Space

(As of Dec. 31, 1999)

Launch Year	Military	NASA & Civilian	Commercial	Total
1958	0	1	0	1
1959	0	4	0	4
1960	3	4	0	7
1961	5	3	0	8
1962	2	9	1	12
1963	8	9	1	18
1964	14	10	0	24
1965	17	18	0	35
1966	15	20	0	35
1967	27	16	0	43
1968	13	13	0	26
1969	15	12	0	27
1970	10	4	0	14
1971	12	3	0	15
1972	8	7	1	16
1973	8	5	0	13
1974	4	4	2	10
1975	5	6	2	13
1976	10	6	6	22
1977	11	4	0	15
1978	14	7	2	23
1979	8	1	2	11
1980	10	1	1	12
1981	5	3	3	11
1982	5	0	6	11
1983	14	4	4	22
1984	15	3	5	23
1985	9	1	4	14
1986	6	1	2	9
1987	10	1	0	11
1988	10	2	4	16
1989	14	3	0	17
1990	23	3	4	30
1991	10	5	2	17
1992	11	4	4	19
1993	13	5	3	21
1994	11	4	5	20
1995	10	5	10	25
1996	15	5	5	25
1997	9	5	66	80
1998	7	8	74	89
1999	8	12	57	77
<b>Total</b>	<b>424</b>	<b>241</b>	<b>276</b>	<b>941</b>



On March 7, 1946, Navy and AAF representatives met to work out a joint satellite development program, but nothing came of it. In fact, two years later, the Research and Development Board, Guided Missiles Committee, stated that neither the Navy nor USAF had as yet established either a military or scientific utility commensurate with the presently expected cost of a satellite vehicle. They added that the question of utility deserved further study and examination.



Life magazine in July 1945 published drawings of a manned space station, as envisioned by German rocket scientists.

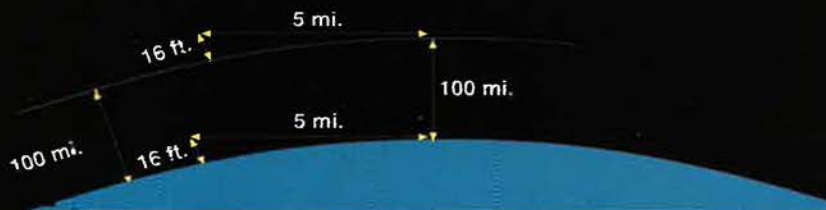
## Upcoming Shuttle Flights

Month/Year	Mission	Name
8/2000	STS-106	Atlantis
9/2000	STS-92	Discovery
11/2000	STS-97	Endeavour
1/2001	STS-98	Atlantis
2/2001	STS-102	Discovery
4/2001	STS-100	Endeavour
5/2001	STS-104	Atlantis
6/2001	STS-105	Endeavour



## Orbits

Orbits result from the mutual attraction of any two bodies with a force proportional to the product of their individual masses and inversely proportional to the square of the distance between them. The curvature of the Earth, on average, drops 16 feet below the horizontal over a distance of about five miles. A spacecraft circling above would "fall" that same amount over the same distance. It travels five miles in one second if gravitational pull equals 1g. Therefore, spacecraft velocity of five miles per second (18,000 mph) produces perpetual orbit at sea level, unless the spacecraft's flight is upset by perturbations, such as solar wind or mechanical anomalies.



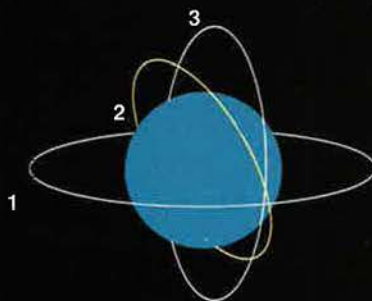
### Orbital Altitude

LEO Low Earth Orbit  
 MEO Medium Earth Orbit  
 GEO Geosynchronous Earth Orbit  
 HEO High Earth Orbit

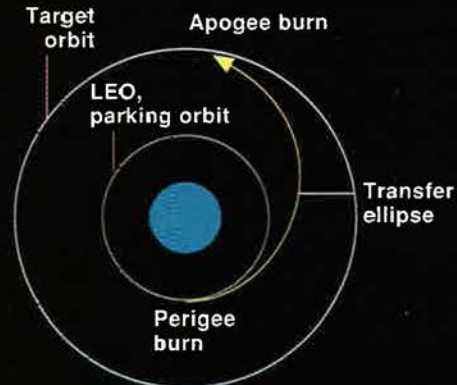
### Orbital Inclinations

1 Equatorial  
 2 Sun synchronous  
 3 Polar

HEO 22,300–60,000 mi.



### Geosynchronous Transfer Orbit



It is common procedure to pick an initial "parking" orbit, usually at LEO, then boost payloads to higher altitude. Engines are fired first (at perigee) to reach the apogee of an elliptical transfer orbit and then are fired again to put the spacecraft into a circular orbit at that higher altitude.

Illustrations are not drawn to scale.

## US Payloads by Mission, 1957–99

Category	Number
<b>Platforms</b>	<b>0</b>
Earth orbital science	237
<b>Automated lunar, planetary</b>	<b>64</b>
Moon	26
Mercury	1
Venus	8
Mars	13
Outer planets	5
Interplanetary space	11
<b>Applications</b>	<b>634</b>
Communications	492
Weather	104
Geodesy	20
Earth resources	16
Materials processing	2
<b>Piloted activities</b>	<b>166</b>
Earth orbital	115
Earth orbital (related)	14
Lunar	20
Lunar (related)	17
<b>Launch vehicle tests</b>	<b>12</b>
<b>General engineering tests</b>	<b>61</b>
<b>Reconnaissance</b>	<b>433</b>
Photographic	249
Electronic intelligence	96
Ocean electronic intelligence	39
Early warning	49
<b>Minor military operations</b>	<b>44</b>
<b>Navigation</b>	<b>85</b>
<b>Theater communication</b>	<b>0</b>
<b>Weapons-related activities</b>	<b>2</b>
Fractional orbital bombardment	0
Anti-satellite targets	2
Anti-satellite interceptors	0
<b>Other military</b>	<b>18</b>
<b>Other civilian</b>	<b>5</b>
<b>Total</b>	<b>1,761</b>

## US Manned Spaceflights

Year	Flights	Persons
1961	2	2
1962	3	3
1963	1	1
1964	0	0
1965	5	10
1966	5	10
1967	0	0
1968	2	6
1969	4	12
1970	1	3
1971	2	6
1972	2	6
1973	3	9
1974	0	0
1975	1	3
1976	0	0
1977	0	0
1978	0	0
1979	0	0
1980	0	0
1981	2	4
1982	3	8
1983	4	20
1984	5	28
1985	9	58
1986	1	7
1987	0	0
1988	2	10
1989	5	25
1990	6	32
1991	6	35
1992	8	53
1993	7	42
1994	7	42
1995	7	42
1996	7	43
1997	8	53
1998	5	33
1999	3	19
<b>Total</b>	<b>126</b>	<b>625</b>



Flight	Mission	Launch	Return
1	STS-1	4/12/81	4/14/81
2	STS-2	11/12/81	11/14/81
3	STS-3	3/22/82	3/30/82
4	STS-4	6/27/82	7/4/82
5	STS-5	11/11/82	11/16/82
6	STS-6	4/4/83	4/9/83
7	STS-7	6/18/83	6/24/83
8	STS-8	8/30/83	9/5/83
9	STS-9	11/28/83	12/8/83
10	STS-10	2/3/84	2/11/84
11	STS-11	4/6/84	4/13/84
12	STS-12	8/30/84	9/5/84
13	STS-13	10/5/84	10/13/84
14	STS-14	11/8/84	11/16/84
15	STS-15	1/24/85	1/27/85
16	STS-16	4/12/85	4/19/85
17	STS-17	4/29/85	5/6/85
18	STS-18	6/17/85	6/24/85
19	STS-19	7/29/85	8/6/85
20	STS-20	8/27/85	9/3/85
21	STS-21	10/3/85	10/7/85
22	STS-22	10/30/85	11/6/85
23	STS-23	11/26/85	12/3/85
24	STS-24	1/12/86	1/18/86
25	STS-25	1/28/86	No Landing
26	STS-26	9/29/88	10/3/88
27	STS-27	12/2/88	12/6/88
28	STS-29	3/13/89	3/18/89
29	STS-30	5/4/89	5/8/89
30	STS-28	8/8/89	8/13/89
31	STS-34	10/18/89	10/23/89
32	STS-33	11/22/89	11/27/89
33	STS-32	1/9/90	1/20/90
34	STS-36	2/28/90	3/4/90
35	STS-31	4/24/90	4/29/90
36	STS-41	10/6/90	10/10/90
37	STS-38	11/15/90	11/20/90
38	STS-35	12/2/90	12/10/90
39	STS-37	4/5/91	4/11/91
40	STS-40	6/5/91	6/14/91
41	STS-43	8/2/91	8/11/91
42	STS-48	9/12/91	9/18/91
43	STS-44	11/24/91	12/1/91
44	STS-39	4/28/91	5/6/91
45	STS-42	1/22/92	1/30/92
46	STS-45	3/24/92	4/2/92
47	STS-49	5/7/92	5/16/92
48	STS-50	6/25/92	7/9/92
49	STS-46	7/31/92	8/8/92

Flight	Mission	Launch	Return
50	STS-47	9/12/92	9/20/92
51	STS-52	10/22/92	11/1/92
52	STS-53	12/2/92	12/9/92
53	STS-54	1/13/93	1/19/93
54	STS-56	4/8/93	4/17/93
55	STS-55	4/26/93	5/6/93
56	STS-57	6/21/93	7/1/93
57	STS-51	9/12/93	9/22/93
58	STS-58	10/18/93	11/1/93
59	STS-61	12/2/93	12/13/93
60	STS-60	2/3/94	2/11/94
61	STS-62	3/4/94	3/18/94
62	STS-59	4/9/94	4/20/94
63	STS-65	7/8/94	7/23/94
64	STS-64	9/9/94	9/20/94
65	STS-68	9/30/94	10/11/94
66	STS-66	11/3/94	11/14/94
67	STS-63	2/3/95	2/11/95
68	STS-67	3/2/95	3/18/95
69	STS-71	6/27/95	7/7/95
70	STS-70	7/13/95	7/22/95
71	STS-69	9/7/95	9/18/95
72	STS-73	10/20/95	11/5/95
73	STS-74	11/12/95	11/20/95
74	STS-72	1/11/96	1/20/96
75	STS-75	2/22/96	3/9/96
76	STS-76	3/22/96	3/31/96
77	STS-77	5/19/96	5/29/96
78	STS-78	6/20/96	7/7/96
79	STS-79	9/16/96	9/26/96
80	STS-80	11/19/96	12/7/96
81	STS-81	1/12/97	1/22/97
82	STS-82	2/11/97	2/21/97
83	STS-83	4/4/97	4/8/97
84	STS-84	5/15/97	5/24/97
85	STS-94	7/1/97	7/17/97
86	STS-85	8/7/97	8/19/97
87	STS-86	9/25/97	10/6/97
88	STS-87	11/19/97	12/5/97
89	STS-89	1/22/98	1/31/98
90	STS-90	4/17/98	5/3/98
91	STS-91	6/2/98	6/12/98
92	STS-95	10/29/98	11/7/98
93	STS-88	12/4/98	12/15/98
94	STS-96	5/27/99	6/6/99
95	STS-93	7/22/99	7/27/99
96	STS-103	12/19/99	12/27/99
97	STS-99	2/11/00	2/22/00
98	STS-101	5/19/00	5/29/00



On Dec. 19, 1958, an orbiting satellite broadcast the first communication from space. It was a Christmas message from President Eisenhower. The Project Score satellite continued to receive and rebroadcast on command new voice and teletype messages for 12 days.



Only 6 inches in diameter and weighing just 2.4 pounds, Vanguard I, built by the Naval Research Lab, was launched March 17, 1958, from Cape Canaveral and is still on orbit. It was the second satellite successfully placed in orbit by the US and was the first solar-powered satellite. Its solar cells operated for about seven years, while conventional batteries on board lasted only 20 days.



In February 1949, the Department of Space Medicine was established at the School of Aviation Medicine at Randolph AFB, Tex.



## Major Military Satellite Systems

### Advanced Extremely High Frequency Satellite Communications System

**Common name:** AEHF  
**In brief:** successor to Milstar, AEHF will provide assured strategic, worldwide C<sup>2</sup> communications with at least five times the capacity of Milstar II but in a smaller, cheaper package.  
**Function:** EHF communications.  
**Operator:** MILSATCOM JPO (acquisition); AFSPC.  
**First launch:** 2004, planned.  
**Constellation:** four.  
**Orbit altitude:** 22,300 miles.  
**Contractors:** Lockheed Martin, Hughes Space and Communications, TRW.  
**Power plant:** N/A.  
**Dimensions:** N/A.  
**Weight:** approx. 5,357 lb (on orbit).

### Defense Meteorological Satellite Program

**Common name:** DMSP  
**In brief:** satellites that collect air, land, sea, and space environmental data to support worldwide strategic and tactical military operations.  
**Function:** environmental monitoring satellite.  
**Operator:** NPOESS Program Office.  
**First launch:** circa 1960s.  
**Constellation:** two.  
**Orbit altitude:** 500 miles.  
**Contractor:** Lockheed Martin.  
**Power plant:** solar array, 500–600 watts.  
**Dimensions:** width 4 ft, length 20 ft 2 in (with array deployed).  
**Weight:** 1,750 lb (on orbit).

### Defense Satellite Communications System III

**Common name:** DSCS III  
**In brief:** nuclear-hardened and jam-proof spacecraft used to transmit high-priority C<sup>2</sup> messages to battlefield commanders.  
**Function:** SHF communications.  
**Operator:** AFSPC.  
**First launch:** October 1982.  
**Constellation:** five.  
**On orbit:** 10.  
**Orbit altitude:** 22,000+ miles.  
**Contractor:** Lockheed Martin.  
**Power plant:** solar array, avg. 1,269 watts (pre-System Life Enhancement Program); avg. 1,500 watts (SLEP; first SLEP satellite launched Jan. 20, 2000).  
**Dimensions:** rectangular body is 6 ft x 6 ft x 7 ft; 38-ft span (deployed).  
**Weight:** 2,580 lb (pre-SLEP); 2,716 lb (SLEP).

### Defense Support Program

**Common name:** DSP  
**In brief:** early warning spacecraft whose infrared sensors detect heat generated by a missile or booster plume.  
**Function:** strategic and tactical missile launch detection.  
**Operator:** AFSPC.  
**First launch:** November 1970.  
**Constellation:** classified.  
**On orbit:** classified.  
**Orbit altitude:** 22,000+ miles.  
**Contractor:** TRW, Aerojet.  
**Power plant:** solar array, 1,485 watts.  
**Dimensions:** width 22 ft (on orbit), length 32.8 ft (on orbit).  
**Weight:** approx. 5,000 lb.

### Global Broadcast System

**Common name:** GBS  
**In brief:** wideband communications program, initially using leased commercial satellites, then military systems, to provide digital multimedia data directly to theater warfighters.  
**Function:** high-bandwidth data imagery and video.  
**Operator:** AFSPC.  
**First launch:** March 1998 (Phase 2 payload on UHF Follow-On).  
**Constellation:** three.  
**On orbit:** three.  
**Orbit altitude:** 23,230 miles.  
**Contractor:** Raytheon (Phase 2).  
**Power plant:** (interim host satellite: UHF Follow-On) 3,800 watts.  
**Dimensions:** width 22 ft, length 86 ft.  
**Weight:** 3,400 lb.

### Global Positioning System

**Common name:** GPS  
**In brief:** constellation of 24 satellites used by military and civilians to determine a precise location anywhere on Earth.  
**Function:** worldwide navigation.  
**Operator:** AFSPC.  
**First launch:** Feb. 22, 1978.  
**Constellation:** 24.  
**Orbit altitude:** 12,636 miles (Block IIA); 12,532 miles (Block IIR).  
**Contractors:** Boeing, Lockheed Martin.  
**Power plant:** solar array, 700 watts (Block IIA); 1,136 watts (Block IIR).  
**Dimensions:** body 8 ft x 8 ft x 12 ft, including solar arrays 11 ft x 19 ft (II/IIA); body 8 ft x 6 ft x 10 ft, span including arrays 37 ft (IIR).  
**Weight:** 2,174 lb (Block IIA, on orbit); 2,370 lb (Block IIR, on orbit).

### Milstar Satellite Communications System

**Common name:** Milstar  
**In brief:** joint communications satellite that provides secure, jam-resistant communications for essential wartime needs.  
**Function:** EHF communications.  
**Operator:** AFSPC.  
**First launch:** Feb. 7, 1994.  
**Constellation:** three.  
**On orbit:** two.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** Lockheed Martin.  
**Power plant:** solar array, almost 5,000 watts.  
**Dimensions:** length 51 ft; solar array 116 ft (deployed).  
**Weight:** approx. 10,000 lb.

### Polar Military Satellite Communications

**Common name:** Polar MILSATCOM  
**In brief:** USAF deployed a modified Navy EHF payload on a host polar-orbiting satellite to provide an interim solution for a cheaper alternative to Milstar to ensure warfighters have protected polar communications capability.  
**Function:** polar communications.  
**Operator:** AFSPC.  
**First launch:** late 1997.  
**Constellation:** three.  
**On orbit:** one.  
**Orbit altitude:** 25,300 miles (apogee).  
**Contractor:** classified.  
**Power plant:** 410 watts consumed by payload (power from host solar array).  
**Dimensions:** numerous items integrated throughout host.  
**Weight:** 470 lb (payload).

### Space Based Infrared System

**Common name:** SBIRS  
**In brief:** advanced surveillance system for missile warning, missile defense, battlespace characterization, and technical intelligence. System includes High (satellites in GEO and HEO) and Low (satellites in LEO) components.  
**Function:** infrared space surveillance.  
**Operator:** AFSPC.  
**First launch:** planned, High FY04; Low FY06.  
**Constellation:** High: 5 GEO sats, 2 HEO sensors. Low: (preliminary) 27 LEO sats, including three spares.  
**On orbit:** none.  
**Orbit altitude:** High at GEO & HEO; Low, LEO.  
**Contractor:** Lockheed Martin (High); TRW and Spectrum Astro for preliminary system designs (Low).  
**Power plant:** N/A.  
**Dimensions:** N/A.  
**Weight:** N/A.



### UHF Follow-On Satellite

**Common name:** UFO  
**In brief:** new generation of satellites providing secure, anti-jam communications; replaced FLTSATCOM satellites.  
**Function:** UHF and EHF communications.  
**Operator:** Navy, AFSPC.  
**First launch:** March 25, 1993.  
**Constellation:** four primary, four redundant.  
**On orbit:** eight.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** Hughes Space & Communications.  
**Power plant:** solar array, 2,500–3,800 watts.  
**Dimensions:** length 60 ft (F-2–F-7); 86 ft (F-8–F10) (deployed).  
**Weight:** 2,600–3,400 lb.

### Wideband Gap-Filler System

**Common name:** WGS  
**In brief:** high data rate satellite broadcast system meant to bridge the communications gap between current systems—DSCS and GBS—and an advanced wideband system, tentatively scheduled for launch in Fiscal 2008.  
**Function:** wideband communications and point-to-point service (Ka-band frequency).  
**Operator:** AFSPC.  
**First launch:** FY04, planned.  
**Constellation:** three.  
**Orbit altitude:** N/A.  
**Contractor:** TBD.  
**Power plant:** TBD.  
**Dimensions:** TBD.  
**Weight:** TBD.

### Dark and Spooky

A number of intelligence satellites are operated by US agencies in cooperation with the military. The missions and, especially, the capabilities are closely guarded secrets. Using a page from the Soviet book on naming satellites, the US government started in the 1980s calling all government satellites "USA" with a sequential number. This allowed them to keep secret the names of satellites which monitor the Earth with radar, optical sensors, and electronic intercept capability. Most of the names of satellites, like White Cloud (ocean reconnaissance), Aquacade (electronic ferret), and Trumpet (Sigint) are essentially open secrets but cannot be confirmed by the Intelligence Community. However, the move to declassify space systems has led to the release of selected information on some systems. Pictures of the Lacrosse radar imaging satellite have been released without details on the system. Details of the Keyhole optical imaging systems in the Corona program have been released.

## Major US Civilian Satellites in Military Use

### Advanced Communications Technology Satellite

**Common name:** ACTS  
**In brief:** technology demonstration satellite for new types of K- and Ka-band communications technologies.  
**Function:** communications.  
**Operator:** NASA.  
**First launch:** Sept. 12, 1993.  
**Constellation:** one.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** Lockheed Martin.  
**Power plant:** solar array, 1,400 watts.  
**Dimensions:** width 29.9 ft, length 47.1 ft (deployed).  
**Weight:** 3,250 lb.

### Geostationary Operational Environmental Satellite

**Common name:** GOES  
**In brief:** hovers over the equator to collect weather data for short-term forecasting.  
**Function:** storm monitoring and tracking, meteorological research.  
**Operator:** NOAA.  
**First launch:** Oct. 16, 1975 (GOES-1).  
**Constellation:** three.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** Space Systems/Loral.  
**Power plant:** solar array, 1,050 watts.  
**Dimensions:** 6.6-ft cube, length 88.6 ft (deployed).  
**Weight:** 4,600 lb.

### Globalstar

**Common name:** Globalstar  
**In brief:** mobile communications with provision for security controls.  
**Function:** communications.  
**Operator:** Globalstar L.P.  
**First launch:** February 1998.  
**Constellation:** 48.  
**Orbit altitude:** 878 miles.

**Contractor:** Space Systems/Loral.  
**Power plant:** solar array, 1,100 watts.  
**Dimensions:** width 4.9 ft, length 35.3 ft (deployed).  
**Weight:** 990 lb.

### Inmarsat

**Common name:** Inmarsat  
**In brief:** sometimes used for peacetime mobile communications services.  
**Function:** communications.  
**Operator:** International Maritime Satellite Organization.  
**First launch:** February 1982 (first lease), Oct. 30, 1990 (first launch).  
**Constellation:** nine.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** Lockheed Martin (Inmarsat 3).  
**Power plant:** solar array, 2,800 watts.  
**Dimensions:** width 6.9 ft, length 5.9 ft, 57.8 ft (deployed).  
**Weight:** 4,545 lb (Inmarsat 3).

### Intelsat

**Common name:** Intelsat  
**In brief:** routine communications and distribution of Armed Forces Radio and TV Services network.  
**Function:** communications.  
**Operator:** International Telecommunications Satellite Organization.  
**First launch:** April 6, 1965 (Early Bird).  
**Constellation:** 17.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** Lockheed Martin (Intelsat 8).  
**Power plant:** solar array, 4,800 watts.  
**Dimensions:** width 8.3 x 7.2 ft, length 11.3 ft, 35.4 ft (deployed) (Intelsat 8).  
**Weight:** 7,480 lb (Intelsat 8).

### Landsat

**Common name:** Landsat  
**In brief:** imagery use includes mapping and planning for tactical operations.  
**Function:** remote sensing.  
**Operator:** NASA/NOAA.  
**First launch:** July 23, 1972.  
**Constellation:** one.  
**Orbit altitude:** 438 miles (polar).  
**Contractor:** Lockheed Martin.  
**Power plant:** solar array, 1,550 watts.  
**Dimensions:** diameter 9 ft, length 14 ft.  
**Weight:** 4,800 lb.

### Loral Orion

**Common name:** Telstar (formerly Orion)  
**In brief:** commercial satellite-based, rooftop-to-rooftop communications for US Army and other DoD agencies.  
**Function:** communications.  
**Operator:** Loral Orion.  
**First launch:** November 1994.  
**Constellation:** three.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** Space Systems/Loral (Orion 2).  
**Power plant:** solar array, 7,000 watts.  
**Dimensions:** width 5.6 ft, length 6.9 ft, 72.2 ft (deployed).  
**Weight:** 8,360 lb (Orion 2).



### NOAA-14 (NOAA-J) and NOAA-15 (NOAA-K)

**Common name:** NOAA (with number on orbit) (also known as Television Infrared Observation Satellite or TIROS).  
**In brief:** weather updates for all areas of the world every six hours.  
**Function:** long-term weather forecasting.  
**Operator:** NOAA (on-orbit); NASA (launch).  
**First launch:** October 1978 (TIROS-N).  
**Constellation:** two.  
**Orbit altitude:** 530 miles.  
**Contractor:** Lockheed Martin.  
**Power plant:** solar array, 1,000+ watts.  
**Dimensions:** diameter 6.2 ft, length 13.8 ft (NOAA-15).  
**Weight:** approx. 4,900 lb (NOAA-15).

### Orbcomm

**Common name:** Orbcomm  
**In brief:** potential military use under study in Joint Interoperability Warfighter

Program.  
**Function:** mobile communications.  
**Operator:** Orbcomm Global LP.  
**First launch:** April 1995.  
**Constellation:** 35.  
**Orbit altitude:** 500–1,200 miles.  
**Contractor:** Orbital Sciences.  
**Power plant:** solar array, 160 watts.  
**Dimensions:** width 7.3 ft, length 14.2 ft.  
**Weight:** 90 lb.

### Satellite Pour l'Observation de la Terre

**Common name:** SPOT  
**In brief:** terrain images used for mission-planning systems, terrain analysis, and mapping.  
**Function:** remote sensing.  
**Operator:** SPOT Image S.A. (France).  
**First launch:** Feb. 22, 1986.  
**Constellation:** three.  
**Orbit altitude:** 509 miles.  
**Contractor:** Matra Marconi Space France.

**Power plant:** solar array, 2,100 watts (SPOT 4).  
**Dimensions:** 6.6 x 6.6 x 18.4 ft (SPOT 4).  
**Weight:** 5,940 lb (SPOT 4).

### Tracking and Data Relay Satellite System

**Common name:** TDRS  
**In brief:** global network that allows other spacecraft in LEO to communicate with a control center without an elaborate network of ground stations.  
**Function:** communications relay.  
**Operator:** NASA.  
**First launch:** April 1983.  
**Constellation:** six.  
**Orbit altitude:** 22,300 miles.  
**Contractor:** TRW.  
**Power plant:** solar array, 1,800 watts.  
**Dimensions:** width 45.9 ft, length 57.4 ft (deployed).  
**Weight:** 5,000 lb.

## Major US Launchers in Military Use

### Athena I

**Function:** low- to medium-weight spacelift.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** Aug. 22, 1997.  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Lockheed Martin.  
**Stages:** two.  
**Propulsion:** stage 1 (Thiokol Castor 120 Solid Rocket Motor), 435,000 lb thrust; stage 2 (Pratt & Whitney Orbus 21D SRM), 43,723 lb thrust.  
**Dimensions:** length 65 ft, max body diameter 7.75 ft.  
**Weight:** 146,264 lb.  
**Payload max:** 1,750 lb to LEO.

### Athena II

**Function:** low- to medium-weight spacelift.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** Jan. 6, 1998.  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Lockheed Martin.  
**Stages:** three.  
**Propulsion:** stages 1–2 (Castor 120 SRMs), 435,000 lb thrust; stage 3 (Orbus 21D SRM), 43,723 lb thrust.  
**Dimensions:** length 100 ft, max body diameter 7.75 ft.  
**Weight:** 265,000 lb.  
**Payload max:** 4,350 lb to LEO.

### Atlas II

**Function:** medium-weight spacelift.  
**Variants:** IIA and IIAS.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** Dec. 7, 1991; Feb. 10, 1992 (USAF).  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Lockheed Martin.  
**Stages:** two.  
**Propulsion:** (IIA and IIAS) stages 1–2 (Boeing MA-5A), 490,000 lb thrust; (IIAS) four strap-on Castor IVA SRMs

**Dimensions:** length 82 ft, max body diameter 10 ft.  
**Weight:** with large payload fairing (IIA) 408,800 lb; (IIAS) 515,333 lb.  
**Payload max:** (IIA) 14,500 lb to LEO; (IIAS) 19,050 lb to LEO.

### Atlas III

**Function:** medium- to heavyweight spacelift.  
**Variants:** IIIA and IIIB.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** May 24, 2000 (IIIA).  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Lockheed Martin.  
**Stages:** two.  
**Propulsion:** (IIIA and IIIB) stages 1–2 (Russian RD-180), 860,200 lb.  
**Dimensions:** length 170 ft, diameter 10 ft.  
**Weight:** with large payload fairing (IIIA) 486,500 lb; (IIIB) 496,908 lb.  
**Payload max:** (IIIA and IIIB) 9,920 lbs to GTO.

### Atlas V

**Function:** medium to heavy launch.  
**Operator:** commercial (AFSPC oversight).  
**First Launch:** planned for late 2001.  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Lockheed Martin.  
**Stages:** two.  
**Propulsion:** RD AMROSS LLC RD-180, up to five strap-on SRMs.  
**Dimensions:** length 106.2 ft, diameter 12.5 ft.  
**Weight:** (400) with large payload fairing 734,850 lb; (551) with Contraves Short (5.4 meter) payload fairing 1,191,250 lb.  
**Payload max:** 18,080 lb to GTO; 13,100+ lb to GSO.

### Delta II

**Function:** medium-weight spacelift.

**Operator:** commercial (AFSPC oversight).  
**First launch:** Feb. 14, 1989.  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Boeing.  
**Stages:** up to three.  
**Propulsion:** stage 1 (Boeing RS-27A), 237,000 lb thrust; stage 2 (Aerojet AJ10-118K), 9,750 lb thrust; stage 3 (Thiokol STAR 48B SRM), 14,920 lb thrust; nine strap-on SRMs (Alliant Techsystems), 100,270 lb thrust.  
**Dimensions:** length 125.2 ft, diameter 8 ft.  
**Weight:** 511,190 lb.  
**Payload max:** 11,330 lb to LEO.

### Delta III

**Function:** medium-weight spacelift.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** Aug. 26, 1998.  
**Launch site:** CCAFS.  
**Contractor:** Boeing.  
**Stages:** up to three.  
**Propulsion:** stage 1 (RS-27A), 237,000 lb thrust; stage 2 (Pratt & Whitney RL10B-2), 20,500 lb thrust; stage 3 Thiokol Star 48B (modified).  
**Dimensions:** length 148 ft, diameter 13 ft.  
**Weight:** 663,200 lb.  
**Payload max:** 18,200 lb to LEO.

### Delta IV

**Function:** medium to heavy launch.  
**Operator:** commercial (AFSPC oversight).  
**First Launch:** planned for 2001.  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Boeing.  
**Stages:** two.  
**Propulsion:** RS-68.  
**Dimensions:** stage 1 length 120 ft, diameter 16.8 ft.  
**Weight:** 480,750 lb (stage 1).  
**Payload max:** 27,400 lb (Delta IV heavy).



### Evolved Expendable Launch Vehicle

**Function:** medium/heavy spacelift.  
**Note:** Atlas V and Delta IV (see individual entries for specifications) are participating in USAF's EELV modernization spacelift program to cut launch costs by 25 to 50 percent. These systems will eventually replace Delta II, Atlas II, Titan II, and Titan IV launch vehicles.

### Pegasus

**Function:** low-weight spacelift.  
**Variants:** Standard and XL.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** (Standard) April 5, 1990; (XL) June 27, 1994.  
**Launch site:** dropped from L-1011 aircraft.  
**Contractor:** Orbital Sciences/Alliant.  
**Stages:** three.  
**Propulsion:** (XL) stage 1, 109,400 lb thrust; stage 2, 27,600 lb thrust; stage 3, 7,800 lb thrust (all Alliant Techsystems).  
**Dimensions:** length 49 ft, wingspan 22 ft, diameter 4.17 ft.  
**Weight:** 42,000 lb.  
**Payload max:** (Standard) 850 lb to LEO; (XL) 1,050 lb to LEO.

### Space Shuttle

**Function:** heavyweight manned spacelift.  
**Operator:** United Space Alliance (NASA

contract).  
**First launch:** April 12, 1981.  
**Launch site:** Kennedy Space Center, Fla.  
**Contractor:** Boeing.  
**Stages:** delta-winged orbiter.  
**Propulsion:** three main engines, 394,000 lb thrust; two SRMs, 3.3 million lb thrust.  
**Dimensions:** system length 184.2 ft; span 76.6 ft.  
**Weight:** 4.5 million lb (gross).  
**Payload max:** 55,000 lb to LEO.

### Taurus

**Function:** low-weight spacelift.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** March 13, 1994.  
**Launch site:** CCAFS, VAFB, Wallops Is.  
**Contractor:** Orbital Sciences.  
**Stages:** three.  
**Propulsion:** Castor 120 SRM, 495,400 lb thrust; stage 1, 109,140 lb thrust; stage 2, 26,900 lb thrust; stage 3, 7,200 lb thrust (stages 1-3, Alliant Techsystems).  
**Dimensions:** length 89 ft, max body diameter 7.6 ft.  
**Weight:** 50,000 lb.  
**Payload max:** 3,000 lb to LEO.

### Titan II

**Function:** low- to medium-weight spacelift.

**Operator:** commercial (AFSPC oversight).  
**First launch:** April 8, 1964 (NASA).  
**Launch site:** VAFB.  
**Contractor:** Lockheed Martin.  
**Stages:** two.  
**Propulsion:** stage 1, 430,000 lb thrust; stage 2, 100,000 lb thrust (both Aerojet).  
**Dimensions:** length 110 ft (stages 1+2), diameter 10 ft.  
**Weight:** 408,000 lb.  
**Payload max:** 4,200 lb to polar LEO.

### Titan IVB

**Function:** heavyweight spacelift.  
**Operator:** commercial (AFSPC oversight).  
**First launch:** (IVB) Feb. 23, 1997.  
**Launch site:** CCAFS, VAFB.  
**Contractor:** Lockheed Martin.  
**Stages:** two; may add Centaur or Inertial Upper Stages.  
**Propulsion:** two SRM upgrades (Alliant Techsystems), 1.7 million lb thrust each; stage 1 (LR87-AJ-11), 551,200 lb thrust; stage 2 (LR91-AJ-11), 106,150 lb thrust (stages 1-2, Aerojet); Centaur, 33,000 lb thrust; IUS (Boeing), 41,700 lb thrust.  
**Dimensions:** length (stage 1-2) 119.2 ft, diameter 10 ft.  
**Weight:** 1.9 million lb.  
**Payload max:** 47,800 lb to LEO.

## Selected NASA Projects Fiscal 2001 Proposal (Current Dollars)

### Discovery

**Funding:** \$196.8 million. **Mission:** Low-cost planetary exploration program. Genesis spacecraft will collect samples of charged particles in the solar wind and return them to Earth for study. Comet Nucleus Tour (CONTOUR) will intercept and collect data on three comets.  
**Launch schedule:** Genesis: January 2001; CONTOUR: June 2002.

### Earth Observing System

**Funding:** \$447.1 million. **Mission:** Document global climatic change and observe environmental processes via satellites. **Launch schedule:** First launch Dec. 18, 1999. Complementary mission to measure ozone distribution and depletion scheduled for launch August.

### Explorer

**Funding:** \$138.8 million. **Mission:** Study the effects of solar wind on Earth's magnetosphere, measure the position and brightness of 40 million stars, and study organic

compounds in interstellar clouds.  
**Launch schedule:** 1999-2004.

### Hubble Space Telescope

**Funding:** \$168.1 million. **Mission:** Perform observations at visible, near-ultraviolet, and near-infrared wavelengths. **Launch schedule:** First launched in April 25, 1990. Previous servicing missions: December 1993, February 1997, December 1999. **Upcoming servicing missions:** 2001, 2003.

### Relativity (Gravity Probe B)

**Funding:** \$13.8 million. **Mission:** Test Einstein's theory of general relativity. **Launch schedule:** September 2001.

### Space shuttle

**Funding:** \$3.2 billion **Mission:** Provide safe, reliable, and effective access to space for wide variety of missions, from rendezvous missions with Russian space station Mir, repair and service of the Hubble Space Telescope, advance of life sciences and technology through Spacelab and Spacehab missions,

and initial assembly of the International Space Station. **Launch schedule:** six flights for FY00, nine for FY01.

### International Space Station

**Funding:** \$2.1 billion. **Mission:** Establish a long-term residence and laboratory for science research and permanently deploy a crew to the facility. **Launch schedule:** TBD.

### Russian Program Assurance

**Funding:** \$300 million. **Mission:** Fund contingency activities and backup capabilities in the event Russia delays or fails in its commitments to the International Space Station.

### Other space operations

**Funding:** \$80 million. **Missions:** Operation of Hubble Space Telescope, Chandra X-Ray Observatory, and International Solar Terrestrial Physics programs, among others. Support of planetary missions includes Cassini, NEAR, Stardust, and Genesis.



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# Foreign Space Activities

## Russian Operational Spacecraft

(As of Dec. 31, 1999)

Mission	Type	Number
Communications	Bonum-1	1
	Kosmos (Strela-3)	10
	Gonets-D	4
	Raduga/Raduga-1	5
	Gorizont	9
	Molniya-1	4
	Molniya-3	4
	Kosmos (Geizer)	2
	LMI	1
	Ekran-M	1
	Ekspress	2
	Gals	2
	Navigation	Kosmos GLONASS
Kosmos (military)		6
Kosmos (civil)		4
Meteorology	Meteor-3	1
Early warning	Kosmos (OkO)	6
Electronic intelligence	Kosmos (Tselina-2)	2
Photoreconnaissance	Kosmos (EORSAT)	1
Remote sensing	Kosmos (Arkon-1)	0
	Okean	1
	Okean-O	1
Geodesy	Resurs-01	2
	Kosmos (Etalon)	2
	Kosmos (GEO-1K)	1
Space station activity	Mir	1
	Kvant-1	1
	Kvant-2	1
	Kristall	1
	Spektr	1
	Priroda	1
	Progress M	1
	Zarya (ISS)	1

## Russian Payloads by Mission, 1957-99

(As of Dec. 31, 1999)

Platforms	507
Earth orbital science	211
Automated lunar, planetary	86
Moon	34
Mercury	0
Venus	33
Mars	19
Outer planets	0
Interplanetary space	0
Applications	529
Communications	310
Weather	74
Geodesy	34
Earth resources	100
Materials processing	11
Piloted activities	252
Earth orbital	88
Earth orbital (related)	156
Lunar	0
Lunar (related)	8
Launch vehicle tests	22
General engineering tests	4
Reconnaissance	1,097
Photographic	802
Electronic intelligence	132
Ocean electronic intelligence	84
Early warning	79
Minor military operations	161
Navigation	219
Theater communication	535
Weapons-related activities	56
Fractional orbital bombardment	18
Anti-satellite targets	18
Anti-satellite interceptors	20
Other military	1
Other civilian	2
<b>Total</b>	<b>3,682</b>



On June 5, 1927, the Society for Space Travel (Verein für Raumschiffahrt, known as VIR) formed in Breslau, Germany.



On April 4, 1930, the American Interplanetary Society, later the American Rocket Society, was founded in New York City for the promotion of interest in and experimentation toward interplanetary expeditions and travel.



## Russian Military vs. Civilian Launches

(As of Dec. 31, 1999)

Year	Military	Civilian	Total
1957	0	2	2
1958	0	1	1
1959	0	3	3
1960	0	3	3
1961	0	6	6
1962	5	15	20
1963	7	10	17
1964	15	15	30
1965	25	23	48
1966	27	17	44
1967	46	20	66
1968	49	25	74
1969	51	19	70
1970	55	26	81
1971	60	23	83
1972	53	21	74
1973	58	28	86
1974	52	29	81
1975	60	29	89
1976	72	25	99
1977	69	29	98
1978	60	28	88
1979	60	27	87
1980	64	25	89
1981	59	39	98
1982	68	33	101
1983	58	40	98
1984	63	34	97
1985	64	34	98
1986	63	28	91
1987	62	33	95
1988	53	37	90
1989	42	32	74
1990	45	30	75
1991	30	29	59
1992	32	22	54
1993	26	21	47
1994	26	22	48
1995	15	17	32
1996	8	17	25
1997	10	18	28
1998	9	15	24
1999	6	22	28
<b>Total</b>	<b>1,629</b>	<b>972</b>	<b>2,601</b>

## Russian Launches

(As of Dec. 31, 1999)

	Launches	Spacecraft
Commercial/Foreign	13	32
Communications	4	5
Dummy satellite (ELV test)	1	1
Early warning	1	1
Electronic intelligence (ocean recon)	1	1
Navigation	1	1
Photoreconnaissance	1	1
Piloted flight	1	1
Remote sensing	2	2
Science and technology	1	1
Unmanned space station resupply	2	2
<b>Total</b>	<b>28</b>	<b>48</b>

## Russian Launch Site Activity

(As of Dec. 31, 1999)

Spacecraft	Number of launches
<b>Baikonur Cosmodrome, Tyuratam, Kazakhstan</b>	
Dniepr	1
Proton-K	7
Soyuz-U	3
Soyuz-U/Ikar	6
Tsyklon-M	1
Zenit-2	1
<b>Total</b>	<b>19</b>
<b>Kapustin Yar Cosmodrome, Kapustin Yar, Russia</b>	
Kosmos-3M	1
<b>Total</b>	<b>1</b>
<b>Odyssey Platform, Pacific Ocean (Sea Launch)</b>	
Zenit-3SL	2
<b>Total</b>	<b>2</b>
<b>Plesetsk Cosmodrome, Plesetsk, Russia</b>	
Kosmos-3M	1
Molniya-M	2
Soyuz-U	3
<b>Total</b>	<b>6</b>



In February 1959, the world's first polar orbiting satellite, Discoverer 1, lifted into space aboard a Thor/Agena booster. Discoverer was actually the cover name for Corona, America's first photoreconnaissance satellite program. It was declassified in 1995.



On March 23, 1961, weeks before Yuri Gagarin made his historic spaceflight, another Russian orbited the Earth. It was Ivan Ivanovich—the equivalent of John Doe in Russian. Ivan was a mannequin that had such lifelike features that Russian technicians wrote "model" on the forehead so anyone finding the "body" after it landed wouldn't be confused.



## Russian Manned Spaceflights

(As of Dec. 31, 1999)

Year	Flights	Persons*
1961	2	2
1962	2	2
1963	2	2
1964	1	3
1965	1	2
1966	0	0
1967	1	1
1968	1	1
1969	5	11
1970	1	2
1971	2	6
1972	0	0
1973	2	4
1974	3	6
1975	4	8
1976	3	6
1977	3	6
1978	5	10
1979	2	4
1980	6	13
1981	3	6
1982	3	8
1983	2	5
1984	3	9
1985	2	5
1986	1	2
1987	3	8
1988	3	9
1989	1	2
1990	3	7
1991	2	6
1992	2	6
1993	2	5
1994	3	8
1995	2	6
1996	2	5
1997	2	5
1998	2	6
1999	1	3
<b>Total</b>	<b>88</b>	<b>200</b>

\*Total number of personnel who flew in space in a given year.  
(Individuals may have made multiple flights.)

## Spacefarers\*

(As of Dec. 31, 1999)

Nation	Persons	Nation	Persons
Afghanistan	1	Mongolia	1
Austria	1	Netherlands	1
Belgium	1	Poland	1
Bulgaria	2	Romania	1
Canada	8	Russia	90
Cuba	1	Saudi Arabia	1
Czechoslovakia	1	Slovakia	1
France	8	Spain	1
Germany	8	Switzerland	1
Hungary	1	Syria	1
India	1	Ukraine	1
Italy	3	United Kingdom	1
Japan	5	United States	246
Mexico	1	Vietnam	1
		<b>Total</b>	<b>390</b>

\*Individuals who have flown in space.

## Payloads in Orbit

(As of Dec. 31, 1999)

Launcher/operator	Objects	Launcher/operator	Objects
Argentina	4	Luxembourg	9
Australia	7	Malaysia	2
Brazil	9	Mexico	6
Canada	16	NATO	8
Chile	1	Norway	3
China	30	Philippines	2
Czechoslovakia	4	Portugal	1
Denmark	1	Russia	1,368
Egypt	1	Saudi Arabia	7
ESA	27	Singapore	1
France	46	South Africa	1
France/Germany	3	South Korea	7
Germany	17	Spain	5
India	19	Sweden	8
Indonesia	9	Taiwan	1
Israel	3	Thailand	4
Italy	8	Turkey	2
ITSO*	56	United Kingdom	26
Japan	68	United States	941
		<b>Total</b>	<b>2,731</b>

\*International Telecommunications Satellite Organization

## Other, Launches

(As of Dec. 31, 1999)

Year	France	China	Japan	Europe	India	Israel
1965	1					
1966	1					
1967	2					
1968						
1969						
1970	2	1	1			
1971	1	1	2			
1972			1			
1973						
1974			1			
1975	3	3	2			
1976		2	1			
1977			2			
1978		1	3			
1979			2	1		
1980			2		1	
1981		1	3	2	1	
1982		1	1			
1983		1	3	2	1	
1984		3	3	4		
1985		1	2	3		
1986		2	2	2		
1987		2	3	2		
1988		4	2	7		1
1989			2	7		
1990		5	3	5		1
1991		1	2	8		
1992		4	1	7	1	
1993		1	1	7		
1994		5	2	6	2	
1995		2	1	11		1
1996		3	1	10	1	
1997		6	2	12	1	
1998		6	2	11		
1999		4		10	1	
<b>Total</b>	<b>10</b>	<b>60</b>	<b>53</b>	<b>117</b>	<b>9</b>	<b>3</b>





# AFA 2000 National Convention

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## Major events at AFA's National Convention:

- Sept. 9** AFA and AEF board meetings.
- Sept. 10** New! Memorial service at Arlington National Cemetery.  
National convention business sessions.  
New! AEF dinner and silent auction kickoff.
- Sept. 11** Awards ceremony and keynote address.  
Aerospace Technology Exposition opening.  
New! Presidential candidates address national defense issues.  
Outstanding Airmen dinner.
- Sept. 12** Delegates' Congressional breakfasts and visits.  
Luncheon in honor of Air Force Chief of Staff Gen. Michael E. Ryan.  
Dinner saluting USAF's 53rd anniversary.
- Sept. 13** Delegates' Congressional breakfasts and visits.  
Luncheon in honor of Air Force Secretary F. Whitten Peters.

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## Space Firsts

**March 22, 1946**

First US rocket to leave Earth's atmosphere, JPL-Ordnance WAC reached 50-mile height after launch from White Sands Proving Ground.

**Feb. 24, 1949**

Bumper-WAC Corporal two stage rocket, first with fully tanked second stage, reaches record altitude of 244 miles and velocity of 5,150 mph.

**July 24, 1950**

Bumper No. 8 becomes first missile launched from Cape Canaveral, Fla.

**Sept. 20, 1956**

US Jupiter C rocket achieves record first flight, reaching altitude of 682 miles and landing 3,400 miles from Cape Canaveral.

**Aug. 21, 1957**

First successful launch of Soviet R7 rocket, which six weeks later will loft Sputnik into orbit.

**Oct. 4**

USSR launches Sputnik 1, first man-made satellite, into Earth orbit.

**Nov. 3**

First animal in orbit, a dog named Laika, is carried aloft by Soviet Sputnik 2.

**Dec. 6**

First US attempt to launch satellite fails when Vanguard rocket loses thrust and explodes.

**Dec. 17**

First successful USAF Atlas ICBM test flight.

**Jan. 31, 1958**

Explorer 1, first US satellite, launched.

**May 15**

USSR launches first automatic scientific lab aboard Sputnik 3.

**Dec. 18**

Project SCORE spacecraft conducts first US active communication from space.

**Feb. 28, 1959**

Discoverer 1 becomes first satellite launched from Vandenberg AFB, Calif.

**June 9**

First engineer group arrives at Cape Canaveral to prepare Atlas booster carrying first Mercury capsule.

**Aug. 7**

Explorer 6 spacecraft transmits first television pictures from space.

**Sept. 12**

Soviet Union launches Luna 2, which two days later becomes first man-made object to strike moon.

**April 1, 1960**

TIFOS 1 becomes first US weather satellite to go aloft.

**April 13**

Transit 1B becomes first US navigation satellite in space.

**May 24**

Atlas D/Agna A booster places MIDAS II, first early warning satellite, in orbit.

**June 22**

US performs first successful launch of multiple independently instrumented satellites by single rocket.

**Aug. 11**

Capsule ejected from Discoverer 13 parachutes into Pacific Ocean and becomes first orbital payload ever recovered.

**Aug. 12**

First passive communications carried via Echo 1 satellite.

**Aug. 19**

Capsule containing first satellite photographs of Soviet Union ejected from Discoverer 14 becomes first orbital payload recovered in midair by C-119 Flying Boxcar.

**Jan. 31, 1961**

Preparing for manned spaceflight, US first tests life support by launching a Mercury capsule with chimpanzee Ham on a suborbital trajectory.

**Feb. 16**

Explorer 9 becomes first satellite launched from Wallops Island, Va.

**April 12**

Soviet cosmonaut Yuri Gagarin pilots Vostok 1 through nearly one orbit to become first human in space.

**May 5**

Lt. Cmdr. Alan B. Shepard Jr., aboard Freedom 7 Mercury capsule, becomes first American in space, climbing to 116.5 miles during suborbital flight lasting 15 minutes, 28 seconds.

**Oct. 27**

First flight of Saturn rocket marks beginning of more than 11 years of Apollo launches.

**Feb. 20, 1962**

Project Mercury astronaut Lt. Col. John H. Glenn Jr., aboard Friendship 7 capsule, completes first US manned orbital flight.

**July 17**

Air Force Capt. Robert M. White earns astronaut wings when he reaches altitude of nearly 60 miles in rocket-powered X-15, first aircraft to be flown to lower edge of space, considered to be 50 miles.

**Dec. 14**

Mariner 2 passes Venus at distance of 21,600 miles, becoming first space probe to encounter another planet.

**June 16, 1963**

Valentina Tereshkova of USSR pilots Vostok 6 to become first woman in space.

**July 26**

Hughes Corp.'s Syncom 2 (prototype of EarlyBird communications satellite) orbits and "parks" over Atlantic to become world's first geosynchronous satellite.

**Oct. 17**

Vela Hotel satellite performs first space-based detection of nuclear explosion.

**July 28, 1964**

First close-up lunar pictures provided by Ranger 7 spacecraft.

**Aug. 14**

First Atlas/Agna D standard launch vehicle

successfully fired from Vandenberg AFB.

**March 18, 1965**

First space walk conducted by Alexei Leonov of Soviet Voskhod 2.

**March 23**

Gemini 3 astronauts Maj. Virgil I. "Gus" Grissom and Lt. Cmdr. John W. Young complete world's first piloted orbital maneuver.

**June 4**

Gemini 4 astronaut Maj. Edward H. White performs first American space walk.

**July 14**

Mariner provides first close-up pictures of Mars.

**Aug. 21**

Gemini 5 launched as first manned spacecraft using fuel cells for electrical power rather than batteries.

**March 16, 1966**

Gemini 8 astronauts Neil A. Armstrong and Maj. David R. Scott perform first manual docking in space with Agena rocket stage.

**June 2**

Surveyor 1 is first US spacecraft to land softly on moon. It analyzes soil content and transmits surface images to Earth.

**Jan. 25, 1967**

Soviet Kosmos 139 anti-satellite weapon carries out first fractional orbit bombardment.

**Jan. 27**

First deaths of US space program occur in flash fire in Apollo 1 command module, killing astronauts Grissom, White, and Lt. Cmdr. Roger B. Chaffee.

**Sept. 8**

Surveyor 5 conducts first chemical analysis of lunar soil.

**Oct. 20, 1968**

Soviet Kosmos 248 and Kosmos 249 spacecraft carry out first co-orbital anti-satellite test.

**Dec. 21-27**

Apollo 8 becomes first manned spacecraft to escape Earth's gravity and enter lunar orbit. First live lunar television broadcast.

**March 3-13, 1969**

Apollo 9 crew members Col. James A. McDivitt, Col. David R. Scott, and Russell L. Schweickart conduct first test of lunar module in Earth orbit.

**July 20**

Apollo 11 puts first human, Neil A. Armstrong, on moon.

**Nov. 14-24**

US Apollo 12 mission deploys first major scientific experiments on moon and completes first acquisition of samples from earlier spacecraft—Surveyor 3.

**Feb. 11, 1970**

Japan launches first satellite, Osumi, from Kagoshima Space Center using Lambda 4S solid-fuel rocket.

**Jan. 31, 1971**

Apollo 14 launched; its astronauts will complete first manned landing on lunar highlands.

**April 19**

First space station, Salyut 1, goes aloft.



**June 6**

USSR's Soyuz 17 performs first successful docking with Salyut space station.

**Oct. 28**

First British satellite, Prospero, launched into orbit on Black Arrow rocket.

**Nov. 2**

Titan IIIC launches first Defense Satellite Communications System (DSCS) Phase II satellites into GEO.

**April 16–27, 1972**

Apollo 16 astronauts Capt. John Young, Lt. Cmdr. Thomas K. Mattingly II, and Lt. Col. Charles M. Duke Jr. are first to use moon as astronomical laboratory.

**July 23**

US launches first Earth Resources Technology Satellite (ERTS A), later renamed Landsat 1.

**Dec. 3, 1973**

Pioneer 10 becomes first space probe to come within reach of Jupiter.

**July 15, 1975**

US Apollo and Soviet Soyuz 19 perform first international docking of spacecraft in space.

**July 20, 1976**

NASA's Viking 1 performs first soft landing on Mars and begins capturing images of Red Planet's surface.

**Aug. 12, 1977**

Space shuttle *Enterprise* performs first free flight after release from Boeing 747 at 22,800 feet.

**Feb. 22, 1978**

Atlas booster carries first Global Positioning System (GPS) Block I satellite into orbit.

**Dec. 13**

Successful launch of two DSCS II satellites puts full four-satellite constellation at users' disposal for first time.

**July 18, 1980**

India places its first satellite, Rohini 1, into orbit using its own SLV-3 launcher.

**April 12–14, 1981**

First orbital flight of shuttle *Columbia* (STS-1) and first landing from orbit of reusable spacecraft.

**Dec. 20, 1982**

First Defense Meteorological Satellite Program (DMSP) Block 5D-2 satellite launched.

**June 13, 1983**

Pioneer 10 becomes first spacecraft to leave solar system.

**June 18**

Space shuttle *Challenger* crew member Sally K. Ride becomes first American woman in space.

**Sept. 11, 1985**

International Cometary Explorer becomes first man-made object to encounter a comet (Giacobini-Zinner).

**Sept. 13**

First US anti-satellite intercept test destroys Solwind scientific satellite by air-launched weapon.

**Oct. 3, 1985**

First launch of *Atlantis* (STS-51J) results in

first launch of pair of DSCS III satellites from space shuttle using Inertial Upper Stage.

**Jan. 24, 1986**

*Voyager 2*, launched Aug. 20, 1977, makes first close planet flyby of Uranus and sweeps by Neptune on Aug. 24, 1989, becoming first spacecraft to visit these planets.

**Jan. 28**

Space shuttle *Challenger* explodes after liftoff, killing seven astronauts.

**Feb. 22**

France launches first *Satellite Pour l'Observation de la Terre* (SPOT) for remote sensing.

**Aug. 12**

First launch of Japanese H-I rocket puts Experimental Geodetic Satellite into circular orbit.

**May 15, 1987**

USSR stages first flight of its Energia heavy launcher, designed to lift 100 tons into LEO.

**Nov. 15, 1988**

USSR makes first launch of 30-ton shuttle *Buran* using Energia rocket.

**Feb. 14, 1989**

Launch of first Block II GPS satellite begins operational constellation.

**Aug. 10, 1990**

Unmanned spacecraft Magellan—on first dedicated US mission to study surface of Venus in detail using radar imagery—enters orbit around Venus.

**Jan. 17, 1991**

What USAF calls "the first space war," Operation Desert Storm, opens with air attacks.

**Oct. 29**

Galileo swings within 10,000 miles of Gaspra, snapping first close-up images of an asteroid.

**May 13, 1992**

First trio of space-walking astronauts, working from shuttle *Endeavour*, rescues Intelsat 6 from useless low orbit.

**Jan. 13, 1993**

USAF Maj. Susan Helms, flying aboard *Endeavour*, becomes first US military woman in space.

**July 19**

Launch of DSCS Phase III satellite into GEO provides first full five-satellite DSCS III constellation.

**Dec. 2–13**

USAF Col. Richard O. Covey pilots shuttle *Endeavour* on first mission to repair Hubble Space Telescope, setting a record for most extravehicular activities—five in one mission.

**Jan. 25, 1994**

Launch of 500-pound unpowered Clementine spacecraft marks first post-Apollo US lunar mission.

**Feb. 7**

First Titan IV Centaur booster launches first Milstar Block I satellite into orbit.

**March 13**

First launch of Taurus booster places two military satellites in orbit.

**Nov. 5**

Ulysses, first probe to explore sun's envi-

ronment at high latitudes, completes pass over sun's southern pole and reveals that solar wind's velocity at high latitudes (i.e., about 2 million mph) is nearly twice its velocity at lower latitudes.

**Feb. 6, 1995**

Shuttle *Discovery* (STS-63) and space station Mir perform first US-Russian space rendezvous in 20 years, with USAF Lt. Col. Eileen M. Collins coincidentally becoming first woman to pilot a US spaceship.

**March 14**

US astronaut Norman E. Thagard becomes first American to accompany Russian cosmonauts aboard Soyuz TM-21 spacecraft and, two days later, becomes first American to inhabit space station Mir.

**June 29**

*Atlantis* (STS-71) docks with Mir, the first docking of a US spacecraft and a Russian space station.

**March 8, 1996**

First successful launch of Pegasus XL rocket from beneath modified L-1011 aircraft sends Air Force Radiation Experiment-II satellite into polar orbit.

**June 27**

Galileo captures first close-up images of Jupiter's moon Ganymede.

**April 21, 1997**

Celestis, Inc., of Houston performs first space "burial" when Pegasus rocket launched from L-1011 off coast of northwest Africa carries cremated remains of "Star Trek" creator Gene Roddenberry, LSD guru Timothy Leary, and 22 other space enthusiasts into orbit 300 miles above Earth.

**April 29**

US astronaut Jerry Linenger and Russian cosmonaut Vasily Tsibliev complete five-hour space walk outside Mir, the first such joint excursion in space history.

**June 27**

In first flyby of "dark, primitive main-belt" type asteroid, NASA's Near-Earth Asteroid Rendezvous spacecraft passes 253 Mathilde.

**July 5**

One day after Mars Pathfinder lands on surface of Red Planet, Sojourner rover becomes first mobile, semiautonomous, robotic vehicle to traverse another planet's surface.

**May 29, 1998**

First transfer of operational military space system to civilian agency occurs when Air Force hands to NOAA control of DMSP spacecraft.

**June 17**

Hughes completes first commercial mission to moon, having used dual lunar flybys to maneuver errant HGS-1 satellite into usable, geosynchronous orbit.

**Dec. 4–15**

Space shuttle *Endeavour* completes the first ISS assembly mission.



**Aerospace.** A physical region made up of Earth's atmosphere and the space beyond.

**Aerospace plane.** A reusable spacecraft able to operate effectively in both the atmosphere and space. Also known as a "transatmospheric vehicle" or, more currently, "spaceplane."

**Apogee.** The point of greatest distance from Earth (or the moon, a planet, etc.) achieved by a body in elliptical orbit. Usually expressed as distance from Earth's surface.

**Atmosphere.** Earth's enveloping sphere of air.

**Boost phase.** Powered flight of a ballistic missile—i.e., before the rocket burns out.

**Burn.** The process in which rocket engines consume fuel or other propellant.

**Circumterrestrial space.** "Inner space" or the atmospheric region that extends from 60 miles to about 50,000 miles from Earth's surface.

**Constellation.** A formation of satellites orbiting for a specific combined purpose.

**Deep space.** All space beyond the Earth-moon system, or from about 480,000 miles altitude outward.

**Eccentric orbit.** An extremely elongated elliptical orbit.

**Ecliptic plane.** The plane defined by the circle on the celestial sphere traced by the path of the sun.

**Elliptical orbit.** Any noncircular, closed spaceflight path.

**Exosphere.** The upper limits of Earth's atmosphere, ranging from about 300 miles altitude to about 2,000 miles altitude.

**Expendable Launch Vehicle (ELV).** A launch vehicle that cannot be reused after one flight.

**Ferret.** A satellite whose primary function is to gather electronic intelligence, such as microwave, radar, radio, and voice emissions.

**Geostationary Earth orbit.** A geosynchronous orbit with 0° inclination in which the spacecraft circles Earth 22,300 miles above the equator and appears from Earth to be standing still.

**Geosynchronous Earth Orbit (GEO).** An orbit at 22,300 miles that is synchronized with Earth's rotation. If a satellite in GEO is not at 0° inclination, its ground path describes a figure eight as it travels around Earth.

**Geosynchronous Transfer Orbit (GTO).** An orbit that originates with the parking orbit and then reaches apogee at the GEO.

**Ground track.** An imaginary line on Earth's surface that traces the course of another imaginary line between Earth's center and an orbiting satellite.

**High Earth Orbit (HEO).** Flight path above geosynchronous altitude (22,300 to 60,000 miles from Earth's surface).

**High-resolution imagery.** Detailed representations of actual objects that satellites produce electronically or optically on displays, film, or other visual devices.

**Inertial Upper Stage (IUS).** A two-stage solid-rocket motor used to propel heavy satellites into mission orbit.

**Ionosphere.** A region of electrically charged thin air layers that begins about 30 miles above Earth's atmosphere.

**Low Earth Orbit (LEO).** Flight path between Earth's atmosphere and the bottom of the Van Allen belts, i.e., from about 60 to 300 miles altitude.

**Magnetosphere.** A region dominated by Earth's magnetic field, which traps charged particles, including those in the Van Allen belts. It begins in the upper atmosphere, where it overlaps the ionosphere, and extends several thousand miles farther into space.

**Medium Earth Orbit (MEO).** Flight path between LEO, which ends at about 300 miles altitude, and GEO, which is at an average altitude of 22,300 miles.

**Mesosphere.** A region of the atmosphere about 30 to 50 miles above Earth's surface.

**Orbital decay.** A condition in which spacecraft lose orbital altitude and orbital energy because of aerodynamic drag and other physical forces.

**Orbital inclination.** Angle of flight path in space relative to the equator of a planetary body. Equatorial paths are 0° for flights headed east, 180° for those headed west.

**Outer space.** Space that extends from about 50,000 miles above Earth's surface to a distance of about 480,000 miles.

**Parking orbit.** Flight path in which spacecraft go into LEO, circle the globe in a waiting posture, and then transfer payload to a final, higher orbit.

**Payload.** Any spacecraft's crew or cargo; the mission element supported by the spacecraft.

**Perigee.** The point of minimum altitude above Earth (or the moon, a planet, etc.) maintained by a body in elliptical orbit.

**Period.** The amount of time a spacecraft requires to go through one complete orbit.

**Polar orbit.** Earth orbit with a 90° inclination. Spacecraft on this path could pass over every spot on Earth as Earth rotates under the satellite's orbit (see orbital inclination).

**Remote imaging.** Images of Earth generated from a spacecraft that provide data for mapping, construction, agriculture, oil and gas exploration, news media services, and the like.

**Reusable Launch Vehicle (RLV).** A launch vehicle that can be reused after flight.

**Rocket.** An aerospace vehicle that carries its own fuel and oxidizer and can operate outside Earth's atmosphere.

**Semisynchronous orbit.** An orbit set at an altitude of 12,834 miles. Satellites in this orbit revolve around Earth in exactly 12 hours.

**Single-Stage-To-Orbit (SSTO) system.** A reusable single-stage rocket that can take off and land repeatedly and is able to boost payloads into orbit.

**Stratosphere.** That section of atmosphere about 10 to 30 miles above Earth's surface.

**Sun synchronous orbit.** An orbit inclined about 98° to the equator and at LEO altitude. At this inclination and altitude, a satellite's orbital plane always maintains the same relative orientation to the sun.

**Thermosphere.** The thin atmosphere about 50 to 300 miles above Earth's surface. It experiences dramatically increased levels of heat compared to the lower layers.

**Transfer.** Any maneuver that changes a spacecraft orbit.

**Transponder.** A radar or radio set that, upon receiving a designated signal, emits a radio signal of its own.

**Troposphere.** The region of the atmosphere from Earth's surface to about 10 miles above the equator and five miles above the poles. This is where most clouds, wind, rain, and other weather occurs.

**Van Allen belts.** Zones of intense radiation trapped in Earth's magnetosphere that could damage unshielded spacecraft.



US Space Command's Space Control Center at Cheyenne Mountain AFS, Colo., tracks nearly 9,000 man-made objects, softball-sized and larger, orbiting Earth. About 7 percent of these objects are operational satellites, 15 percent are rocket bodies, and the remainder are fragmentation and inactive satellites.



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## The Golden Age of NASA

<b>Name</b>	<b>Project Mercury</b>
<b>Duration</b>	<b>Nov. 3, 1958–May 16, 1963</b>
<b>Cost</b>	\$392.1 million (cost figures are in then-year dollars)
<b>Distinction</b>	First US manned spaceflight program
<b>Highlight</b>	Astronauts are launched into space and returned safely to Earth
<b>Number of flights</b>	Six
<b>Key events</b>	<b>May 5, 1961</b> Lt. Cmdr. Alan B. Shepard Jr. makes first US manned flight, a 15-minute suborbital trip <b>Feb. 20, 1962</b> Lt. Col. John H. Glenn Jr. becomes first American to orbit Earth <b>May 15, 1963</b> Maj. L. Gordon Cooper Jr. begins flight of 22 orbits in 34 hours
<b>Name</b>	<b>Project Gemini</b>
<b>Duration</b>	<b>Jan. 15, 1962–Nov. 15, 1966</b>
<b>Cost</b>	\$1.3 billion
<b>Distinction</b>	First program to explore docking, long-duration flight, rendezvous, space walks, and guided re-entry
<b>Highlight</b>	Dockings and rendezvous techniques practiced in preparation for Project Apollo
<b>Number of flights</b>	10
<b>Key events</b>	<b>June 3-7, 1965</b> Flight in which Maj. Edward H. White II makes first space walk <b>Aug. 21-29, 1965</b> Cooper and Lt. Cmdr. Charles "Pete" Conrad Jr. withstand weightlessness <b>March 16, 1966</b> Neil A. Armstrong and Maj. David R. Scott execute the first space docking <b>Sept. 15, 1966</b> Conrad and Richard F. Gordon Jr. make first successful automatic, computer-steered re-entry
<b>Name</b>	<b>Project Apollo</b>
<b>Duration</b>	<b>July 25, 1960–Dec. 19, 1972</b>
<b>Cost</b>	\$24 billion
<b>Distinction</b>	Space program that put humans on the moon
<b>Highlights</b>	Neil Armstrong steps onto lunar surface. Twelve astronauts spend 160 hours on the moon
<b>Number of flights</b>	11
<b>Key events</b>	<b>May 28, 1964</b> First Apollo command module is launched into orbit aboard a Saturn 1 rocket <b>Jan. 27, 1967</b> Lt. Col. Virgil I. "Gus" Grissom, Lt. Cmdr. Roger B. Chaffee, and White die in a command module fire in ground test <b>Oct. 11-22, 1968</b> First manned Apollo flight proves "moonworthiness" of spacecraft <b>Dec. 21-27, 1968</b> First manned flight to moon and first lunar orbit <b>July 16-24, 1969</b> Apollo 11 takes Armstrong, Col. Edwin E. "Buzz" Aldrin Jr., and Lt. Col. Michael Collins to the moon and back Armstrong and Aldrin make first and second moon walks <b>Dec. 7-19, 1972</b> Final Apollo lunar flight produces sixth manned moon landing

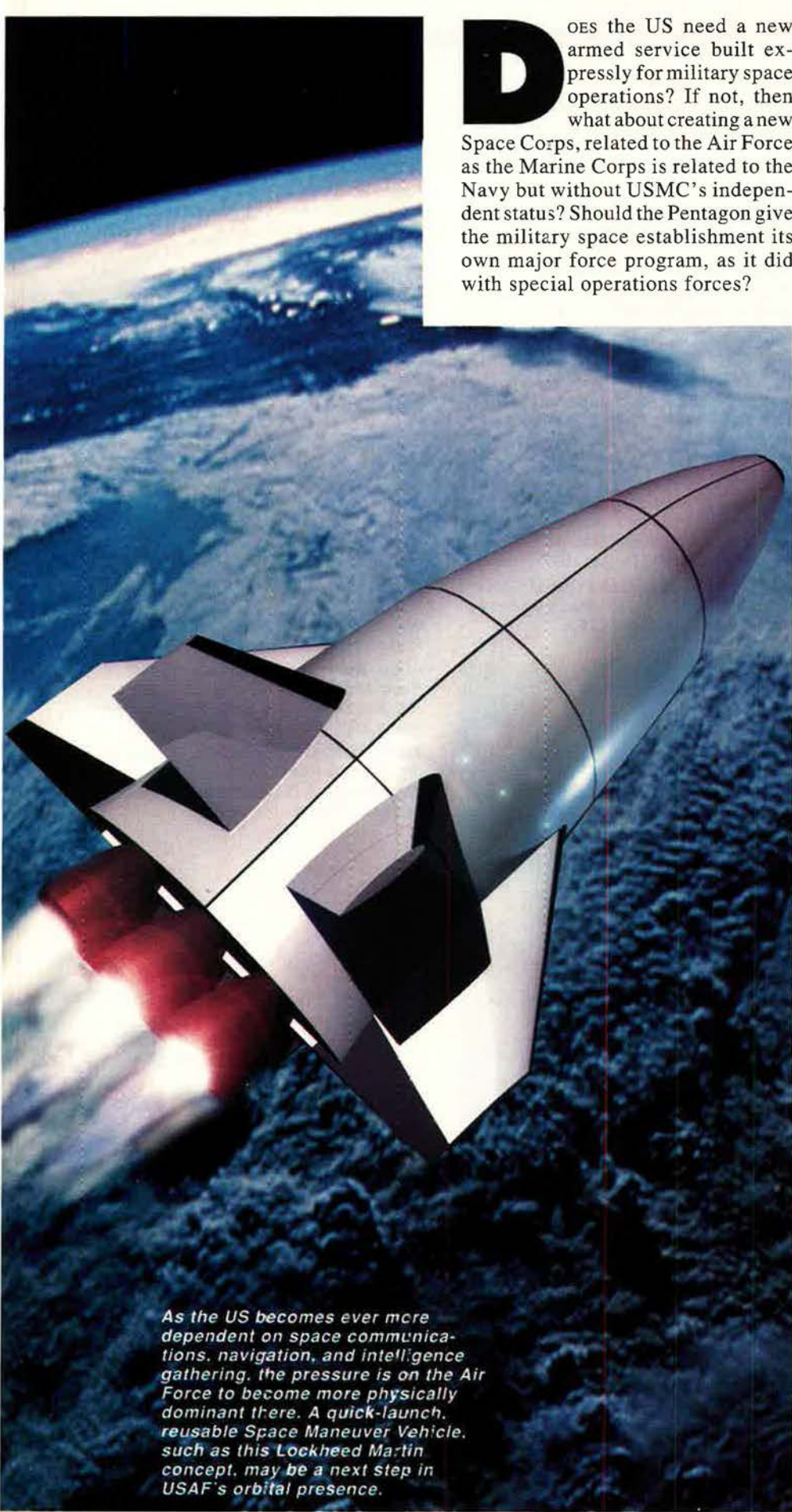


Every two years, NASA receives some 4,000 applications for its 20 or so openings for new astronauts.



The oldest person accepted for astronaut training was Barbara R. Morgan, a civilian selected into the 1998 US astronaut candidate class. She was 46.



A detailed illustration of a Lockheed Martin reusable Space Maneuver Vehicle (SMV) in orbit above Earth. The vehicle is a sleek, white, conical structure with a large, dark, multi-faceted nose cone and a complex, multi-faceted tail section. It is shown from a low-angle perspective, appearing to rise from the bottom left towards the top right. The background is a view of Earth from space, showing the blue and white clouds of the planet against the blackness of space. The vehicle's nose is pointed towards the upper right, and its tail is towards the lower left. The overall scene is set against the backdrop of the Earth's horizon and atmosphere.

**D**OES the US need a new armed service built expressly for military space operations? If not, then what about creating a new Space Corps, related to the Air Force as the Marine Corps is related to the Navy but without USMC's independent status? Should the Pentagon give the military space establishment its own major force program, as it did with special operations forces?

If things go as planned, a blue-ribbon federal commission in late 2000 will report back with answers to these and other questions.

There is no assurance that the Air Force and its supporters will like what the commission says. In fact, the opposite is more likely to be the case. The panel was the brainchild of Air Force critics in Congress who claim USAF leaders, being infatuated with fighters and bombers, have failed to make a strong effort to put weapons in space and establish physical dominance there.

Sen. Bob Smith (R-N.H.), one of the most vocal proponents of a more aggressive military posture in space, told a recent Washington symposium that he sees USAF as interested only in "supporting non-space forms of power projection" and that funding for programs geared to space control have been "paltry." Smith said that, if the Air Force won't "embrace space power," then "Congress will have to drag them there kicking and screaming, if necessary."

The critics—and commission members—should take a closer look.

They would find the Air Force is well along in developing systems to increase its access to orbit and broaden the range of tasks it can perform there. The service is generating doctrine—and technologies—for eventual use of weapons in space.

### Tricky Endeavor

For the Air Force, this is a tricky endeavor, given that many of the weapons that might actually be deployed in space are prohibited by treaties to which Washington is a signatory. Others with high promise nevertheless are in their scientific infancy and not even close to being deployable.

Gen. Michael E. Ryan, USAF Chief of Staff, is on record as saying that the idea of a separate space force makes little sense at this particular time. He argues that USAF is doing everything its budget will allow to press forward on space technologies that offer the most payback to national strategy.

Without doubt, an increase in USAF's budget would make additional funding available for military space research. Yet the creation of a separate service—and a new bureaucracy—would work at cross purposes with space development, said Ryan.

*As the US becomes ever more dependent on space communications, navigation, and intelligence gathering, the pressure is on the Air Force to become more physically dominant there. A quick-launch, reusable Space Maneuver Vehicle, such as this Lockheed Martin concept, may be a next step in USAF's orbital presence.*



**The Air Force is working on the integration, not the separation, of air and space.**

# The Fight for Space

By John A. Tirpak, Senior Editor

It actually would drain funds away from new space initiatives, he asserted. A separate service, he said, is "at best ... an inefficient way to use [defense] resources."

As Ryan recently told *Air Force Magazine*, "You want us to do more in space? Give us more topline," referring to the budget ceiling.

The 13-member study panel—officially, the Commission to Assess United States National Security Space Management and Organization—was instructed to look at the benefits of a separate space service or a space corps within USAF, creation of a new office of Assistant Secretary of Defense for Space, and a new apparatus for managing space affairs within the Pentagon.

The panel is chaired by Donald Rumsfeld, former Secretary of Defense (1975–77). Its military members are: Gen. Howell Estes III, USAF (Ret.), former commander in chief, US Space Command, and commander, Air Force Space Command; Gen. Ronald Fogleman, USAF (Ret.), former USAF Chief of Staff; Gen. Charles Horner, USAF (Ret.), former commander in chief, USSPACE, and commander, AFSPC; Adm. David Jeremiah, USN (Ret.), former vice chairman of the Joint Chiefs of Staff; Gen. Thomas Moorman Jr., USAF (Ret.), former USAF vice chief of staff and commander, AFSPC; Gen. Glenn Otis, US Army (Ret.), former commanding general, US Army Training and Doctrine Command; and Lt. Gen. Jay Garner, US Army (Ret.), former commanding general, US Army Space and Strategic Defense Command.

The civilian members are: Duane Andrews, former deputy undersecretary of defense for command, control, communications, and intelligence; Robert Davis, former deputy undersecretary of defense for space; William Graham, former chairman of DoD's Ballistic Missile Defense Advisory Committee; Douglas Necessary, former professional staff member, House Armed Services Committee; and Malcom Wallop (R-Wyo.), former United States Senator.

This year, the Air Force is devoting to space systems and activities nearly 8 percent of its budget (\$84 billion in Fiscal 2000). Officials expect this percentage to hold through 2005, with annual outlays remaining





*Access to space is key. Current Expendable Launch Vehicles, like this Titan IV Centaur, are giving way to a new fleet of ELVs that are more efficient, more reliable, and cheaper.*



at a roughly steady level. Space's percentage share has remained constant since 1993, despite a 16 percent drop in the service's overall budget during that period. Thus, military space has commanded an increasing share of the pie, relatively speaking.

The Air Force wants to do more. In April, the service unveiled a white paper, "The Aerospace Force," which detailed how the service is moving to integrate surface, airborne, and spaceborne capabilities to achieve greater synergy between them and more effectiveness in combat. It described how USAF will move toward creating an aerospace culture and the elimination of the traditional barriers between air operators and space operators. USAF envisions the emergence of a new, seamless force, focused on effects rather than mechanisms used to obtain them.

Air Force preparation for future space war runs from investment in new technology—for spacecraft and launch systems—to teaching USAF and other service operators about existing space systems and the capabilities they offer for combat. New, mandatory courses on using space systems in combat operations, wargames featuring attacks on US space assets, and the creation of a Space Aggressor Squadron all are part of the effort.

### Look Again

"The people who say we are not moving fast enough ... just aren't paying attention," said Col. Robert E. Ryals, vice commander of Air Force Space Command's Space Warfare Center.

Ryals said that the SWC, located at Schriever AFB, Colo., has been tasked with figuring out how best to get the Air Force's substantial space capabilities into every aspect of terrestrial warfare, which he calls "bringing space to the fight."

Doing that entails working with the Air Force Doctrine Center to plug space capabilities into procedures and plans where they may not have been considered before and obliging students at command schools to confront space-related combat issues in regular wargames.

"Right now, there isn't a [concept of operations] for space," said Lt. Col. David Tobin, who was head of the SWC commander's action group. "There is a void in doctrine."

Tobin asserted that one can find a strong parallel with the early days of military aviation.

"In World War I, the airplane was used mainly for observation and then, in a limited way, for fighting," he said. "[For] World War II, it was fully developed as a weapon ... because the Army had created the Air [Corps] Tactical School" to develop doctrine and ways of using the airplane in conjunction with other forces.

### "A Decisive Force"

In the same way, Tobin said, space is now used chiefly for observation but "can become a decisive force" in future wars. He noted that Gen. Ralph E. Eberhart, commander in chief of US Space Command and commander of Air Force Space Command, recommended the formation of a Space Tactical School to develop space warfare concepts "and the Air Staff is looking at that."

The SWC organized the Space Aggressor Squadron, whose job it is to play against the Air Force and other services in wargames such as Red Flag and to heighten both military and civilian awareness of the threat, according to Lt. Col. Timothy Marceau, the squadron commander. "We are joined at the hip," he said, with the Air Force Information Warfare Center in San Antonio. Many types of information attacks involve space systems, and the two coordinate their activities.

Commercial space concerns, with many billions invested in telecommunications and other types of satellites, have been slow to recognize a threat, Marceau said. His unit's job, in part, will be to educate them as to "what an attack looks like," but part of their reluctance is due to their "fears of a new space arms race."

Erecting defenses for satellites—even minimally, with shielding or armor—would add substantially to the cost of space systems, since launch costs are still in the \$10,000 per pound range. The lack of any physical attacks so far has led industry to ignore a space threat for now because "there is no business case yet" to develop defenses, Marceau said.

Marceau pointed out that space operations require a ground station, a satellite, an uplink, and a downlink. Interfering with any link in



this chain can deny an operator his access to space. At the moment, disrupting ground stations—through power outages or destruction—or uplinks—by localized jamming—are proving far cheaper and easier than interfering with satellites themselves.

Marceau's squadron has developed inexpensive devices that can locally jam satellite signals. He has used them in exercises to deprive blue forces of some of their space capabilities during wargames.

The aggressor squadron educates decision-makers about other realities of the space age.

Marceau noted, for example, that commercial satellite imagery of 1-meter resolution can be ordered and received in under four hours by anyone with the money to pay for it. No longer is satellite reconnaissance available only to great powers. Given the information available on the Internet—in many cases, detailed, unclassified information about military systems—an adversary can learn "quite a bit about what he's seeing" in a purchased image, Marceau pointed out.

Some companies plan to offer satellite imagery at a resolution of less than 1 meter, Ryals noted. Fast disappearing is the ability to build up a ground force capable of springing a surprise on the enemy.

The aggressors also develop charts showing when the fewest number of Global Positioning System satellites will be available for satellite-guided munitions to use against given targets. The fewer the satellites, the less precise the strike will be. These charts can help attack aircraft in planning their runs, but Marceau noted that adversaries "also have the ability to generate this kind of information," so aircrews are forewarned that the best time to attack will be known to an enemy as well.

Another mission of the SWC is to help the Space Battlelab, also located at Schriever, in looking for innovative, cost-effective ways to get more uses out of existing assets or helping to streamline the ways space comes in when USAF goes to war. For example, the Air Force will soon be issuing aircrew survival radios equipped with GPS receivers to quicken the pace at which downed fliers can be located and recovered.

Of roughly 1,400 people that Air

Force Space Command must provide to Aerospace Expeditionary Forces, 70 are space operators. Many of these will be in-place deployments, attached to an AEF but physically present in a space operating location. Additionally, all space organizations are training reserve augmentees in nearly all aspects of space operations, so that Air Force Reserve Command will be able to supply space specialists when they are called up.

### Policy and Pieces

Ryals said the Air Force will have responsibility for achieving "space superiority, achieved through offensive and defensive counterspace operations," much as air superiority is broken up into offensive and defensive counterair operations.

"The policy is in place, the concepts are in place," he said. "The pieces are understood."

Though the US has not deployed weapons, some technologies for acting against satellites are now at hand. These include dazzling lasers that can blind satellites, ground-based movable jammers, and explosive, hard kill anti-satellite devices for low earth orbit.

USAF also has the means to defend against most of these technologies or deny an enemy any access to space systems, Ryals said. An attack aircraft can destroy "the ground station, the uplink, or the downlink" or an electronic combat aircraft can jam the uplink or downlink.

"All you do is pick out the weakest node," Ryals observed.

To date, no one has felt it necessary to physically damage a satellite itself. Because USAF and an enemy might well depend on the same specific commercial satellite, it prefers to block access to the satellite rather than damage the satellite itself.

At present, Ryals feels that developing a concept of operations and doctrine are the key.

"In the past, we got a new weapon and then figured out how to use it." Now, he said, it is necessary to anticipate the weapons and figure out how to use them.

Ryals said he feels it is a misnomer to describe Desert Storm or Allied Force as the first space wars. Though there was substantial use of satellite information and communications in both conflicts, neither side

in either conflict made a serious effort to disrupt the other's access to space systems.

"The first space war hasn't come yet," he asserted.

Not all in the Air Force leadership believe that space should become a battleground. Some are set against further militarization of space, at least for now.

"Space is a safe haven for us at this point in time," said one Air Staff official. "We have the upper hand. We have all our sensors, navigation, and [communications] platforms up there, and they work, and we have them in such depth that no one [else] can match it." A highly visible move like the creation of a space force would, the official said, "give our adversaries ideas. It would lead to a new arms race. ... We have the most to lose and the least to gain from making space a contested area of operations."

### Top Priority

Air Force Space Command's top program is the Space Based Infrared System, according to Brig. Gen. Michael A. Hamel, AFSC's director of requirements.

"SBIRS is clearly the No. 1 priority" for Eberhart, Hamel said. The SBIRS program will replace the 30-year-old Defense Support Program satellites that watch the Earth for the telltale heat signatures of ICBM launches. About 20 DSP satellites have been launched over the decades and only a few are left, Hamel said, making SBIRS crucial to maintaining nuclear deterrence. "We will be husbanding those very carefully," Hamel said.

Besides giving warning of missile attack, the DSP satellites are also able to provide valuable intelligence on "any sort of infrared event" around the world, such as North Korean missile tests or even Scud missile launches during the Gulf War, Hamel noted.

The Air Force wants the Ballistic Missile Defense Organization to take over the SBIRS program, since it will play a key role in missile defense. Hamel said the Air Force would still operate and "execute the acquisition" of the system, but BMDO would pay for it.

Next in priority after SBIRS is a new slate of military communications satellites, Hamel said. Several



years of work have gone into examining what the commercial market can provide, as well as an analysis of how much military communications must be secure and jam-proof.

Replacing the jam-resistant and highly secure Milstar system will be the Advanced Extremely High Frequency Satellite Communications System. This will carry Presidential message traffic, as well as communications to nuclear forces—communications that “we will never, ever allow to be provided by a commercial [venture],” Hamel said. The Advanced EHF will offer more bandwidth, demand for which has “grown enormously ... from all the services.”

For the far more numerous, less crucial messages in which jam-resistance is less important, the US currently relies on the Defense Satellite Communications System. It, in turn, is to be replaced with the Advanced Wideband System.

“The demand for communications just grows exponentially, particularly with expeditionary forces and reachback,” which requires massive amounts of communications capacity, Hamel said. He noted that the bandwidth capacity supporting Allied Force in Kosovo was five times that used during the 1991 Gulf War.

All told, the Air Force is spending about \$1.3 billion a year on military communications satellite modernization, Hamel reported.

“We are often criticized with not being committed to the space mission and not providing the right kind of resources to the warfighter,” Hamel noted. “This is the classic case. ... The Air Force is just a small fraction of the use of satellite communications, but we’re spending over \$1 billion a year to modernize.” Though providing a “five- to 20-fold increase” in the traffic its spacecraft will be able to carry, the Air Force “seldom gets any credit for this,” Hamel asserted.

Ryan recently said the Air Force will be seeking special consideration in the coming budget for the programs it operates as a service to all the armed forces as well as, in the case of the Global Positioning System, the world’s civilian population. GPS’s most precise location signals—previously reserved for the US military alone—were recently made fully available to all users.

A Space Command official said



*A flying experimental Space Based Laser, shown here as an artist's concept, is due about 2012. Missile defense is an obvious application, but use against aircraft and other "soft" targets is also possible.*

Photo illustration by Erik Simonsen



part of the reason the highest quality GPS signal was made available to all users was to discourage other countries—particularly European nations—from launching competing versions. While the US is making the GPS signal available to everyone, being the sole proprietor allows the US some control over its use in wartime, he noted.

In addition to its use in fixing location, GPS satellite signals are used as baseline universal clocks on the Internet and can also be used to detect electromagnetic pulse and X-ray emissions.

"There's an unlimited demand for ... bandwidth," Hamel said, mainly because "it's free." The other military services only have to "demand that more gets provided, and they don't have to pay for it." The other services should be subject to some sort of limits that would oblige them to design their ground systems more efficiently, so that "users have to make choices about just how much bandwidth they really do need."

He said the availability of satellites to carry message traffic is analogous to the problem of airlift—there's only so much to go around. As with airlift, officials must make choices about the priority of traffic, since carrying capacity is limited.

All of the new satellites must get to space, and the new Evolved Expendable Launch Vehicle program has been a success "beyond our wildest imagination," Hamel asserted. EELV is a cost-sharing program in which contractors and the Air Force each put up money to develop medium and heavy launch vehicles that would capture the latest technologies and efficiencies. Originally intended to yield a single contractor that would sell launch services to the US government, the EELV program has carried two contractors—Boeing and Lockheed Martin—into a competitive arrangement. This helps lower launch costs but was made possible by the "sudden explosion in demand for launch services" in the mid-1990s, Hamel reported. There was enough commercial business, he said, for both companies to make money even by splitting the Air Force work.

Under a deal with NASA struck in the early 1990s, the Air Force took on the job of developing the next generation of expendable launch

vehicles while NASA would try to develop the next round of reusable vehicles. The reusables proved "a lot more difficult to engineer into a system" than anticipated, Hamel said; NASA's X-33 program has suffered a number of setbacks.

With NASA, USAF has been examining a Space Maneuver Vehicle that could serve as a partially reusable system. The SMV, which could ride to orbit on an X-33-style vehicle or an expendable booster, could deploy small satellites, conduct repairs of other satellites, inspect a foreign spacecraft, or perform other missions and return to Earth to be used again. Glide tests of a Boeing vehicle have already been conducted.

### A Bridge Too Far?

"Maybe single stage to orbit is a bridge too far" at this time, Hamel said. The SMV would represent a half step, combining reusable elements with expendable elements.

As with the EELV, the Air Force and NASA may seek a cost-sharing arrangement with industry to develop the SMV, since USAF "doesn't have the money or the charter to go this alone," Hamel noted.

Also among the top programs in Space Command is the Discoverer II project, a joint Air Force, Defense Advanced Research Projects Agency, and National Reconnaissance Office effort to develop a space-based radar for detecting ground moving targets, as well as obtaining radar imagery and precise target location.

The program is charged with determining whether such a system is "feasible, affordable, and militarily useful," Hamel noted. "It is extremely important to us," considering that it could lead to a fleet of satellites providing Joint STARS-like intelligence pervasively and worldwide.

Hamel also argued that the system would have a powerful deterrent effect, if successful.

"The ... potential of an adversary knowing that at any instant in time there is a US satellite overhead that could be observing what's going on ... will have dramatic impacts on awareness and deterrence." Moreover, such a system would save the effort of having to deploy radar aircraft like Joint STARS to a theater at all. He called the concept the embodiment of the notion of "light, lean, and lethal."

However, ground-based research is not sufficient to move the concept along, Hamel claimed. "We can't just do this as a paper model. We have to get some hands-on experience" to demonstrate the feasibility of such a system, he said.

What Hamel described as the "most technologically challenging concept" on the roster of space projects is the Space Based Laser. This system would involve a large space platform with a laser capable of destroying ballistic missiles in flight, and possibly generating enough power to also destroy aircraft or other thin-skinned targets.

An integrated flight experiment that would marry a laser with a power source and tracking system is anticipated for launch in the "2011, 2012 time period," Hamel said. An all-up system capable of conducting combat operations would not be available until several years later, though, since an operational system would "have to have orders of magnitude better capability."

Work is progressing by a team including Lockheed Martin, Boeing, and TRW. All three are considered to have important and unique expertise in various aspects of the system, and the focus at first will be to have "the best flight experiment" possible.

If the concept proves out, the three would bid individually for the development phase.

"The Air Force really believes that this is a critical missile defense capability for the future," Hamel said of the SBL.

One senior Air Force official said the corporate view of the service leadership is that a separate space corps or service may be necessary at some point in the future, but it is a fairly distant future. "In 50 years or so, when our physical presence in space is much greater, that may come to pass," he said.

Ryals, however, noted that the Air Force's immediate task should be truly achieving air and space integration. It will have happened, he said, when "we no longer have a Space Warfare Center, just a Warfare Center. And it won't be Air Combat Command, it will simply be Combat Command."

Space, he said, will for at least a decade be "the enabler of everything else we do down here. ... It's not time for Buck Rogers yet." ■



Airlifters from around the world descended on Pope AFB, N.C., for a week of competition and camaraderie.

Photography by USAF Combat Camera Photographers

# RODEO

## 2000

*A giant C-5 Galaxy from Dover AFB, Del., is moments from landing at Pope AFB, N.C., site of Air Mobility Command's Rodeo 2000. The week-long competition in early May tested the professional core abilities of air mobility forces from the US Air Force and several foreign countries. In the end, the 6th Air Refueling Wing, MacDill AFB, Fla., captured the top award as best overall air mobility wing.*







USAF photo by SSGT. Jeffrey Allen



Since its beginning in 1962 as a combat skills competition, Airlift Rodeo has brought together the best air mobility forces to test their abilities against each other, compare tactics and procedures, and exchange ideas. Rodeo 2000 teams competed in several categories: aerial port, aeromedical evacuation, airdrop, air refueling, cargo loading, maintenance, security forces, assault landing, single integrated operations plan, and special tactics.

At right, the C-130 team from Brazil arrives at Pope and—flags flying—lets the flight line know it. USAF's international air mobility partners began competing in Rodeo in 1979. The top international team this year came from Belgium.



USAF photo by MSgt. Steven M. Turner

USAF photo by A1C D. Myles Cullen



Flown by many countries, the C-130 is a seasoned Rodeo competitor. At left, a Turkish maintenance crew stands by while their C-130 is inspected. Below, an Egyptian C-130 prepares to drop US Army paratroopers over a Ft. Bragg, N.C., drop zone.



USAF photo by SrA. Lee E. Rogers

C-130s from the host 43rd Airlift Wing taxi down the runway before loading up paratroopers for a personnel drop at Ft. Bragg, located adjacent to Pope.

Rodeo 2000 commander Maj. Gen. Sivas R. Johnson Jr. noted, "This is the largest air mobility competition the world has ever seen." More than 3,000 people and 79 aircraft participated. The personnel came from 34 active duty, 10 Air National Guard, and 18 Air Force Reserve Command units and eight foreign countries. Thirteen other nations and air forces sent representatives to observe.



USAF photo by SSGT. Jerry Morrison



The venerable C-141 still gets the job done. At right, SSgt. Marcel Rodarte with the 452nd Air Mobility Wing (AFRC), March ARB, Calif., stands ready to taxi a C-141.



USAF photo by MSgt. Steven M. Turner

USAF photos by TSgt. James E. Lotz



Rodeo's aerial refueling competition is judged on aircraft timing and accuracy in navigating to the air refueling track, as well as air refueling operations. At left, KC-135R boom operator SrA. Matt Galloway assists in making the calculations to refuel a C-5. At left below, he refuels the aircraft. Galloway is from the 22nd ARW, McConnell AFB, Kan. Below, the KC-135R prepares to refuel the C-5 from the 60th AMW, Travis AFB, Calif.



A boom operator from Fairchild AFB, Wash., described the aerial refueling challenge: "The only thing we can't do in Rodeo is talk to the pilot on the receiving end," said SSgt. Alicia Judd. "So, sometimes that gets a little tricky as you have to stay connected for 24 minutes."







Aeromedical emergency scenarios in the Rodeo competition require teams to assess and initiate patient care quickly and efficiently. At left, Capt. Angie Cleek of the 156th Aeromedical Evacuation Squadron from Ohio calls out for the next litter to be loaded onto a C-141. Below, "patients" await their turn to participate in the scenario.



This year was the third time Rodeo included an aeromedical evacuation event. However, it was the first time for an aeromedical evacuation obstacle course. At right, 514th AES members from McGuire AFB, N.J., work their way through the low crawl portion of the obstacle course. They are judged on using proper body mechanics and lifting techniques.



A KC-10 from the 60th AMW, Travis AFB, Calif., arrives at Pope. KC-10s took part in events including aerial refueling and cargo loading, where teams were evaluated on preparation, loading and unloading, and mission paperwork.





A C-17 from Altus AFB, Okla., performs an assault landing on a dirt landing strip. Aircraft in this Rodeo event aimed for a smooth, consistent approach to a specific point 250 feet into the touchdown zone and received points for proper speed, smooth approach, and landing without bouncing.

Air transportation specialists SSgt. Wayne Donnelly and SrAs. Kevin Taboada, Timothy Chew, and David Owens, all with the 97th AMW at Altus, exit a C-17 after finishing an engines running off-load. The engine running onload/off-load event demonstrates wartime skills in quick-turn missions flown from deployed locations. This year, instead of teams bringing their own drivers to load Army vehicles onto aircraft, the Army provided drivers, and the competing teams were matched with drivers through a lottery.



More than 100 aircrew umpires judged Rodeo 2000's flying events, and additional chief umpires handled ground events. Belgium, Canada, and the UK provided umpires, too. Umpires MSgt. Keith Claus (at far left and above) and CMSgts. John Wilson and Jerry Parrish complete inspections of a C-5 from the 97th AMW.





A French commando listens to directions from an umpire (right) and receives help with the 40-pound rucksack he carried on the special tactics 10K run. Below, SMSgt. Ralph Humphrey (left) and SSgt. Charles McHarney help SrA. Ron Fripp after he sprained an ankle in the special tactics endurance course.



Rodeo 2000 featured a new competition—special tactics—for combat controllers and pararescuemen. The teams competed in a biathlon, combat obstacle course, parachute employment/assault zone establishment, and the rucksack run. At right, SrA. Lee Raley from the 21st Special Tactics Squadron at Pope gathers his parachute after a High-Altitude Low-Opening jump. In this event, the teams perform a HALO jump, then navigate a four-kilometer compass course, establish a helicopter landing zone, and perform personnel recovery.



"Rodeo turns the focus to teamwork," said Gen. Charles T. Robertson, commander of Air Mobility Command. "It takes everyone—aircrews, aerial porters, maintainers, and security forces—to make up a team." At left, SSgt. Dale Vince Cruz, from the 60th Aircraft Generation Squadron at Travis, enjoys the camaraderie of fellow C-5 ground crew members. Everyone who attends Rodeo is specifically selected by their unit. It's not only a big honor to go but a big responsibility, once they return, to teach what they have learned at the competition.





*TSgt. Chuck McNeill, a C-130 loadmaster from Willow Grove ARS, Pa., prepares to drop a pallet in a drop zone at Ft. Bragg. Crews are scored on joint airdrop inspection and also on low-level route turn points, timing to the drop zone, and accuracy in releasing loads over the drop zone. Success depends on planning and crew coordination between the pilot, loadmaster, and navigator. This element of Rodeo provides valuable joint and combined training: The paratroopers for personnel airdrops come from the Army's 18th Airborne Corps.*



*Above, a drag chute pulls a pallet out of a C-130, and at the right, green smoke marks a drop zone. Enoch Johnson, assault zone manager, observes the action.*



*A C-17 sits on the ramp at Pope, waiting for the next mission at Rodeo. The biennial readiness competition gives air mobility forces an opportunity to showcase their abilities and build relationships with each other. Rodeo commander Johnson called Rodeo 2000 an international demonstration of airpower and told the competing teams, "You have truly demonstrated full force mobility in action." ■*



If the question is whether aerospace power is effective against ground forces, the answer is “yes.”

# True Blue: Behind the Kosovo Numbers Game

By Rebecca Grant

**D**ID NATO airstrikes really hit hundreds of Yugoslav army mobile targets during last year's Kosovo campaign, or was it just a handful? In its May 15, 2000, “The Kosovo Cover-Up” story, *Newsweek* magazine alleged that Air Force investigators working for NATO “suppressed” a report and beefed up claims of successful strikes against Serb army tanks, armored personnel carriers, and artillery during last year's Operation Allied Force.

If the cover-up story sounds too sensational to be true, that is because it is. Air Force and NATO personnel who compiled the study of strike missions in Kosovo not only told the truth, but also put together an impressively detailed account of how NATO turned up the heat on the Yugoslav forces. There was no “suppressed” report—*Newsweek* obtained a working draft of the findings of one part of the Munitions Effectiveness Assessment Team whose mission was to gather information on the effects of various munitions by examining any Serb equipment remaining in Kosovo.

## Airplane vs. Tank

Putting aside the emotional overtones, at issue is a very serious point: Can aerospace power strike effectively against an adversary's ground forces? The answer, according to the NATO data, is “yes.”

Underneath the Kosovo contro-



USAF photo

**They guessed wrong.** Serb armor officers who parked their tanks in this clump of trees mistakenly believed they were well-hidden and safe from NATO air attack. Note that turrets were blown off.





Photo by Gert Kromhout

**Battle-tested.** This F-16 of USAF's 510th Fighter Squadron, based at Aviano AB, Italy, sports mission marks of the Balkan air war. Airmen focused significant attention on mobile targets.

versy is lingering doubt that airplanes can hit tanks, artillery, and other types of vehicles at all. From the technology standpoint, airmen have long since proven they can. Strafing P-47 Thunderbolts chewed up many a German tank in World War II. On one day, Aug. 13, 1944, Lt. Gen. George S. Patton's Third Army reported that supporting XIX Tactical Air Command fighters destroyed 45 German tanks. Aircrews first used laser-guided bombs to strike tanks late in the Vietnam War, specifically in the 1972 airstrikes against the North Vietnamese Easter Offensive. Tank "plinking" became a common sight on television during the 1991 Gulf War when aircraft like the now-retired F-111 put laser spots on Iraqi tanks and destroyed them with 500-lb bombs.

In Kosovo, the whole campaign got off to a slow start. NATO switched from plans for three days of bombing to a sustained campaign designed to inflict retribution on the Yugoslav army and degrade its capabilities. Supreme Allied Commander Gen. Wesley Clark pushed hard for more forces to target the Yugoslav army in Kosovo. But by the time the campaign stepped up, Slobodan Milosevic's forces were dispersed in small knots. Still, by late May, the air war was having an impact on army targets. "What did the trick was the accuracy of the precision weapons, the avoidance of losses, and the increasing destruc-

tion of the Serb forces," said Clark, who was quoted in *The New York Times* on June 5, 1999.

The first cumulative assessment came from a press conference held by Secretary of Defense William Cohen and Chairman of the Joint Chiefs of Staff Gen. Henry H. Shelton on June 10, 1999. Shelton briefed that the damage to fixed targets and to Serb fielded forces was substantial. One of Shelton's charts, widely released, showed a relatively flat tally of mobile targets, then what Shelton described as an "exponential" increase late in the campaign as weather improved and more forces joined in operations over Kosovo. Cohen's and Shelton's estimate raised few questions from the press—until the Serbs fired back.

### Serb General Fires Back

On June 16, the Serbs claimed the NATO numbers were inflated. Serb army Lt. Gen. Nebojsa Pavkovic declared that his forces lost only 13 tanks, six armored personnel carriers, and 27 artillery pieces. Earlier, he also claimed to have shot down 47 NATO planes.

Pavkovic's statements fit smoothly into a Serb media campaign that included ample television pictures of cheerful Serbs withdrawing from Kosovo. Reporters in Kosovo watched columns of 60–80 Serb vehicles, including trucks, cars, and ambulances, forming convoys to head north and extrapolated from this that the Serbs

had not been hit hard. Despite their losses, the whole tone of Milosevic's and Pavkovic's statements put up the facade that the army was not beaten. It was not surprising that the losers wanted to save face and keep their reputations intact, at least in the eyes of fellow Serbs. But it was astonishing that credible media like *The Times* of London reported the Serb 13-tank claim uncritically.

### NATO's Assessment

While the Serbs were pulling out with a smile for the news cameras, NATO was beginning to go back over the campaign results. Clark consistently stressed that "battle damage bean counting" was not the way to measure the full effects of airpower. NATO achieved its aims, so in one sense the number of artillery pieces hit was not the issue, because, evidently, enough had been hit to help pressure Milosevic to give in.

However, with the Serbs boasting that NATO barely touched them, Clark himself, a four-star Army general, wanted to know what the air campaign had or had not done to the Yugoslav army. Professional curiosity most likely played a role. Clark had once been in charge of combat development in the Army's Training and Doctrine Command, and any Army general would want to know about one of the biggest ongoing issues in military doctrine: How and when is air effective against key mobile forces? Clark said he forced air planners to fly more sorties against the Yugoslav armed forces. He now wanted to review the results, and to all appearances, he drove his staff to give him a meticulous study.

In Desert Storm, the bomb damage assessment methodology began with mission reports. Then "pilot reports had to be supported by either an aircraft-generated videotape recording (VTR) [common name is gun camera video] or imagery produced by other sources," according to the April 1992 Department of Defense report. Ground liaison officers reviewed the claims. After the war, the CIA and others used U-2 pictures to count destroyed vehicles.

For Kosovo, the criteria were tougher and the data were better. The study team of 200 people from different nations and services had three big advantages:

- First, the number of missions





**Road kill.** This Serb tank was attacked and knocked out while traveling on a Kosovo road. After the first days of attack, Serb units got out of the open and into hiding places.

was fairly small. About 3,000 strike sorties were flown over Kosovo itself. Of those, just under 2,000 generated instances in which aircrews stated they had hit a mobile target. In comparison, there were over 41,000 airstrikes against Iraqi forces in Kuwait during Operation Desert Storm in 1991.

■ Second, NATO had a wealth of sources that enabled the team to say “yea” or “nay” to the tally in each mission report. The assessment did rely on what Clark described as “very sensitive and classified” sources, like imagery from satellites, aircraft, and unmanned aerial vehicles. Talking in detail about satellite pictures is still taboo in the military. Yet in a world where satellite images can be bought over the Internet, it should come as no surprise that military reconnaissance can produce some very crisp images of equipment on the ground.

■ Third, most of the information was in computer databases. Eight years earlier, in Desert Storm, the tracking was done on paper. Having networked computer data helped make the task of tracking and evaluating damage easier. Data, including video and imagery, could be transferred rapidly from Europe to Washington, for example, to feed into the Joint Staff’s daily summaries that were briefed to the Secretary of Defense and the Chairman. After seeing bomb damage assessments for 78 days, top officials were confident

that air warfare was having an impact.

The Kosovo Strike Assessment, produced under the auspices of an Army general, turned out to be the most complete and careful review of strike data in the history of air warfare. Analysts took each aircrew mission report and checked to see if the strikes claimed could be verified by a source other than the aircrew’s memory. Fifteen different types of second-source confirmation were used in the study. Examples included cockpit video, on-site findings, statements from forward air controllers, intelligence reports, post-strike imagery, and other sources.

### Backup Sources

The mission report was “validated” as a successful strike only if at least one other source corroborated the mission report. To reiterate: Successful strikes had to have two sources—the aircrew mission report and one other source as described above. All validated strikes had at least two sources. Close to half of the validated strikes actually had three or more sources that backed up the verification. In the end, about half of the total mission reports were unable to be confirmed as successful strikes (which does not mean that some of them were not successful—just that they could not be counted under the strict rules).

Taking into account the operational realities of flying in the Kosovo En-

gagement Zone also puts the strike assessment data in context. Attacks against fielded forces were slow to get started. Only a handful of successful strikes occurred in the first 20 days of the campaign. After that, pilots and planners both spent time looking for targets as the Serbs dug in, moved tanks in between buildings, and stopped traveling in the open. NATO also did not have enough aircraft to operate over Kosovo for more than a few hours per day.

Scrolling through the strike assessment data for each day, the successful strikes are so scattered that it appears the totals cannot possibly add up to much. From late March through mid-May, the sortie rates fluctuated and the hits came piecemeal. By April 30, Day 38 of the campaign, NATO had validated strikes on only 11 tanks, 21 APCs, and 34 artillery pieces. But the situation began to change when more aircraft were deployed for Operation Allied Force and as planners found more targets. Pilots also became familiar with the Kosovo Engagement Zone. By the middle of May, weather improved, more aircraft were flying missions, and aircrews were able to find and hit more targets.

Even then, the hit rates came in as steady rain, not a deluge. The greatest number of validated strikes on tanks in any one day was just seven, on May 30. One or two strikes per day was more typical. On some days, no hits are listed at all for any category.

Finally, there were the big days, like May 22, May 30, and most of the days in June, when 30 or 40 or more hits were validated. From May 13, when strikes increased, to the end of May, an average of 18 successful strikes across all categories occurred each day. From June 1 to the end of the air war on June 9, the average was about 28 successful strikes per day. The day-by-day figures actually back up what pilots said: It took time to find and hit the Yugoslav army forces.

What the numbers suggest is an air campaign that started by scratching at the Serb forces but then struck hard in the last three weeks. And, after 78 days, the numbers did add up to enough to help convince Milosevic to quit Kosovo. The credit can be spread among the NATO allies, which were responsible for about 25 percent of the strikes, the US Navy



carrier air wing, for another 25 percent, and the US Air Force, which had the most planes in theater and conducted about 50 percent of the validated strikes.

### Results on the Ground

Still, why didn't the 35-person on-site team find more burned-out hulks? The team visited over 400 sites in Kosovo, examining damage to fixed targets and surveying areas where Yugoslav army forces had been. Although the on-site survey contributed useful evidence, the team arrived in Kosovo too late to compile a definitive assessment.

In a battlefield survey, time is critical. During World War II, when Patton's forces moved in just hours behind coordinated airstrikes, walking the battlefield right after the engagement was the fastest and most accurate way to count up the damage.

In Kosovo, two things were different. First, the quickest way to survey the battlefield was with overhead imagery taken within hours after the airstrikes. That is why the reconnaissance by unmanned aerial vehicles, aircraft, and satellites was so important. Even so, it was a race to get the bomb damage assessment photos before the Serbs moved the equipment damaged by airstrikes. Clearing damaged equipment off the battlefield is standard doctrine for armies everywhere.

Second, the Serbs were long gone before the NATO team hit the ground in Kosovo. The Serbs started with-

The Numbers				
	Tanks/Self-Propelled Guns	Armored Personnel Carriers	Artillery and Mortars	Military Vehicles
Cohen and Shelton (June 1999)	120	220	450	N/A
Serb Military Claims (June 1999)	13	6	27	N/A
NATO (September 1999)	93	153	389	339
Newsweek (May 2000)	14	18	20	N/A

**Wide disparity.** As the chart demonstrates, Newsweek's figures track closely with those issued by the Serb military.

drawing on June 10, after their commanders had dragged out cease-fire talks for several days. NATO wanted the Serbs out within a week but eventually gave the Serbs until June 20 to complete the withdrawal. For the Serbs, this provided them with the opportunity to carry out what they could salvage. They deployed about a hundred heavy equipment transporters to remove tanks. Considering this, it is not surprising that the on-site survey team did not find much when it began work in early July. What is more surprising is that they found any vehicles at all. In fact, of the 26 tanks and self-propelled guns

left behind and found by the survey team, all were catastrophic kills, meaning there was no point in taking them back to garrison for repair.

With this background, NATO's strike assessment stands as reasonable, and perhaps even conservative. In the end, nearly half of the aircrew mission reports were thrown out because they failed to meet the criteria. Multiple strikes and decoys were factored into the count. If a mission report claimed a hit on a vehicle within two nautical miles of another vehicle strike, it was logged as a multiple strike. Several decoys were struck: a total of 25 out of the grand total of 1,102 validated strikes.

### The Losses Hurt

For Milosevic, who had used the Yugoslav army to back up his policies in Kosovo for a decade, the steady losses mattered. "It's no wonder that the Serbs are trying so hard to conceal the damages that NATO did," Clark said at his Sept. 16, 1999, press conference. Clark estimated the Yugoslav army had 350 tanks, 450 armored personnel carriers, and 750 artillery pieces in Kosovo. Over 78 days, NATO airmen scored validated hits on 26 percent of the tanks, 34 percent of the armored personnel carriers, and 47 percent of the artillery pieces.

Journalists want to catch the Pentagon in a "cover-up," but inside the military, the stakes are different. Strike counts matter because the car-



**The hulk that remains.** Members of a NATO survey team converse with local Kosovo residents at surface-to-air missile site destroyed in a NATO air attack.





**Into the fray.** Two F-16CGs of the 555th Fighter Squadron, based at Aviano, go hunting for the Serb armor and other mobile targets during Operation Allied Force.

casses of Yugoslav army tanks are pawns in an ongoing chess match between land force doctrine and aerospace doctrine. Fixed targets aren't on the chessboard—it has been conceded for decades that it takes airpower to hit military and industrial targets deep behind enemy lines. But mobile targets are at the center of combat analysis about the best ways to stop an enemy. If it turned out that the US Air Force, Navy, Marines, and NATO allies hit almost nothing, then land force advocates would be able to say that it really does take soldiers on the ground to impact an enemy army. If NATO airmen got good results, then that stands as more evidence that aerospace power is a very efficient tool. Pentagon planning for areas like advanced munitions depends in part on simulation models that estimate the effectiveness of air attacks on ground forces.

A generation ago, a study like the Kosovo Strike Assessment would never have been attempted, simply because the technology to routinely produce accurate airstrikes and copious pictures of the battlespace barely existed. At the same time, no one would have expected just 3,000 sorties over 78 days to generate so many validated strikes. Many studies of World War II, Korea, and Vietnam analyzed the effect of air interdiction, but they all did it from the standpoint of a cumulative approach, sifting through the operational results achieved over time.

Granular analysis of individual mission reports and equipment struck is a new phenomenon. On the one hand, with such resources, the temptation is to create a benchmark, but this temptation should be resisted. Modeling future warfare would be easy if analysts could plug in 17.5 percent as the magic number needed to slow, stop, or destroy an adversary force. Experience suggests that destroying lead vehicles can disrupt a division on the move and sap its initiative. Cold War doctrine held that inflicting 25 percent attrition made a unit combat ineffective.

### War Isn't Linear

But as NATO leaders were aware, it is dangerous to assume there is a magic number, especially since goals will vary. Clark and others made it plain that they did not believe destroying military equipment could be placed on a linear scale. The Kosovo Strike Assessment was not done to prove a theory that Milosevic would fold if he lost a certain number of vehicles.

Clark's goal in targeting Yugoslav army forces was to put relentless pressure on Milosevic by hitting his army, which was the agent of his will in

Kosovo, along with important fixed targets, like the electricity grid, approved by NATO in Serbia and Kosovo. NATO's strike assessment confirms three things. First, aerospace power is effective against mobile targets, even when they are dispersed. At the same time, the tough challenges are finding the targets in the first place and keeping up enough air coverage of the battlespace to spot and attack forces that try to maneuver. Second, surveillance has progressed to the point where it is possible to track a highly accurate tally of what is being located and hit. This is valuable information as commanders weigh options and evaluate operations that are under way. Third, the campaign should balance fixed strategic targets and mobile targets. One is not effective without the other. Would Milosevic have capitulated with an army that was still intact and free to maneuver around Kosovo wreaking havoc? The corollary to this lesson is that the number of aircraft needed in theater will be driven by what is needed to hunt and strike ground forces.

NATO's Kosovo Strike Assessment was a fair and accurate portrayal of the impact of the air war on Yugoslav army mobile targets. The cover-up allegation just does not hold up. The Serbs did not shoot down 47 aircraft nor did they lose only 13 tanks to the air war.

The roots of the controversy aside, NATO's strike assessment methodology was rigorous and conservative. It made full use of the most sophisticated, timely intelligence sources at hand. Its day-to-day results make sense given the operational environment for the Kosovo airstrikes: scattered effects, then a crescendo in the last weeks.

Finally, the impact on the Yugoslav army matters. Aerospace power is an efficient tool, not just for US joint forces but for operations with allies. NATO airmen who drew the assignment to hunt and strike Milosevic's forces had to do the job the hard way, but they succeeded nonetheless. This is the real lesson behind the numbers. ■

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*Rebecca Grant served as a consultant to the Air Force on the analysis of Operation Allied Force. She is president of IRIS, a research organization in Arlington, Va., and has worked for RAND, the Office of Secretary of the Air Force, and the Chief of Staff of the Air Force. Grant is a fellow of the Eaker Institute for Aerospace Concepts, the public policy and research arm of the Air Force Association's Aerospace Education Foundation.*



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Compiled by Chanel Sartor, Editorial Associate

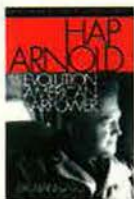
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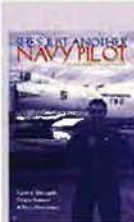
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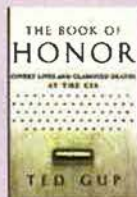


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These families have found an alternative to traditional public education.

# Homeschooling, Air

By Bruce D. Callander



Photo by Paul Kennedy

*Air Force spouse Pam Haseltine teaches her six-year-old daughter, Paula, at home.*



# Force Style

**W**HEN the family lived in California, Pam Haseltine would keep her children indoors until after the school bus went through the neighborhood. She was afraid the neighbors would report them as truants. Haseltine and her husband (a major in the Air Force) had decided to educate the children themselves, and the local school district contended that homeschooling violated the laws on compulsory education.

Today, Haseltine doesn't hide the fact that she homeschools her children. In fact, she has become volunteer director of Bolling Area Home Educators, an association of like-minded parents that is well-received on Bolling AFB, D.C. "This is the only base at which we've been stationed where we have a working relationship with the command," Haseltine said. "They allow us to meet on base and use base facilities without charge."

Angie Toppings, chief of Bolling's community programs, agrees with Haseltine's assessment.

"Bolling is a unique place for Air Force families," she said, "so we do things to meet their unique needs. ... About 1995, I became a liaison for the homeschoolers, and we really started working closely together. Now, we provide information packages to folks being assigned to this area, not promoting homeschooling any more than we would any other option but just making people aware that it is an option."

The BAHE began nine years ago when a homeschooling Navy couple circulated a flyer asking their neighbors if they would be interested in forming a support group. Some 35 people responded and, today, an estimated 100 Bolling families are homeschooling. The support group is open to all comers and includes members from other military installations and civilian communities in

Maryland, Virginia, and the District of Columbia.

## Something Special

Haseltine was a schoolteacher and had planned to put her children into the school where she was teaching. Then, she met a homeschooling couple. "We saw something in that family," she said. "There was a bonding between the parents and the children and among the siblings. We decided we wanted that for our children."

She went on, "We have homeschooled from the beginning. When we move, we check ahead to see if there is a support group on or near the base and try to get in right away. I was involved with one at Vandenberg [AFB, Calif.] that operated under the chapel program. Then, I helped form a group in our church in Illinois. So, when I came out here, I guess they saw me as a good possibility for a director."

BAHE is open to all families who homeschool, whatever the reasons. For the Haseltines, religion is an important issue. "We wanted our children to be raised in our religious beliefs," she said. "I felt I could teach them just as well as a public school, if not better, and they wouldn't be getting somebody else's values."

Some parents say they are worried about violence in public schools. Others question the quality of public education, but they can't afford private schooling.

For military families, there is an added incentive. "The military lifestyle involves moving every two to three years," Toppings said, "and moving from one school system to another to another can be very devastating on the children's social and learning development. So if you choose to homeschool, you're always in control of the curriculum and the environment."

Haseltine underscores this last point.

"As a public school teacher," she said, "I would have a class of 25 students and had to teach to the middle of the class. If I had a slow student and had time after class, I could work with him. If I had students who were faster, I had to give them busy work so they wouldn't become a behavior problem. I knew that many children were falling between the cracks. With homeschooling, if my child understands the concept, we don't have to drum it in 10 million times. Or, if he doesn't grasp it, we can slow down and try from different angles until he gets it."

Despite these attractions, homeschooling is a daunting prospect for many parents. Fortunately, say veteran home educators, there is a wealth of resource material available, much of it offered through the Internet.

## Growing Market

"There are lots of homeschool helps out on the market today," said Haseltine. "Many schools, whether Christian or secular, are realizing that homeschooling is on the rise and they want to tap into that growing market."

Debbie Sanzone, another of Bolling's homeschooling Air Force parents, has a single source for her material. "I use Christian Liberty Academy, which is a private school," she said. "The books I get have been tested in their school. They send us tests that we send back in and we get a report card every quarter. But, sometimes I'll see an interesting book that I think my kids might like this for science or something, and we'll add that to the curriculum we have."

For parents who need more than they can order or download from the Internet, BAHE provides additional aids.

"We have a program called Mentoring Moms," said Haseltine, "where we match veteran homeschoolers with new ones by interest or chil-



dren's ages. The mentor takes the newcomer under her wing at least through her first year."

Nor are homeschooling parents the only teachers their children see. Some parents take turns teaching each other's children, and there are occasional group-learning sessions. Sanzone's son recently took an intensive three-day class in writing. "That was under our group," said Haseltine, "and there are others run by other support groups in Virginia and Maryland."

Being at Bolling also gives homeschoolers some added advantages.

"BAHE is a private organization," said Toppings, "but like the Scouts and some other groups, they have the approval of the base commander. The liaison they have with my office allows them to use base facilities such as the community center, the pool, and the bowling alley. ... This group is very well-organized and needs very little assistance except occasionally to make sure that people understand that they have the right to exist and that what they do is legal."

In addition, the base commander allows the group to put on one fundraiser per year.

Bolling is unusual in its degree of support, but it is not the only base on which one finds active support groups. At Offutt AFB, Neb., for example, there are at least two. "There is a military support group," said Beverly Krueger, a homeschooling parent there, "and I belong to a much larger support group off base that also has many military families."

The Offutt-area parents use base facilities to substitute for some of the group activities their children miss by not attending public schools. "Several years ago," said Krueger, "our athletic program was able to begin using the base's youth center gym for volleyball and basketball programs. We hold our practices and most games at times when the general school-age population is in school, and we pay a yearly fee for the privilege."

No such accommodation is possible in the civilian community. Krueger said, "In Nebraska, homeschoolers are not allowed to participate on public or private school teams if those take part in the Nebraska athletic association."

## Online Ed

In addition to homeschooling her own five children, Krueger operates a nonprofit Web site called Eclectic Homeschool Online. Like many such sites, this one stresses religion but offers a variety of other resources as well. Krueger's husband, Michael, an Air Force major, shares the management of the site.

Krueger says she has never had any problems about homeschooling at Offutt or at Ft. Benjamin Harrison, Ind., an Army post where they began homeschooling. But she said some bases could do a better job of telling newcomers about state regulations and local resources. Many, like Bolling, do provide information packages, but whether they go any further than that appears to vary widely from one installation to another.

In the continental United States, particularly, bases often seem not to consider it their function to become involved with the question. "There are probably many other bases that have families that homeschool their children," said Toppings. "We really have no way of identifying whether they are parts of groups. ... There is no requirement for families to let their leadership know what their private choice is for educating their children. ... It would be like monitoring what faith group you belong to or like monitoring what political party you have. It's really an individual family's private business."

The Department of Defense Education Activity, which monitors schools run by the military, recognizes homeschooling as an option but stops short of encouraging parents to choose it.

DoDEA notes that the agency is responsible for providing free appropriate public education to DoD dependents overseas who are command sponsored and to eligible dependents who reside on a military installation where there is a [state-side] dependent school. However, unless the sponsor enrolls a child in one of the government schools, DoDEA directives state that it has no duty to provide that child with an education.

Homeschoolers should check with their local commander to see if the host country's rules allow this option, DoDEA says. And, since the commander controls access to the

installation, per DoDEA, "The installation commander may require attendance at our [a DoD Dependents Schools] schools, some alternative school approved by DoDDS, or some alternative program acceptable to the commander as a condition of continued command sponsorship."

Although this appears to suggest that homeschoolers may face loss of base privileges, DoDEA spokesperson Gwen Davis said, "We do not know of any commander who has questioned the homeschooling of any children. If the homeschool program is accredited, the grades will be accepted. If the program is not accredited, the DoD school will test the student to ensure that their grade placement is correct."

## Modest Assistance

In fact, the agency offers some assistance to parents who decide to educate their children themselves. DoDEA does not provide homeschool materials; however, DoDEA schools will loan surplus textbooks to parents if those materials would be helpful to the homeschool program. Also, DoDEA has authorized the part-time enrollment of homeschooled students in its schools if that student would otherwise be eligible for space-required enrollment benefits. This lets homeschoolers make up courses they need for college or other reasons.

Overseas bases vary widely in their handling of homeschooling parents. Misawa AB, Japan, provides detailed guidelines to newcomers, including telling them that they must complete a "Release of Liability" and return it to the school liaison office along with a one-page description of the educational curriculum they plan to use. Sponsors also must provide their children's test results annually. Exams from a nationwide testing service are recommended, say the guidelines.

Misawa has a Home Educators Support Group, which circulates these local guidelines, lists activities, and posts newsletters. A similar group serves military families on Guam. Newcomers there are advised of local laws which require that homeschooled children "must be instructed in English in several branches of study required in the public schools for at least three hours per day for 170 days each calendar year."



Support groups are active at Ramstein AB, Germany, and in the Sembach and Kaiserslautern area of Germany. Another serves families at RAFs Mildenhall, Lakenheath, and Feltwell in Britain. There are similar groups in Iceland, Italy, and other areas with military populations.

Sanzone recalls that, when her family was at an Army post in Stuttgart, Germany, she had been told that DoDEA would not be friendly to homeschoolers. That was not her experience, however. "The school there was very receptive in letting homeschoolers come in to take classes. They were not core classes but band, art, computer training, and the German culture class."

The Air Force does not have a headquarters counterpart to Toppings's office at Bolling. However, without endorsing homeschooling as such, USAF does provide some information on the subject through a Web site called Air Force Crossroads ([www.afcrossroads.com](http://www.afcrossroads.com)). The site's section on education recently added information about homeschooling, including links to teaching resources, legal advice, and support groups. Crossroads is careful to note, however, that its listing such groups does not constitute official endorsement.

Governments save money on homeschoolers, but the savings are not passed along to the parents to offset costs of teaching materials, books, and other necessities. "We spend anywhere from \$100 to \$700 per year per child," said Haseltine. "I realize that's probably less than half of what most private schools would charge, but if we want them to go somewhere, we drive them ourselves. It's all out of our pockets."

### Strings Attached

Some homeschooling proponents argue that parents should receive financial help from local school districts and, in the case of military families, from impact aid funding. Others, including Haseltine, see problems with this approach. "It's a touchy point," she said. "Sure, it would be nice to be funded, but, unfortunately, most of the time when you get federal aid, along with the money comes the federal government saying what you can and cannot teach. And the main reason we become homeschoolers in the first

place is so we can make those choices ourselves."

Other homeschoolers share the concern that federal interest will lead to greater control of the program.

President Clinton recently gave his conditional support to homeschooling, but he also raised some warning flags. In May, he said, "I think that states should explicitly acknowledge the option of homeschooling, because it's going to be done anyway. It is done in every state of the country and therefore the best thing to do is to get the homeschoolers organized."

He added, however, that homeschooled children should be required to meet academic standards or face the likelihood of being put in more conventional schools.

His remarks drew fire from a number of homeschool organizations. "I think we are pretty organized," said Michael Farris, president and founder of the Home School Legal Defense Association. "It would seem to me that the last person we would want to be organized by is the government."

As for needing to meet academic standards, Farris said that a 1998 study by Lawrence M. Rudner of the University of Maryland showed that students who are educated at home have consistently scored above the national average in standardized tests.

Many US colleges apparently agree. They not only accept homeschooled students but seem eager to have them. Haseltine said, "I'm getting calls all the time from colleges begging to advertise in our newsletter or to come and speak to our group. They realize the study skills of homeschoolers are far above most public school children and that's what they want. That's not just Christian colleges. It's public universities and state colleges, too."

Several homeschooling Web sites furnish long lists of colleges and universities that accept homeschooled students. The list includes many state universities and the Air Force Academy. The academy's Web site indicates homeschooled students can be as competitive for appointment as any other student.

The Air Force was slow to accept homeschoolers for enlistment as airmen. It placed them in the same category as GED holders and persons with no high school equivalency and accepted only 1 percent of all enlistees from this category.

### Homeschool Trial

In late 1998, however, USAF exempted homeschooled students from the 1 percent cap on a trial basis. The change, said the Air Force, "is part of an Air Force program to permit increased opportunities for homeschoolers to enlist and to determine if their attrition from basic military training is equivalent to traditional high school diploma graduates."

Whatever problems may face them, the homeschoolers seem to agree that their approach is gaining acceptance and will profit from the explosive growth of the Internet and other technologies. Toppings agrees. "I don't like to predict," she said, "but, as you read the national media and listen to TV, I think it would be safe to conclude that our nation feels that educational programs and services are in need of repair and are looking for options, ... everything from homeschools to private schools to charter schools to corporations sponsoring for-profit schools."

Sanzone added, "My husband is finishing his degree through distance learning so he says he homeschools, too. There is more access to everything, including college courses by correspondence. I think more people will be involved with homeschooling and you won't be considered a weirdo if you do it."

At Offutt, Krueger said, "I think the homeschool genie is out of the bottle and putting it back in will be impossible. More and more people are saying, 'These are our kids, not the government's kids. When did the government begin caring more for my kids than I do?' Education policy has drifted too far into turning out good little consumer-producers, ignoring the unique individuality of each child. The goal should be to see each child develop his unique gifts." ■

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*Bruce D. Callander, a regular contributor to Air Force Magazine, served tours of active duty during World War II and the Korean War. In 1952, he joined Air Force Times, serving as editor from 1972 to 1986. His most recent story for Air Force Magazine, "The Recruiting and Retention Problems Continue," appeared in the June 2000 issue.*



Even then, the defoliation missions over Vietnam were controversial.

# Ranch Hand

By Walter J. Boyne

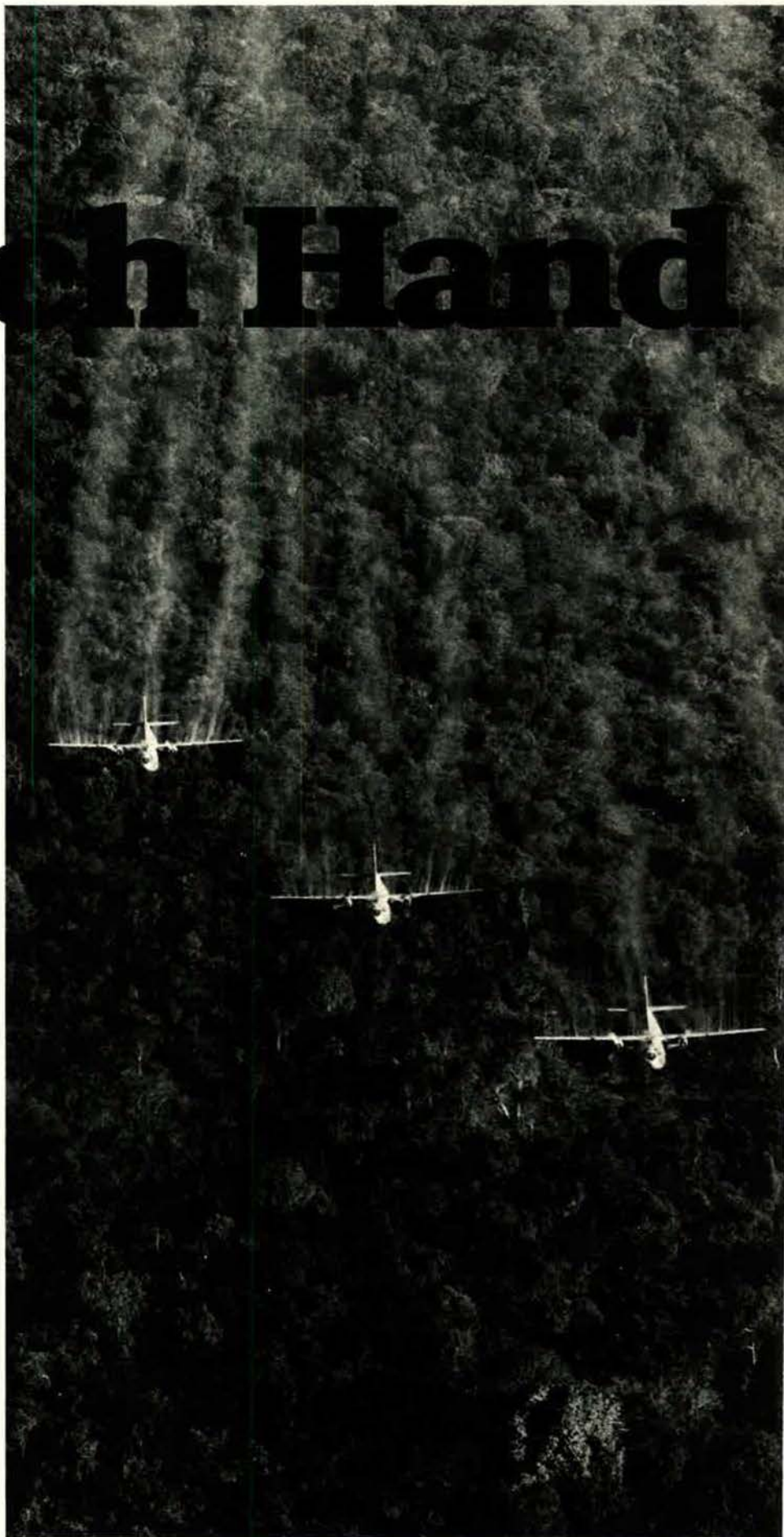
**I**T was an unheralded mission, unfolding over nine long and dangerous years. Even by the standards of the Vietnam War, it was politically sensitive, and national political leaders tended to recoil from discussing it. At its cutting edge were old, unarmed aircraft making low and slow flights, straight into enemy fire.

That is the way it was for the men of Operation Ranch Hand, the Air Force's long-running campaign to defoliate jungles and, in so doing, deprive the Communist forces of concealment cover and food supplies. Ranch Handers had the hot, smelly, and dangerous job of spraying chemical herbicides over large expanses with maximum enemy presence and minimum protection.

They flew their obsolescent UC-123s with abandon, hurling them at times into 60 degree banks at treetop level, taking hits on virtually every mission. Their success could be measured in the fact that they always were in high demand. In fact, Air Force officials never could provide enough crews and airplanes to satisfy the requests of US ground commanders.

They were unsung heroes. Neither those who flew on the missions nor those who supported them have received the credit deserved. The men of Ranch Hand accept this, for they were an unusual breed, regarding anti-aircraft hits and casualties as badges of honor. They were never a spit-and-polish outfit.

The basis for Ranch Hand was simple. Americans fighting in the







field wanted the jungle growth stripped from camp perimeters, lines of communication, and the Ho Chi Minh Trail, to better prevent ambushes by the endless flow of North Vietnamese infiltrators and assisting in their destruction. Under the call sign "Cowboy," Ranch Hand aircraft met these demands day after day by plunging into heavy gunfire over enemy-held terrain. Their hard work saved the lives of many US and South Vietnamese troops.

Statistics give some measure of the effort exerted by the force. Between 1962 and 1971, Ranch Hand operators flew many thousands of sorties and sprayed more than 9,000 square miles of terrain. They delivered some 19 million gallons of herbicide, 11 million of which were Agent Orange, the controversial defoliant that has been the subject of numerous inquiries (see box).

### The Start

The effort was launched in January 1962, with only three airplanes. For most of the campaign, Ranch Hand didn't have more than 20 aircraft and never exceeded 33. Five aircraft were lost in combat (one was on a training mission but presumed lost to ground fire). The Ranch Hand unit was shot at and hit more frequently than any other Air Force unit in the Vietnam War. One survivor—an icon to Ranch Hand veterans—is "Patches," a UC-123K (serial number 56-4362), on display at the Air Force Museum in Ohio. Many metal skin patches cover the damage of many of its 1,000 battle hits.

The Ranch Hand organization had a series of designations. Names ranged from Special Aerial Spray Flight to 12th Air Commando Squadron to 12th Special Operations Squadron to A Flight of the 310th Tactical Airlift Squadron. Whatever the designation, the mission always was flown by air commandos.

Ranch Hand may have lacked glamour, but not danger. Losing an engine on takeoff or when spraying in mountainous areas meant that a crash was a near certainty, unless the overgrossed UC-123 could immediately dump its load. Crew members faced other hazards such as the need to make steep turns at 150 feet altitude in an aircraft with a 110-foot wingspan. Also to be feared were midair collisions with the local fruit bat type,

an enormous creature whose wingspan often extended 5 feet.

Then there were the nighttime Viet Cong mortar attacks, sabotage on the base, and relentless small arms and .50-caliber machine gun fire as a spray run began. It was a mission that could be carried out only by skilled personnel. It generated high morale and genuine camaraderie sustained to this day by some 1,200 Ranch Hand veterans.

During post-World War II years, the Air Force established a Special Aerial Spray Flight for insecticide work, using the C-47 as its basic flight vehicle. SASF became the focus of a series of complementary if unrelated events that decades later would make Ranch Hand possible.

A 1952 engineering study led Hayes Aircraft Corp. to build the MC-1 aerial spray system, which came to be known as "Hourglass." It comprised a 1,000-gallon aluminum tank, a centrifugal pump, control valve, pipes with six spraying nozzles, emergency dumping system, and miscellaneous equipment.

Hayes produced 100 units, but plans for their use were dropped and they went into storage, where they lay untouched and virtually forgotten. Eight years later, an SASF stalwart, Capt. Carl W. Marshall, proposed replacing the C-47s with C-123s, noting that these could be used to dispense insecticides and defoliants. Marshall's search for equipment led to the Hourglass cache, which was well-suited for use in the C-123.

### White House Interest

Meanwhile, Presidential Advisor Walt W. Rostow, a prime advocate of increased US intervention in Southeast Asia, had become interested in using herbicides, perhaps as a result of South Vietnamese President Ngo Dinh Diem's calls for the US to spray Viet Cong crops to deny them food.

From the first, senior US officials were totally aware of the political dangers and the near certainty that American use of herbicides would become a propaganda windfall for the Communists. For that reason, and despite the high level of interest, things would move slowly for a while. US officials, concerned about charges of biological and chemical warfare, were in the grip of extreme caution.



On Nov. 30, 1961, President Kennedy accepted the joint recommendation of the State Department and Pentagon that the US proceed with a limited herbicide effort characterized by discriminate target selection and execution.

In response, Tactical Air Command sent six C-123s to Olmstead AFB, Pa., for required reconfiguration. At Olmstead, the airplanes were equipped with MC-1 tanks and stripped of all unnecessary equipment. They were fitted with an engine oil supply replenishment system. Spray booms were installed along trailing edges of the wing. Later, they went behind the tail.

In early December 1961, with all C-123s having received their planned equipment changes, the aircraft redeployed to Clark AB in the Philippines. The long-distance flight proved the capability of the C-123. On Jan. 7, 1962, three C-123s were deployed to Tan Son Nhut in Vietnam as a part of the 346th Troop Carrier Squadron.

The sensitivity of herbicidal warfare became apparent. Despite urgent pleas from the field, officials debated at length whether the C-123s should be disguised with South Vietnamese insignia and flown by USAF crews in civilian clothes. As the origin of the aircraft could not be denied, this idea was abandoned. Also serving to delay full implementation of the program was the fact that local stocks of herbicide were limited.

The delays disconcerted the Ranch

Hand crew members, all of whom were volunteers. They found themselves quartered in a tent city without much to do, their aircraft parked in the same secure area at Tan Son Nhut that housed President Diem's squadron of fighters commanded by Lt. Col. Nguyen Cao Ky. While Ranch Hand had bosses at many levels—TAC, 2nd Advance Echelon, Military Assistance Advisory Group Vietnam, 13th Air Force, and Pacific Air Forces—it had little supervision. Few at any level of command knew how to execute the mission or how to evaluate its results.

### Self-Taught

Fortunately, Ranch Hand crews knew they had much to learn and much to do. There were no tactical manuals and no doctrine for herbicidal warfare. They knew virtually nothing about how the various types of trees and other vegetation would react to herbicide. Nor did they know the quantity per acre of herbicide that would be required. Maps were few, intelligence was lacking, weather briefings were inaccurate, and no one was sure how to solve the operational problems posed by wind, temperatures, and terrain. Moreover, the prospective degree of enemy opposition was a totally unknown factor.

On Jan. 13, 1962, Marshall formally initiated the Ranch Hand program. He and Capt. William F. Robinson Jr. took off and sprayed along Route 15, flying at 150 feet altitude

and at a speed of 130 knots. Also on board were a flight mechanic, an Army scientist, several observers, and the required Vietnamese "aircraft commander."

The first series of missions went well, as the Ranch Hand crews began teaching themselves their business. The pilot flew with both hands on the yoke, maintaining vertical and horizontal spacing in formation, and controlling the spray pump with a switch. The copilot maintained fore-and-aft spacing, monitored the airspeed and altitude, and stood ready to execute the emergency procedures or to take the controls if the left-seater was injured. An aircraft commander soon became one with the airplane, flying with his eyeballs and the seat of his pants because there was little time to look at the instruments.

The Ranch Hand crews quickly learned the necessity of surprise. To avoid small arms fire, they made their approaches to the target at 3,000 feet altitude. At a precomputed point, the C-123 would enter a steep, 2,500-foot-per-minute dive, pulling out at 150 feet. At that point, the crew would turn on the spray equipment and let it run for about four-and-one-half minutes. If everything worked as planned, the airplane would lay a swath of herbicide 240 feet wide and 8.7 miles long.

Then the C-123 would make a steep climb to get out of the range of ground fire.

Ranch Hand pilots flew missions in formations of two or three ships in the early days and as many as 10 in the latter stages of the program. Some targets required sharp turns, and the turns required the aircraft to stack up in a "piggyback" formation to avoid being run into the ground.

Later, when crop destruction missions were flown, tactics changed. Exposure to enemy fire could last as long as 45 minutes, compared to about eight to 10 minutes on defoliation runs.

Crews soon learned that they had to spray in the early morning, when ground temperatures did not yet exceed 85 degrees. Once the temperatures went higher, the spray would rise rather than drop to earth. Wind also could be a major problem. If its speed exceeded 10 miles per hour, herbicides would be dissipated over an overly large area and have little effect on vegetation.



*Two Ranch Hand C-123s drop to treetop level before spraying jungle foliage. Ranch Hand crews developed special tactics to avoid ground fire, a constant threat since they had to fly slowly and close to the ground for these missions.*





At Tan Son Nhut AB, South Vietnam, in 1965, USAF TSgt. Henry E. Heath (in hat) and a South Vietnamese soldier rush to reload a Ranch Hand C-123. Their loading hose was attached to a high-speed mixing tank.

### Colored Drums

Ranch Hand used common agricultural chemicals widely used within the United States. These herbicides were shipped to Vietnam in distinctive color-coded drums. This was the origin of the names “Agent Orange,” “Agent Blue,” “Agent White,” and so forth. Despite popular belief to the contrary, Agent Orange did not create an orange-tinged haze when delivered.

The correct amount of coverage was about three gallons of herbicide per acre. The first signs of leaf kill could be seen in as little as four days. A definite color change would take place within two weeks. After two to four months, a sprayed area would appear barren. Forward Air Controllers said vertical visibility improved by as much as 70 percent, permitting them to keep much closer tabs on enemy activity.

As the self-training process went on, so did the evaluation at the highest levels, with Secretary of Defense Robert McNamara monitoring operations and constantly inquiring as to the effect that the defoliants had on both vegetation and operations.

On Feb. 2, 1962, the Air Force lost its first aircraft in Vietnam. It was a Ranch Hand C-123, flown by Capt. Fergus C. Groves II, Capt. Robert D. Larson, and SSgt. Milo B. Coghill. All three died in a still-unexplained crash near Route 15. Soon, Ranch Hand suffered its second loss, in a landing accident. The crew survived,

however, and the tempo of spraying operations began to pick up.

All military evaluations of Ranch Hand were positive, and demands for defoliation missions increased as the number of US forces steadily grew. Perimeter areas of fortified camps were studded with mines and barbed wire, but the quick regrowth of jungle vegetation allowed easy infiltration by the Viet Cong. To the US soldiers in the camps, aerial spraying was life insurance, pure and simple, for both offensive and defensive missions.

Ranch Hand would increase its flexibility by expanding operations from its main base—at first it was Tan Son Nhut and then Bien Hoa. Units also flew from Da Nang, Phan Rang, and Nha Trang. The specialized mountainous terrain missions were flown out of Da Nang by crews sent on temporary duty for two weeks at a time.

As the United States committed more and more of its resources to the Vietnam War, worry about the program increased. Protests caused the top leaders to exercise even more authority over target selection and approval. Extremely rigid controls were established, with the result that many months elapsed between the time a province chief or a field commander made a request for a defoliation mission and the date of execution.

Then suddenly, almost offhandedly, Washington stepped aside, granting

approval authority to Saigon. Approval for even the most sensitive of the missions, crop destruction, now was in the hands of the new US ambassador, Maxwell D. Taylor, and the commander of Military Assistance Command, Vietnam, Gen. William C. Westmoreland. Eventually, the time between request and mission execution was reduced to about 75 days.

Ranch Hand crews were sent to Vietnam on temporary duty, and this became the preferred practice for years. The temporary duty process was vital for training. When the Ranch Hand crews rotated back to the United States—first to Langley AFB, Va., and later to Hurlburt Field, Fla.—they brought with them the latest information on how to execute the mission. After spending a short period training new crews, veteran personnel would go back to South Vietnam for another tour. Many of crews accumulated several hundred combat missions, and the store of knowledge they built up turned Ranch Hand into a superbly disciplined unit in the air.

### Fighter Support

As the Ranch Hand unit improved its capability, the Viet Cong improved their defenses. By late 1963, Ranch Handers saw a marked increase in ground fire. Fighter escorts became an absolute necessity. In April 1964, Maj. Gen. Joseph H. Moore, commander of 2nd Air Division, launched an experimental mission to test the effectiveness of fighter support—in this case four South Vietnamese air force A-1 fighters and four VNAF T-28s. The target was a canal south of Tan Son Nhut, a site of Communist anti-aircraft activity.

Two Ranch Hand aircraft flew down the canal. Capt. Charles Hagerty was in the lead airplane on the left. Capt. Eugene D. Stammer was in command of the No. 2 airplane on the right. Intense .50-caliber machine gun fire riddled Hagerty’s airplane, knocking out one engine. Feathering the propeller and dumping his load of herbicide, Hagerty climbed through another burst that tore up the cockpit. The VNAF airplanes attacked the machine gun sites as Hagerty limped to an emergency landing at Soc Trang. His airplane had taken more than 40 hits.

Ranch Hand crews adapted to in-



creasing ground fire with a variety of new tactics, including approaching the target at an altitude of 20 feet and popping up for the spray run. They took maximum advantage of terrain to mask the approach and chose alternative targets so that intense gun fire in one area would simply divert the C-123s to another target. The C-123's limited single engine capability forced them to plan all flights in mountainous areas so that the runs were made downhill. Even so, missions in areas such as the A Shau Valley were so dangerous that losing an engine usually meant losing the aircraft.

As the war heated up, spray missions always flew with a FAC and with a fighter escort. Targets were analyzed, and meetings were held with the fighter unit to assess the expected level of danger. Some "hot" targets had to be softened up with napalm, cannons, and cluster bombs. On other occasions, the fighters waited until they saw anti-aircraft fire before beginning their suppression runs. Guns were usually visible first to the crews of the spray airplanes. They would drop smoke grenades to mark the place of origin on dangerous ground fire.

### In Demand

The demand for missions grew swiftly by 1965 as the complement of Providers (now designated UC-123) grew to seven. The Ranch Hand ground crews had learned to reduce

turnaround times between sorties to about 10 minutes, allowing aircrews to fly as many as six sorties in three hours with two aircraft.



**MSgt. James C. Kafferly (center), a flight line supervisor, inspects a Ranch Hand aircraft for damage, in this case a hole ripped open by a .50-caliber bullet.**

## Agents of Controversy

Critics of the use of herbicides were vocal during the Vietnam War and again when questions were raised in this country about the effects of the ominously named Agent Orange. The debate still rages.

US forces used 10 different herbicides in Southeast Asia, most of them variants of 2,4-D (D for dichlorophenoxyacetic acid) or 2,4,5-T (T for trichlorophenoxyacetic acid). Others included sodium salt of cacodylic acid and triisopropanolamine salt of picloram.

The names "Pink," "Green," "Purple," "Blue," "Orange," and so on came from the 4-inch-wide band painted on the 55-gallon drums containing the herbicide. The herbicide contained in orange-striped drums came to be called "Agent Orange." A 50-50 solution of 2,4-D and 2,4,5-T, it was the most widely used of the herbicides and gained the most notoriety.

All of the herbicides used in Southeast Asia had been used in commercial agriculture for many years. As an example, in the United States in 1961, about 40 million acres were treated with 2,4-D and 2,4,5-T herbicides.

Among the many myths about herbicide spraying was that forest areas were "drenched" with spray that "soaked" clothing of those on the ground. In actual practice, the dispensation of three gallons of herbicide per acre is the equivalent of about .009 of an ounce per square foot. In most instances, only about 6 percent of the sprayed material reached the ground, the rest being absorbed by the jungle foliage. Drenching and soaking did not occur.

Dioxin was present in Agent Orange, but only as a trace amount—.0002 of 1 percent, and this amount was degradable by sunlight within 72 hours.

Over the past 18 years, Ranch Hand veterans have participated in a \$120 million epidemiological study—the Air Force Health Study, commonly called the Ranch Hand Study. The participants received physical exams in 1982, 1985, 1987, 1992, and 1997. The final physical exams are scheduled for 2002. Although Ranch Hand personnel naturally had the greatest degree and frequency of contact with the herbicides, physical examinations at the Kelsey-Seybold clinic in Houston and the Scripps Clinic and Research Foundation in La Jolla, Calif., reveal that the mortality rate of the group is the same as a matched comparison group (Air Force veterans who flew in C-130s in Southeast Asia during the Ranch Hand time frame) and significantly lower than the rate for the male population of the United States. The number of birth defects among children of Ranch Hand veterans is the same as the children of the comparison group.

The testing of Ranch Hand veterans will conclude in 2006, at which time a report will be prepared.

As Ranch Hand operations expanded, Hanoi, Beijing, Moscow, and anti-war groups in the United States all launched propaganda barrages. They claimed the US was engaged in wholesale elimination of forests and blamed the US for an assortment of human ills, which were demonstrably false, but the charges had a curious reverse effect. The Viet Cong evidently believed the propaganda and often fled, and even surrendered, during the early period of herbicide application.

Though protests continued, Ranch Hand missions increased swiftly, and more aircraft were added to the unit. In May 1964, Ranch Hand flew only 20 sorties. In May 1966 it flew 244. Other missions were laid on. These included spraying the Ho Chi Minh Trail in Laos, conducting insect control in Thailand, and carrying cargo.

USAF made primitive attempts to improve crew safety. The efforts included installation of additional cockpit armor and new helmets with visors to guard against glass and



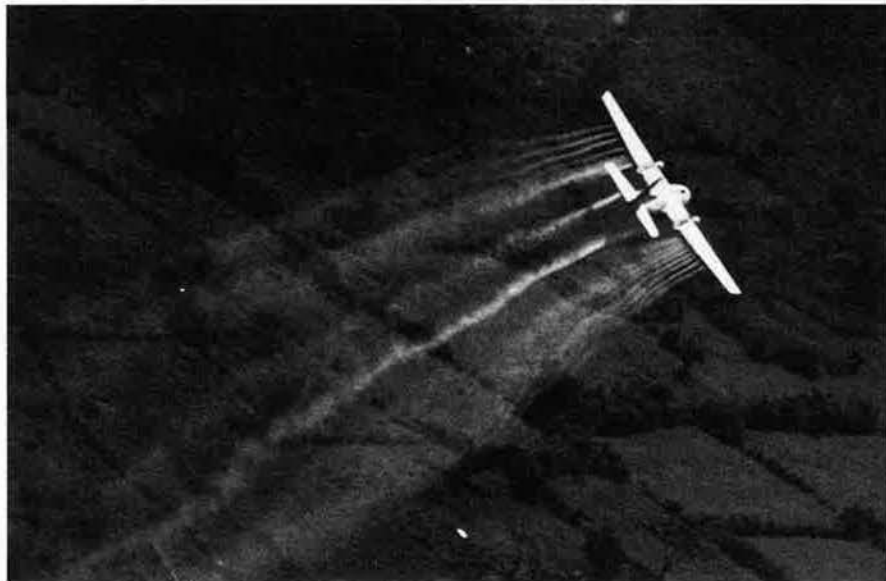
Plexiglas splinters. Crews wore and sometimes sat upon flak jackets. USAF built an armor-plated box for the flight mechanic in the cargo hold.

The first known combat loss of a Ranch Hand aircraft took place on June 20, 1966. Two UC-123s were making multiple passes on a target in Quang Tin province. Both were hit on each of the first four passes, but they pressed on for a fifth spray run. On the fifth pass, heavy machine-gun fire shot an engine out on the aircraft of Lt. Paul L. Clanton. The aircraft crashed, trapping Clanton in the burning wreckage. He was saved by the efforts of his crew—Lt. Steve Aigner and SSgt. Elijah R. Winstead. As the escort fighters bombed and strafed the Viet Cong, Winstead used his personal weapon to provide covering fire. A Marine assault team of six helicopters rescued them.

The Ranch Hand workload increased in direct proportion to the increase in American activity in Vietnam. When, in time, the US began to leave Vietnam, the number of missions declined. Arranging a mission was still a bureaucratic nightmare, with many US and South Vietnamese agencies involved, but Ranch Hand crews always had plenty of targets.

In December 1966, the Ranch Hand operation moved its headquarters to Bien Hoa, where the ramp was less crowded, and a special "herbicide farm" was set up to speed the turnaround process. This greatly increased USAF's capability but at a cost of higher casualties.

Continuous exposure to danger transformed some Ranch Hand crewmen into adrenalin junkies. When required to perform routine cargo duties, as during the 1968 Tet Offensive, they quickly became bored and longed to get back to the spraying operation. As an indication of the degree of difference in hazard, the Ranch Hand unit averaged a hit every six missions when flying spray missions. During the almost 3,000 cargo missions they flew during Tet, they received only one hit.



**A C-123 sprays jungle growth and thickets in South Vietnam. Forward Air Controllers said vertical visibility improved as much as 70 percent as a result of Ranch Hand defoliation missions.**

### Joy of Jets

In early 1968, UC-123K versions of the Provider began to arrive. The new model had a more powerful GE jet engine mounted under each wing, anti-skid braking, improved armor, a better pumping system, and numerous other refinements. The extra power was used on take off, the climb outs afterward, and of course during emergency conditions. The offsets to the increased power were increased weight and higher fuel consumption, both gladly accepted by the Ranch Hand crews, in exchange for the blessed power of the jets. The new airplanes were not invulnerable, however, and a UC-123K was lost on May 24, 1968.

However, the value of the jet engines was indisputable. This was proven dramatically on Dec. 13, 1968. On that date, Lt. Col. Winthrop W. Wildman was hammered by automatic weapons fire while leading a six-airplane formation north of Bien Hoa. His airplane rolled rapidly to the left. Only by applying full left rudder and full right aileron, with his right jet engine at idle and his left jet at full power, was Wildman able to herd the UC-123K back to Bien Hoa where they landed

safely after a risky approach. Without jet engines, they would have crashed.

The years 1968 and 1969 saw a continued high level of activity. Crews had become highly proficient in their tasks, and spraying, whether defoliating or destroying crops, was as routine as it could be for airplanes that were still flying at 130 knots, 150 feet off the ground, in the face of gunfire.

Even so, political support for the program was rapidly disappearing as a result of continual political protests at home and abroad. As the US involvement in Vietnam wound down, so did Ranch Hand missions—from an average of 400 sorties per month in 1969 to only 43 in the last quarter of 1970. By then, the handwriting was on the wall. Ranch Hand was going to shut down, even though the demand of local commanders was as high as ever. The Defense Department "temporarily" halted all spraying of one particular herbicide, Agent Orange, in April 1970. That ban was never lifted, despite protests from the military.

The program was phased out over the next year as the amount of spraying declined dramatically and the number of Ranch Hand aircraft dwindled without replacement. The men of Ranch Hand flew their final three herbicide missions on Jan. 7, 1971—nine years to the day after arrival of the first spray airplane at Tan Son Nhut. ■

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*Walter J. Boyne, former director of the National Air and Space Museum in Washington, is a retired Air Force colonel and author. He has written more than 400 articles about aviation topics and 29 books, the most recent of which is Beyond the Horizons: The Lockheed Story. His most recent article for Air Force Magazine, "The Forgotten War," appeared in the June 2000 issue.*



# Congressional **Veterans'** **Affairs** Establishment

An Air Force Magazine Directory (Members arranged by seniority in committee)

## Senate Committee on Veterans' Affairs

### Republicans



**Arlen Specter**  
Chair  
Pennsylvania



**Strom Thurmond**  
South Carolina



**Frank H. Murkowski**  
Alaska



**James M. Jeffords**  
Vermont



**Ben Nighthorse  
Campbell**  
Colorado



**Larry Craig**  
Idaho



**Tim Hutchinson**  
Arkansas

### Democrats



**John D. Rockefeller IV**  
Ranking Minority Member  
West Virginia



**Bob Graham**  
Florida



**Daniel K. Akaka**  
Hawaii



**Paul Wellstone**  
Minnesota



**Patty Murray**  
Washington



# House Committee on Veterans' Affairs

## Republicans



**Bob Stump**  
Chair  
Arizona



**Chris Smith**  
New Jersey



**Mike Bilirakis**  
Florida



**Floyd D. Spence**  
South Carolina



**Terry Everett**  
Alabama



**Steve Buyer**  
Indiana



**Jack Quinn**  
New York



**Cliff Stearns**  
Florida



**Jerry Moran**  
Kansas



**J.D. Hayworth**  
Arizona



**Helen Chenoweth-Hage**  
Idaho



**Ray LaHood**  
Illinois



**James V. Hansen**  
Utah



**Howard "Buck" McKeon**  
California



**Jim Gibbons**  
Nevada



**Michael Simpson**  
Idaho



**Richard Baker**  
Louisiana



## Democrats



**Lane Evans**  
Ranking Minority Member  
Illinois



**Bob Filner**  
California



**Luis V. Gutierrez**  
Illinois



**Corrine Brown**  
Florida



**Mike Doyle**  
Pennsylvania



**Collin C. Peterson**  
Minnesota



**Julia Carson**  
Indiana



**Silvestre Reyes**  
Texas



**Vic Snyder**  
Arkansas



**Ciro Rodriguez**  
Texas



**Ronnie Shows**  
Mississippi



**Shelley Berkley**  
Nevada



**Baron Hill**  
Indiana



**Tom Udall**  
New Mexico





# AFA Nominees for 2000-01

**A**t a meeting May 27, 2000, in Colorado Springs, Colo., the Air Force Association Nominating Committee selected a slate of candidates for the four national officer positions and the six elective positions on the Board of Directors. This slate will be presented to the delegates at the National Convention in Washington, D.C., in September.

The Nominating Committee consists of the five most recent past National Presidents (not serving as Chairman of the Board) and one representative from each of the 14 US regions.

Nominated for National President was **John J. Politi** of Sedalia, Mo. He is a business consultant and President of the Excellence in Missouri

Foundation. Politi is a 1997 recipient of the Governor's Quality Leadership Award and is on the Malcolm Baldrige National Quality Award Board of Examiners. In AFA, he currently serves as a National Director, Chairman of the Membership Committee, and member of the Executive and Resolutions Committees. He is also the Vice President, Leadership Development, for Missouri State AFA.

Politi graduated from Central High School in Valley Stream, N.Y., and from the University of Colorado at Boulder, with a major in political science. He also earned a master's degree in economics from South Dakota State University and completed the Advanced Executive Management Program at Texas A&M University.

He was commissioned into the Air Force through the ROTC program in March 1966. Politi retired from the Air Force as a colonel after 26 years of service, the majority of which was spent in strategic nuclear weapons systems. His assignments included air division, wing, and group command, as well



as major air command and Air Staff duties.

Politi has served as National Vice President for the Midwest Region, Missouri State President and Treasurer, Chairman of the Audit Committee and the Ad Hoc Financial Committee, and a member of the Membership Committee and Credentials Committee. He has received AFA's Medal of Merit, Exceptional

and Chairman of the National Air Force Salute Foundation, an organization set up by the chapter to support Air Force-oriented charities, which raised and donated over \$2 million since its inception.

Among his many awards, McKee has received New York State AFA's Exceptional Service Citation, AFA's Exceptional Service Award, and AFA's Presidential Citation. He has

customer relations for the Northrop Grumman Corp.

McKee earned a bachelor of arts degree in political science from Southeast Missouri State University and completed the Emerging Executives Program at Pennsylvania State University in 1983.

In addition, McKee is a Trustee on the following boards: Air Force Memorial Foundation in Arlington,



Politi



McKee



Hendrickson



Nelson

Service Award, and Presidential Citation.

He is married to the former Terri Hatch and has five children, Pam, Eileen, Jay, Stephanie, and Chip.

**Thomas J. McKee** of Fairfax Station, Va., an aerospace industry executive and former Air Force pilot, was nominated for National Chairman of the Board. He was elected National President of the Air Force Association during its 1998 National Convention and recently completed his second one-year term in office.

McKee had served as Chairman of the Board of the Aerospace Education Foundation, AFA's educational affiliate, and is a past President of the foundation. He has also served as an Under-40 National Director, AFA National Secretary, Chairman of both AFA's Resolutions Committee and Industrial Associate Task Force, and as a member of its Executive and Communications Committees.

At the grass-roots level, he has been an active member of AFA's Iron Gate Chapter, located in New York City, previously serving as Chapter Vice President, President,

twice been designated an AEF Doolittle Fellow in recognition of his seven years as Chairman of the National Air Force Salute Committee.

As an Air Force dependent, McKee traveled extensively and was later commissioned into the United States Air Force through Officer Training School. After earning his pilot wings at Reese AFB, Tex., he served as a T-38 instructor pilot and check pilot at Williams AFB, Ariz., and subsequently transferred to Tactical Air Command where he flew the A-7D Corsair II while assigned to Myrtle Beach AFB, S.C. After seven years of service, he separated from the Air Force and began a career in the defense industry.

McKee joined the Grumman Aerospace Corp. in Bethpage, N.Y., as a customer requirements representative for Air Force programs. He later became the Director of Air Force Requirements and was subsequently transferred to Grumman's Washington Operations and elected a Corporate Vice President by the Board of Directors. When Grumman Corp. was acquired by Northrop in 1994, McKee became responsible for executive-branch (defense and nondefense)

Va.; Falcon Foundation at the United States Air Force Academy in Colorado Springs; and the College of Aeronautics in New York City. He is a Charter Sustaining Life Member of the Aerospace Education Foundation and a Life Member of AFA.

He is married to the former Patricia Rizzuto from Midland Park, N.J., and they have three children, Michelle, Catherine, and Thomas Jr.

Nominated for National Secretary was **Daniel C. Hendrickson** of Layton, Utah. He is the Minuteman Chief Systems Engineer for Boeing and in 1996 was named ICBM Engineer of the Year for the company. In AFA he is a National Director and member of the Resolutions and Executive Committees.

Hendrickson was born in Upland, Calif., and graduated from Chaffey High School in Ontario, Calif. He received his bachelor of science degree in mathematics with honors from California State Polytechnic University in 1967. He later received a master's degree in business administration from California State University at Fullerton.

After receiving his undergraduate





Craig



Trost



Rader



Vasina



Kemp



Patterson

degree, Hendrickson joined Autometrics, formerly a division of Rockwell International and now a division of Boeing. In this position he developed inertial guidance equations and computer programs for the Minuteman III ICBM. Since then he has accepted increasingly more complex and responsible assignments related to the engineering, scientific, and business aspects of ICBM guidance. To better employ his expertise with the Air Force customer he relocated to Utah in 1975. He has held positions in engineering management, program management, and program development. He co-authored a 1995 book entitled *A Brief History of Minuteman Guidance and Control*.

In AFA Hendrickson has served as National Vice President for the Rocky Mountain Region, Chairman of the Membership and Credentials Committees, and Utah State and Chapter President. He has received two Presidential Citations, the Medal of Merit and the Exceptional Service Award. He has also been honored as a Jimmy Doolittle Fellow in the Aerospace Education Foundation where he serves as a member of the Public Awareness and Development Committees. He was elected a National Director in 1997 and selected to serve on the Executive Committee in 1999.

He and his wife, Judy, have a son, Paul, who is an AFROTC student at Tulane University in New Orleans.

**Charles A. "Chuck" Nelson** of Sioux Falls, S.D., was nominated as

National Treasurer. Nelson was born in Sioux Falls and received a bachelor of science degree in business administration from the University of South Dakota in 1983 and became a certified public accountant in 1985.

Nelson enlisted in the South Dakota Air National Guard in 1980, was commissioned as a second lieutenant in 1984, and retired from the South Dakota ANG at the grade of major in 1995.

A Life Member of AFA, Nelson has served as North Central Region President, covering Montana, North Dakota, South Dakota, Minnesota, and Wisconsin, South Dakota State President, and Dacotah Chapter President. Nationally, he has been active since 1989 while serving on the Junior Officer Advisory Council, Air National Guard Council, Membership Committee, Finance Committee, and as an Under-40 National Director, and most recently as Chairman of the Audit Committee. He received AFA's Medal of Merit in both 1991 and 1998.

Nelson is currently President of the Gloria Dei Lutheran Church and has previously served as their Treasurer and Chairman of the Board of Administration. He also serves as Secretary and Treasurer of the South Dakota Air Show, Inc. He is married to the former Kristine Christensen, and they have three daughters, Rebecca, Jillian, and Sarah.

The six people whose photographs appear on this page are nominees for the six elected Directorships for the

coming year. Five are nominees from their respective regions and are to be ratified by the delegates to the convention.

**John E. Craig II**, Virginia (Central East Region). Former Virginia State President; President of the Donald W. Steele Sr. Memorial Chapter. Currently Central East Region President.

**Arthur F. Trost**, California (Far West Region). Former National Vice President, Far West Region; California State President; President of the Golden Gate Chapter. Currently California AFA Chairman of the Board and member of the Finance Committee.

**Coleman Rader Jr.**, Minnesota (North Central Region). Former Minnesota State Vice President; President of the General E.W. Rawlings Chapter. Currently Minnesota State President.

**Howard R. Vasina**, Colorado (Rocky Mountain Region). Former Colorado State President; President of the Colorado Springs/Lance P. Sijan Chapter. Life Member of AFA.

**Thomas J. Kemp**, Texas (Texoma Region). Former Texas State President; President of the Fort Worth Chapter. Currently Texoma Region President. Life Member of AFA.

The sixth person is the nominee to be elected at large.

**Robert E. Patterson**, Florida (At Large). Former Florida State President; President of the Eglin Chapter. Currently Eglin Chapter Vice President for Programming. Life Member of AFA. ■



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# This Is AFA

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Information regarding AFA activity within a particular state may be obtained from the president of the region in which the state is located.



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Delaware, District of Columbia, Maryland, Virginia, West Virginia

John E. Craig II  
947 28th St. S.  
Arlington, VA 22202-2442  
(202) 863-2306



**Far West Region**  
California, Guam, Hawaii

Rich Taubinger  
12 Century Ct.  
Roseville, CA 95678-1088  
(916) 771-3639



**Florida Region**  
Florida, Puerto Rico

David R. Cummock  
2890 Borman Ct.  
Daytona Beach, FL 32124-6846  
(904) 760-7142



**Great Lakes Region**  
Indiana, Kentucky, Michigan, Ohio

W. Ron Goerges  
4201 W. Enon Rd.  
Fairborn, OH 45324-9412  
(937) 429-6070, ext. 102



**Midwest Region**  
Illinois, Iowa, Kansas, Missouri, Nebraska

Robert M. Williams  
6014 Country Club Oaks Pl.  
Omaha, NE 68152-2009  
(402) 572-7655



**New England Region**  
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

Eugene M. D'Andrea  
P.O. Box 8674  
Warwick, RI 02888-0599  
(401) 461-4559



**North Central Region**  
Minnesota, Montana, North Dakota, South Dakota, Wisconsin

Charles A. Nelson  
517 S. Minnesota Ave.  
Sioux Falls, SD 57105-1717  
(605) 336-1988



**Northeast Region**  
New Jersey, New York, Pennsylvania

Raymond "Bud" Hamman  
9439 Outlook Ave.  
Philadelphia, PA 19114-2147  
(215) 677-0957



**Northwest Region**  
Alaska, Idaho, Oregon, Washington

Barbara M. Brooks-Lacy  
7315 N. Curtis Ave.  
Portland, OR 97217-1222  
(503) 283-4541



**Rocky Mountain Region**  
Colorado, Utah, Wyoming

Boyd Anderson  
1120 Canyon Rd., Apt. 15  
Ogden, UT 84404-7649  
(801) 621-2839



**South Central Region**  
Alabama, Arkansas, Louisiana, Mississippi, Tennessee

Billy M. Boyd  
LSI Bldg. 268  
166 Liberty St.  
Columbus AFB, MS 39710-2001  
(662) 434-2644



**Southeast Region**  
Georgia, North Carolina, South Carolina

Zack E. Osborne  
306 Lake Front Dr.  
Warner Robins, GA 31088-8064  
(912) 929-3384



**Southwest Region**  
Arizona, Nevada, New Mexico

Scotty Wetzel  
628 Via Linda Ct.  
Las Vegas, NV 89144-1501  
(702) 362-1767



**Texoma Region**  
Oklahoma, Texas

Thomas J. Kemp  
3608 Kimberly Ln.  
Fort Worth, TX 76133-2147  
(817) 695-7644



**Special Assistant Pacific**

Gary L. McClain  
Komazawa Garden House D-309  
1-2-33 Komazawa  
Setagaya-ku, Tokyo 154-0012  
Japan  
81-3-3405-1512



**Special Assistant Europe**

Frank M. Swords  
PSC 3, Box 1469  
APO AE 09021-1466  
011-49-6308-7237

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# AFA / AEF National Report

By Frances McKenney, Assistant Managing Editor

## AFA, Air University Create Spaatz Award

Air University at Maxwell AFB, Ala., and the Air Force Association have created an award named for Gen. Carl A. Spaatz, first Chief of Staff of the independent Air Force. It will be presented annually to the Air Command and Staff College graduate who writes the best paper on advocacy of Air Force aerospace power.

The winner will also receive \$5,000 from AFA's Aerospace Education Foundation. The new presentation is sponsored by AFA, which will provide an award bearing the likeness of Spaatz, to remain on permanent display at Maxwell, as well as miniature versions to be given to each annual winner.

The award was created in cooperation with Air University, which oversees Air Command and Staff College and other major Air Force professional military education schools.

About 600 USAF captains and majors will attend ACSC this school year. The award seeks to stimulate thought and writing on Air Force aerospace power. It is also a means to honor Spaatz, a legendary World War II leader, strategic thinker, and AFA chairman of the board (1950-51).

### Outreach in Europe

AFA National President Thomas J. McKee traveled to Europe in May to gain firsthand knowledge of US Air Forces in Europe operations and to touch base with AFA's European chapters. He also presented the charter for a new chapter in Germany—**Charlemagne Chapter**.

McKee began at USAFE headquarters, Ramstein AB, Germany, where he met with Gen. Gregory S. Martin, USAFE commander, and Lt. Gen. Charles R. Holland, USAFE vice commander, and received briefings on the command, the host 86th Airlift Wing at Ramstein, implementation of the Aerospace Expeditionary Force concept, the Department of Defense Dependent School System, and personnel issues.

He went on to visit Europe's largest computer simulation organization, the Warrior Preparation Center, located at nearby Einsiedlerhof and



*On a stop at Spangdahlem AB, Germany, AFA National President Thomas McKee (right) greets SSgt. Jason Harrell of the 81st Fighter Squadron. McKee spent two weeks in Germany, Italy, and the UK, meeting with AFA chapters and listening to the concerns of airmen.*

jointly operated by USAFE and US Army Europe. The **Lufbery-Campbell Chapter** hosted a luncheon at the center.

McKee talked with troops at the USAFE NCO Academy and Lancstuhl Regional Medical Center and was introduced to German business and community leaders at a reception hosted by Martin.

### Spangdahlem Chapter

After a trip to Stuttgart for the US European Command change of command, McKee headed to Spangdahlem AB, where he addressed senior leaders of the 52nd Fighter Wing at a wing staff meeting.

He stopped in at base facilities, including the 606th Air Control Squadron and the civil engineering heavy equipment compound, where he spoke to the "Dirt Boys," as the personnel are nicknamed. At the 81st Fighter Squadron, McKee met A-10 pilots and maintainers and learned from a crew chief about the challenges of maintaining the "Warthog."

All ranks from across the wing attended the **Spangdahlem Chapter's**

luncheon for McKee, reported Capt. Jamie A. Maki, chapter vice president. The chapter members were especially interested in McKee's remarks on the Air Force Memorial. "He went into detail on what the memorial means to each of us," said Maki.

McKee met with members of the supply squadron on base before heading to Bitburg Annex. There he spoke to a class at the William H. Pitsenbarger Airman Leadership School and fielded questions.

### Charlemagne Chapter

Geilenkirchen AB, Germany, is a NATO Airborne Warning and Control System base, with 3,000 military and civilian personnel from 12 NATO nations. The town is 40 miles west of Köln, near the Netherlands border.

At the base, McKee met with Lt. Col. Kenneth R. Koehler, US national support unit commander and a chapter member, then called on German Brig. Gen. Klaus-Peter Stieglitz, commander of the NATO Airborne Early Warning Force E-3A Component. They spent an hour chatting after they discovered they'd gone through

USAF photo by A1C Kimberlie Drews





pilot training at about the same time in Texas, McKee at Reese AFB and Stieglitz at Sheppard AFB.

At an awards luncheon for the combined Regional Headquarters Allied Forces North Europe and NATO AWACS Component, McKee spoke about AFA and presented Capt. Joseph Price with the charter to AFA's newest chapter, the **Charlemagne Chapter**. Included in the ceremony were Capt. Thomas M. Cooper, chapter vice president, and TSgt. Gwllis J. Nicholson, chapter treasurer.

The reality of USAFE's high op-tempo hit home when it turned out more than half of the award nominees and most of the winners named at the luncheon were on temporary duty or deployed.

Before leaving the base, McKee toured an E-3A, receiving a briefing from crew members. They included pilot Cooper and weapons directors Capt. John R. Oberst, who is chapter vice president for membership, and Capt. Timothy L. Brester, a chapter member.

### Buon Giorno!

Breakfast with the **Dolomiti (Italy) Chapter** was the first order of business at Aviano AB.

Chapter President Capt. Eric J. Bjurstrom, Vice President 2nd Lt. David J. Wheelock, communications VP Terry J. Hamrick Jr., Maj. John F. Caudill II, and TSgt. Steven C. Hamer were among those who joined the group at a dining facility on the flight line.

McKee then attended the change of command ceremony for Lt. Gen. Michael C. Short, who retired after a 35-year Air Force career. Short relinquished command of Allied Air Forces South, NATO, and 16th Air Force to Lt. Gen. Ronald E. Keys.

In the next few days, McKee learned about USAF operations at Aviano and in Vicenza. Wheelock and chapter member Capt. John W. Jurgensen Jr. accompanied him to the Balkans Combined Air Operations Center and other stops in Vicenza.

During his time in Italy, McKee renewed ties with AFA's Italian coun-



USAF photo by S/A. Tony R. Telley

*At RAF Lakenheath, UK, AFA National President McKee was escorted through an engine shop by CMSgt. Duane Mackay, 48th CRS. Behind them are Lt. Col. Rhett Taylor, 48th Logistics Group, with Patricia McKee, and Capt. Camille Juenke and CMSgt. Michael Limric, both from the 48th CRS.*

terpart, the Association Arma Aeronautica. AAA leaders and several members had visited AFA headquarters last October.

### United Kingdom Chapter

Two days in the UK began with **United Kingdom Chapter** President Capt. Christopher J. Urdzik escorting McKee to RAF Lakenheath.

The next morning kicked off with breakfast with airmen and NCOs at an RAF Mildenhall dining facility, followed by a 3rd Air Force mission briefing and base tour.

The chapter hosted a luncheon at RAF Mildenhall's Galaxy Club. According to chapter vice president for communications, TSgt. Mary McHale, McKee spoke about the Air Force budget, forging relationships with the defense industry, and the value of AFA's grassroots membership.

Back at RAF Lakenheath, McKee visited several units, including the 48th Medical Group, commanded by chapter member Col. Cynthia A. Terri-berry, and the 48th Logistics Group, commanded by chapter member Col. David T. Nakayama.

Lufbery-Campbell Chapter member Col. Allan Swaim escorted McKee throughout his two weeks in Europe.

### 600 Hot Dogs and Burgers

The **Gen. B.A. Schriever Los Angeles Chapter** held a cookout on Los Angeles AFB on a Friday lunch hour in June that resulted in an "unequaled chapter membership drive success," according to James L. Grogan, chapter president.

Col. Wesley A. Ballenger Jr.—who shared chairmanship of the cookout with Robert G. Peterson—led a team of chefs, including Robert H. Krump and Lt. Col. Norman R. Albert, that grilled more than 600 hot dogs and hamburgers in two hours, feeding about 300 people.

Edwin W.A. Peura pitched the AFA shirts, caps, and brochures to the crowd, while G. Wesley Clark earned the nickname "Barker Bill" for his enthusiastic promotion of AFA membership to those in line.

Grogan said they extended the cookout to accommodate people who arrived after working out at the nearby gym during the lunch hour.





**Sheila Padlo (left), a nominee for AEF's regional teacher of the year, and Melinda Kelley, who won the honor in 1998, spoke to a Virginia state AFA meeting about aerospace activities in their classrooms. Both are Leigh Wade Chapter members.**

The chapter gained 29 new members, a life member, and a Community Partner from this event, he said.

#### Fighters of the Future

A native of Vietnam who is headed for The Citadel on an Air Force ROTC scholarship this fall won an essay contest sponsored by the **Worcester (Mass.) Chapter**.

Le T. Nguyen wrote the winning entry, entitled "Drones: Fighters of the Future." A senior at Shrewsbury High School in Shrewsbury, Mass., Nguyen received an AFA Citation and a \$100 savings bond from Lt. Col. Scott R. Liard, chapter president, at a school ceremony in June.

This was the first time the chapter sponsored the contest and had promoted it by sending posters—seeking essays on the value of US airpower, past, present, or future—to more than 60 high schools.

Liard, who was the AFROTC de-

tachment commander at Worcester Polytechnic Institute until July, headed the chapter committee that sifted through the entries. Other committee members were Donald B. Warmuth, chapter vice president; Maj. Peter Poon, secretary; and Cheryl Kristant, treasurer.

#### Of Vermont Granite

A bench of Vermont granite now sits near a stand of birch trees in the Vermont Veterans Memorial Cemetery in Randolph Center, Vt., thanks to a year-long effort by the **Burlington Chapter**.

Eugene M. D'Andrea, region president (New England Region), joined Erwin R. Waibel, chapter president; John Roach, vice president; A.E. "Gene" Eardensohn, treasurer; and about 50 guests at a dedication for the bench on May 4. Rabbi Ben Wall led the group in prayer.

Before the ceremony, the guests

had lunch at Vermont Technical College, located next to the cemetery. Joe Lumbr, supervisor of the cemetery and now a chapter member, spoke to the gathering about the cemetery's history. It is Vermont's first state-operated veterans cemetery and was dedicated in 1993.

Commenting on the site selected for the bench, which bears the words "Air Force Association," Waibel said, "This peaceful hillside, surrounded by sugar maples, birch trees, stone walls, and dairy cows, says Vermont in a perfect way."

#### Convention in South Carolina

The **Ladewig-Shine Memorial (S.C.) Chapter** hosted the South Carolina State Convention in Myrtle Beach in May, with Lt. Col. John Stauffer as guest speaker.

Assigned to the Pentagon as a strategic planner, Stauffer spoke about USAF in the Gulf War and Allied Force and its key role in future military operations.

Convention activities for the 125 attendees included national, regional, and state AFA updates on Friday morning, followed by a golf tournament that afternoon and a shooting match at a local pistol range.

The high point of the convention, wrote State President Guy Everson, was Saturday morning, when representatives from all of the Air Force elements in the state—Shaw AFB, Charleston AFB, McEntire ANGB, and AFROTC units at Clemson University, University of South Carolina, and The Citadel—presented briefings on their activities during the past year. It became clear that South Carolina makes significant contributions to national defense, Everson said.

The **Swamp Fox Chapter** was named Chapter of the Year at the convention, and chapter member Charles W. "Tony" Myers was named Outstanding Member of the Year.

#### Convention in Mississippi

Retired Lt. Gen. John C. "Clark" Griffith served as keynote speaker at the Mississippi State Convention, hosted by the **John C. Stennis Chapter** in Biloxi, Miss., in June.

During his 35-year career, Griffith was a fighter pilot, with 280 combat missions in Vietnam, and commanded several units, including a numbered Air Force and the Joint Task Force in Southwest Asia. He retired in 1998. Griffith spoke about the rules of war, as they apply to the "rules of life," according to State President Gerald E. Smith.

### AFA Conventions

Aug. 11-13	<b>Georgia State Convention</b> , Robins AFB, Ga.
Aug. 11-13	<b>Indiana State Convention</b> , Indianapolis
Aug. 18	<b>Michigan State Convention</b> , Mount Pleasant, Mich.
Aug. 18-19	<b>Alabama State Convention</b> , Birmingham, Ala.
Aug. 18-19	<b>Colorado State Convention</b> , Aurora, Colo.
Aug. 18-20	<b>Virginia State Convention</b> , Roanoke, Va.
Aug. 25-26	<b>Illinois State Convention</b> , Springfield, Ill.
Sept. 8-13	<b>AFA National Convention</b> , Washington
Sept. 16-17	<b>Delaware State Convention</b> , Dover, Del.
Sept. 29-Oct. 1	<b>New Hampshire State Convention</b> , Portsmouth, N.H.



In awards presentations that followed, Lt. Col. Richard W. Davis, commander of the AFROTC detachment at the University of Southern Mississippi in Hattiesburg, was named as an AFA Medal of Merit recipient. Other award winners: TSgt. Kimberly R. VanGorder from Keesler, Airman of the Year; SMSgt. Johnny F. McKinney of the ANG Combat Readiness Training Center in Gulfport, Air National Guardsman of the Year; 1st Lt. Robert A. Poncet from the 403rd Wing (AFRC) at Keesler, Reservist of the Year; Sondra Caillavet from Michel Junior High School in Biloxi, Teacher of the Year; Michael A. Provencher from Mississippi State University, AFROTC and also Civil Air Patrol Cadet of the Year; Sophie Cullotta, also from Mississippi State, Silver Wings scholarship recipient; and Francie Pruett, AFJROTC Cadet of the Year.

Smith was re-elected state president, with Patrick R. Ray as secretary and Gene Neal Patton as treasurer. All are from the **Jackson Chapter**. Ronald J. Vaughan of the **Golden Triangle Chapter** will be vice president.

#### Convention in Arkansas

At the Arkansas State Convention, luncheon keynote speaker Brig. Gen. Craig R. McKinley, deputy director of the Air National Guard, and ANG leaders in the state drew media attention through a symposium on the role of the Guard. The convention was hosted by the **Razorback Chapter** in Fort Smith in June.

Col. Philip R. Bunch, commander of the 188th Fighter Wing (ANG) at Fort Smith MAP and a Razorback Chapter member, told the symposium audience his wing would receive 17 F-16Cs this fall, replacing its F-16As and Bs. The announcement rated a major headline in the local newspaper.

Other mission briefings at the symposium were given by Col. Riley P. Porter, vice commander of the 189th Airlift Wing (ANG), Little Rock AFB; Lt. Col. William E. Stanton, commander of the 123rd Intelligence Squadron at Little Rock and a **David D. Terry Jr. Chapter** member; and Lt. Col. Calvin Huneycutt, director of operations for the 223rd Combat Communications Squadron in Hot Springs. State President John L. Burrow served as moderator.

McKinley provided follow-up information on the briefings. He was joined by Maj. Gen. Don C. Morrow, the adjutant general of Arkansas and a Terry Chapter member, and Brig. Gen. Andrew J. Thompson, state ANG commander.



*Capt. Vida Beard flips burgers at a highly successful membership drive cookout for the Gen. B.A. Schriever Los Angeles Chapter at Los Angeles AFB. (See "600 Hot Dogs and Burgers," p. 97.)*

At the convention business meeting, Jerry Reichenbach from the Terry Chapter was elected state president. Serving with him will be Paul W. Bixby of the Razorback Chapter, treasurer, and Marleen E. Eddlemon, from the Terry Chapter, secretary.

#### Spotlight on Space

The **Lincoln (Neb.) Chapter** co-sponsored Air and Space Day 2000 activities at the University of Nebraska-Lincoln, the Air National Guard facility at Lincoln MAP, and the Strategic Air Command Museum in Ashland, Neb.

According to Robert S. Selzer, chapter vice president for communications, more than 2,000 attended the two days of events, about double the number that attended the first Air and Space Day last year.

Astronaut candidate Clayton C. Anderson, who considers Ashland his hometown, spoke about growing up in small-town Nebraska, his career with NASA's space shuttle program, and the importance of education. Other speakers who joined him in presentations at all three locations were Lockheed engineer Kent Burns, from Palmdale, Calif., who talked about development of the SR-71 reconnaissance aircraft, and engineer Ron Landis, from the Johnson Space

Center in Houston, who described working in Russia on the International Space Station project. NASA aerospace education specialist Pam Christol, from the Johnson Space Center, conducted workshops for students and teachers.

At the ANG base, visitors toured a KC-135 displayed by the 155th Air Refueling Wing (ANG).

The university set up astronomy exhibits and programs in various departments, observatories, and the Mueller Planetarium. The planetarium's photos and description of the two days' activities is on the Web at <http://www.space.laser.com/astroday2000.html>. The site displays AFA's and AEF's logos in a sponsors section.

From the **Central Florida Chapter**, Richard A. Ortega and Barbara Walters-Phillips, a chapter member and the 1995 recipient of AEF's Christa McAuliffe Memorial Award for Teachers, helped a seventh-grade science class at Chain of Lakes Middle School in Orlando, Fla., plan a special project as part of the worldwide celebration of Space Day on May 4.

The students in Nancy Bridge's class built model rockets from plastic bottles, with nosecones and stabilizing fins of styrofoam. According to Ortega, who visited the class, the



## Postal Service Considers Doolittle Stamp

The US Postal Service notified AFA in June that its Citizens' Stamp Advisory Committee is considering the idea of issuing a commemorative postage stamp honoring Jimmy Doolittle.

AFA and AEF had joined the Doolittle Raiders—surviving members of the group led by Doolittle on the first airstrike against the Japanese homeland in April 1942—in seeking to have a postage stamp issued to honor the World War II hero, who was also one of AFA's 12 founders and its first National President.

According to a letter AFA received from Terrence W. McCaffrey, manager, stamp development, the committee is working on stamp programs for 2002. McCaffrey told AFA it would be three years after that before a stamp—if it is approved—would be issued.

rocket bottles were partially filled with water, and a bicycle pump added air to the container. The students pulled a string to release the pressure, launching their models into the air. One rocket reached an altitude of nearly 50 meters.

The mayor of Colonial Heights, Va., declared May as Space Month to honor Melinda D. Kelley, **Leigh Wade (Va.) Chapter's** 1996 and 1998 Teacher of the Year and the Regional Teacher of the Year in 1998.

Kelley joined Sheila T. Padlo, a current nominee for Region Teacher of the Year, as guest speaker for the Virginia state quarterly meeting held in Petersburg, Va. The two teachers from Colonial Heights Middle School, who are both chapter members, set up displays on their work and spoke about aerospace activities they have incorporated into their classrooms and after-school programs.

During the quarterly meeting, presided over by State President Thomas G. Shepherd and Chapter President Glen E. Thompson, representatives from 10 state chapters and national directors Charles G. Durazo and Mary Anne Thompson, also listened to an overview of Leigh Wade Chapter's aerospace activities in the past five years.

George Aguirre received a citation as Chapter Member of the Year. He and Glen Thompson and David S. Lutz, from the **William A. Jones III Chapter** received certificates of appreciation. Shepherd presented An-

drew H. Heath with two awards, while Mary Anne Thompson received four and a proclamation from the chapter. In addition, the chapter's 19 Community Partners were honored.

### More AFA/AEF News

■ The **Alamo (Tex.) Chapter's** Armed Forces Week Breakfast featured Harry C. Stonecipher, Boeing president and chief operating officer, as guest speaker. Gen. Lloyd W. Newton, then commander of Air Education and Training Command, made the formal introduction to the audience of more than 300 at the Gateway Club at Lackland AFB, Tex. Stonecipher received an Alcalde (honorary mayor) Award from San Antonio Mayor Howard W. Peak, while Newton received an AFA Citation. It recognized his exceptional service to AFA and USAF. Thomas J. Kemp, region president (Texoma Region), and C.N. "Buster" Horlen, state president, made the presentation.

■ Armed Forces Day activities at Misawa AB, Japan, included the **Miss Veedol Chapter's** 3rd annual Armed Forces Day golf tournament. Bernice Pezoulas, chapter fund-raising chair, organized the event, held at the Gosser Memorial Golf Center on base. Col. (sel.) Daniel R. Kirkpatrick, who is a chapter member, and Maj. Jeff Calder shared first place. Chapter President Maj. Steven W. Herman reported that the tournament raised \$500 in support of education and recognition programs.

■ Air Force Secretary F. Whitten Peters spoke at a luncheon sponsored by the **Harry S. Truman (Mo.) Chapter** and a local chapter of the Business Executives for National Security. The Truman Chapter works closely with AFJROTC units in the area and invited Lee's Summit North High School from Lee's Summit, Mo., to provide a color guard for the Kansas City event. The four students who performed were thrilled to meet Peters. Chapter President Rodney G. Horton said, "Their enthusiasm on returning to school has had a very positive effect in promoting AFJROTC among their peers."

■ Also in Missouri, the **Earl D. Clark Jr. Chapter** helped host a visit to Whiteman AFB, Mo., by 30 students from Camdenton High School in Camdenton, Mo. Chapter member Capt. Scott Hannan served as tour guide for the students who were participating in a School-to-Work program and wanted to visit an Air Force base while considering career options. The students visited the Oscar-01 Min-

uteman II ICBM Launch Control Facility, a weapons load trainer facility, and a B-2 bomber and B-2 combat training facility. Chapter member John D. Miller, also Missouri state vice president, organized the field trip.

■ Undersecretary of the Air Force Carol A. DiBattiste spoke at a luncheon at St. Joseph's University in Philadelphia. She was in town both to visit JROTC units and for the luncheon, sponsored by the 318th Recruiting Squadron of New Cumberland, Pa. In her speech, she covered Air Force enlistment and retention goals. A large AFA contingent at the luncheon included Raymond "Bud" Hamman, region president (Northeast Region); Eugene B. Goldenberg, Pennsylvania state president; **Liberty Bell (Pa.) Chapter** President Robert Bender and seven chapter members; and **Brandywine Chapter** President Stephen Rudloff and Chapter Treasurer Joseph Dougherty.

■ In the western part of state, Lee Niehaus of the **Total Force (Pa.) Chapter** presented Community Partner William A. Bittner, president of the Tri State Federal Credit Union in Midland, Pa., with a new year medalion for his Community Partner plaque. Other chapter Community Partners who recently added medallions to their plaques were Randy Gran and Fran Soczik.

■ **Richard W. Asbury (Ill.) Chapter** members manned a booth at the 21st Century Veterans Fair in Davenport, Iowa, in May. The day-long event was billed as the first of its kind for the quad-cities area on the Illinois-Iowa border. It featured presentations by USAF Col. Mark C. Lee, a veteran of three spaceflights, and Joseph C. "Charlie" Plumb, a former Navy F-4 pilot who was a POW in North Vietnam for more than five years. Information sessions at the fair covered such topics as veterans benefits, women veterans, and veterans health care. Richard W. Asbury, William C. Vickery, Benjamin H. Hunter, and Willard A. Branch were among the chapter volunteers at the AFA booth.

■ The **Carl Vinson Memorial (Ga.) Chapter** members honored Michael R. Osborne as AEF's Regional Teacher of the Year for the Southeast Region. Osborne teaches third-graders at Robins Elementary School at Robins AFB, Ga., and was selected on the basis of his involvement in the school's Young Astronaut program, after-school science club, and science-oriented activities organized for his students. At the school's recognition ceremony, held at a local golf



club, Zack E. Osborne, region president (Southeast Region), presented the award. National Directors Dan Callahan and Jack H. Steed, State President Robert E. Largent, AEF Trustee Victoria W. Hunnicutt, and Chapter Vice President Arthur D. Bosshart attended the event.

■ William D. Croom Jr., AFA national secretary, was guest speaker at a **Cape Fear (N.C.) Chapter's** quarterly meeting. Among those turning out for the event were James E. "Red" Smith, national director emeritus and a **Scott Berkeley (N.C.) Chapter** member, and the North Carolina State Secretary William W. Michael, from the **Pope (N.C.) Chapter**. Also this spring, Cape Fear Chapter President Jacob N. Shepherd was a guest speaker at a dining-out for the AFJROTC cadets at Emsley A. Laney High School in Wilmington, N.C., and at the school's Senior Awards Ceremony presented a \$1,000

scholarship to AFJROTC cadet Jason Girard.

■ Eight JROTC teams—including a Navy unit—competed in the **Delaware Galaxy Chapter's** sixth annual Delaware Eagle Drill Competition, held at Dover AFB, Del., in April. The cadets competed in the categories of knockout drill, regulation drills, color guard, and inspection. The Navy unit, from Christiana High School, Newark, Del., was overall winner for the fourth consecutive year.

■ Ted Eaton, national director, and Richard W. Hoerle and Warren Motts, both of the **Capt. Eddie Rickenbacker Memorial (Ohio) Chapter**, dedicated a replica of Rickenbacker's boyhood home in June at Groveport, Ohio. Volunteers built the replica on the grounds of Motts Military Museum. Rickenbacker, the leading American ace of World War I (with 26 victories), was born in Columbus, Ohio, in 1890. ■

## New Membership Directory: Next Phase

Production of the 2001 edition of the *Air Force Association Membership Directory* continues on to the next phase: In August, the Bernard C. Harris Publishing Co. begins phoning AFA members to confirm the information they provided or to ask those who didn't respond to earlier mailings if they want to be included in the directory.

The new directory will be the most comprehensive source of information ever compiled on AFA's more than 155,000 members. Delivery date is February 2001.

To confirm information for the directory or to order a copy, phone 1-800-249-5235.

## Unit Reunions

reunions@afa.org

**4th FIW**, Korea (1950-54). Sept. 21-24, 2000, at the Marriott St. Louis West in St. Louis. **Contact:** Andrew Whipple, PO Box 20996, Bradenton, FL 34204-0996 (941-739-6947) (andrewwhipple@aol.com).

**5th AF** (WWII and Korea). Sept. 13-17, 2000, in Springfield/Branson, MO. Units include the 314th Composite Wg and Hq squadron, 5th Bomber Command, 5th/108th Station Hospital, 80th Service Gp, 405th Signal Co, and 502nd Tactical Control Gp. **Contacts:** Louis J. Buddo, PO Box 270362, St. Louis, MO 63127 (314-487-8128, 314th Composite Wg and 5th Bomber Command) or Jeff H. Seabock, PO Box 3635, Hickory, NC 28603 (828-324-6464, 5th/108th Station Hospital).

**12th TFW**, 12th BG. Sept. 17-22, 2000, at the Hotel San Remo Casino & Resort in Las Vegas. **Contact:** Wilbur Anderson (12th TFW), 270 Airport Rd., Pikeville, NC 27863 (919-736-3711) or Mary Bushnell (12th BG), 1000 Ferndale St. S., Maplewood, MN 55119 (661-739-0051).

**26th Air Division (Defense)**, Long Island, NY (1948-58). Sept. 15-17, 2000, in Pierre, SD. **Contact:** Chuck Doran, 5258 Pitcairn Rd., Huber Heights, OH 45424 (937-236-0081).

**29th FIS**, Malmstrom AFB, MT. Oct. 29-31, 2000, at The Menger Hotel in San Antonio. **Contact:** Tommy Manley, 19906 Encino Cove, San Antonio, TX 78259 (210-497-2481).

**38th BG Assn** (WWII), including all squadrons and associates. Oct. 3-5, 2000, at the Imperial Palace Hotel and Casino in Las Vegas. **Contact:** Harry E. Terrell, 20475 Upper Bay Dr., Newport Beach, CA 92660-0741 (949-852-8015).

**39th FS Assn**, including 40th and 41st FSs, 35th FG, Fifth AF. Oct. 18-22, 2000, at the Holiday Inn Old Town in Scottsdale, AZ. **Contact:** Henry Chick, 7734 N. Hummingbird Ln., Paradise Valley, AZ 85253 (480-948-6025) (chickhenry@az.rmci.net).

**59th FIS**, Otis AFB, MA; Goose Bay, Canada; and Thule AB, Greenland (1950-66). April 18-22, 2001, in Fort Walton Beach, FL. **Contacts:**

Donald Schipke (937-426-1852) (schipke@erinet.com) or Larry Ellgass (706-692-4325) (fasu@mindspring.com).

**85th Aircraft Maintenance Repair Sq**, Erding, Germany (1951-54). Oct. 19-21, 2000, in Hot Springs, AR. **Contacts:** Arnold Vadney, 908 Stirrup Pl., Jacksonville, AR 72076 (501-982-5675) or Jesse Humphreys, 1556 Hobson Ave., Hot Springs, AR 71913 (501-622-2524).

**89th Troop Carrier Gp** and squadrons and 807th Air Base Gp, Bergstrom Field, TX (WWII). Sept. 7-10, 2000, at the Holiday Inn Conference Center in Fairborn, OH. **Contact:** David A. Turner, 120 Tulip Ln., Dayton, OH 45432-3820 (937-252-4586) (d1920@aol.com).

**95th BW**, Biggs AFB, TX. Oct. 26-Nov. 3, 2000, at the Radisson Downtown Market Square in San Antonio. **Contact:** Al Lebsack (804-476-7640) (bicycle@gcronline.com).

**100th ARS**, Pease AFB, NH. Sept. 22-24, 2000. **Contacts:** Stan Klepper (864-972-2520) or Leo Mackey (603-436-1157).

**199th FIS/TFS**, Hawaii ANG. Feb. 24, 2001, at the Hickam AFB, HI, Officers Club. **Contact:** (http://sites.netscape.net/aekopilots/Homepage.index.html).

**312th BG Assn**. Sept. 28-Oct. 1, 2000, at the Holiday Inn North in Dayton, OH. **Contact:** John T. Happy, PO Box 848, Haines City, FL 33845 (863-439-2223) (jthappy@juno.com).

**315th BW Assn**, Northwest Field, Guam. Sept. 13-17, 2000, at the Holiday Inn Hotel and Convention Centre in Omaha, NE. **Contact:** Beverly Green (217) 893-3197.

**320th BG**, North Africa, Sardinia, and southern France. Aug. 27-29, 2000, at the Drawbridge Estates in Fort Mitchell, KY. **Contact:** Ralph Wolff, 4095-A Palm Beach Cir., West Palm Beach, FL 33406-4088 (561-686-9075) (woolfdn@aol.com).

**366th FG Assn**, including members from WWII,

NATO, Gunfighters, Desert Storm, and 366th FW. Oct. 11-15, 2000, in San Antonio. **Contact:** John France, 2301 St. Claire Dr., Arlington, TX 76012 (817-860-2780) (luv2fly@flash.net).

**368th FG**, Ninth AF (WWII). Oct. 12-15, 2000, at the Radisson Plaza Hotel Lexington in Lexington, KY. **Contact:** Randolph Goulding, 2000 Clearview Ave. NE, Atlanta, GA 30340 (phone: 770-455-8555 or fax: 770-455-7391).

**391st BG**. Oct. 5-9, 2000, at the Doubletree Hotel Omaha Downtown in Omaha, NE. **Contacts:** Wendell Fetters, 2001 Condolea Dr., Leawood, KS 66209 (913-491-1611) (waffe2@aol.com) or Bob Holliday, 525 McNeilly Rd., Pittsburgh, PA 15226 (412-561-7620) (haps80@aol.com).

**436th FS**, 479th FG, Eighth AF (WWII). Oct. 22-25, 2000, at the Best Western Oak Hills in San Antonio. **Contact:** Travis Greenwood, 4506 Navajo Path, Austin, TX 78745-1520 (512-442-7134).

**474th Fighter-Bomber Gp** and squadrons, Kunsan, South Korea. Sept. 6-8, 2000, at the Holiday Inn Conference Center in Fairborn, OH. **Contacts:** David Day (318-688-5073) or Bill Oliphant (865-525-7948) (billolly@juno.com).

**487th BG**. Aug. 30-Sept. 2, 2000, at the Radisson Hotel Old Towne Alexandria in Alexandria, VA. **Contact:** Bernard Nolan, 2121 Jamieson Ave., Alexandria, VA 22314 (703-567-1882) (bt Nolan@aol.com).

**525th FIS**, Ramstein AB, Germany. Sept. 15-17, 2000, in Banner Elk, NC. **Contact:** Dick Rhyne (828-387-4356) (rhynefly@aol.com).

**648th AC&W Sq**. Sept. 16, 2000, in Pittston, PA. **Contacts:** B. Wall, 528 Ridgewood Dr., Northfield, NJ 08225 (wallmbw@bellatlantic.net) or T. Palischak (apalis@ptd.net).

**932nd Airlift Wg**, current and former members. Sept. 8-10, 2000, at Scott AFB, Ill. **Contacts:** Terry Rupp (618-229-7200) or CMSgt. Kris McManus (618-229-7225).



## Unit Reunions

**Air Commando Assn.** Oct. 5-9, 2000, in Fort Walton Beach, FL. **Contact:** Rip Kirby, PO Box 7, Mary Esther, FL 32569-0007 (850-581-0099) (heynav@aircommando.net).

**AF Photomapping Assn.** Oct. 4-7, 2000, at the Residence Inn by Marriott in Vancouver, WA. **Contacts:** Bob and Liz Cross, 4407 NE 51st St., Vancouver, WA 98661 (360-695-8732).

**AFROTC** graduates of the University of Northern Colorado (formerly Colorado State College). Sept. 28-Oct. 1, 2000, in Greeley, CO. **Contacts:** Rex Schweers, 5601 W. 18th St., #31, Greeley, CO 80634 (970-330-3481) or UNC Alumni Assn., 501 20th St., Greeley, CO 80639-0008 (phone: 970-351-2551 or fax: 970-351-2553).

**Aviation Cadets.** Nov. 8-11, 2000, in Branson, MO. **Contact:** Aviation Cadet Museum, Inc., 542 Country Rd. 2073, Eureka Springs, AR 72632 (501-253-5008) (www.aviationcadet.com).

**Aviation Cadet Class 50-B.** Oct. 19-21, 2000, in Arlington, TX. **Contact:** Richard K. Chambers, 1414 Canadian Cir., Grand Prairie, TX 75050 (phone: 972-647-1008 or fax: 972-606-4561) (rkc1928@aol.com).

**Ellington Navigators Class 50-F.** Nov. 29-Dec. 2, 2000, at the Radisson Hotel & Conference Center Hobby Airport in Houston. **Contacts:** Roy Pitrucha (713-667-4746) or Van Keriakos (703-404-0530).

**Forward Air Controllers.** Sept. 21-24, 2000, at the Ramada Plaza Beach Resort in Fort Walton

Beach, FL. **Contact:** Frank Gray (850-939-8396) (www.fac.aerix.com).

**Newark AFB, OH, Aerospace Guidance & Metrology Center.** Aug. 5-6, 2000, in Heath, OH. **Contact:** Earl T. Bodem (etbodem@newarkafb.org) (www.newarkafb.org).

**P-51 Mustang Pilots Assn.** Oct. 15-19, 2000, at the Doubletree Hotel at Red Park in Tucson, AZ. **Contact:** Robert Blackwood, 3331 S. Calle Del Albano, Green Valley, AZ 85614 (520-648-1933).

**Pilot Training Class 42-I.** Oct. 3-8, 2000, at the Holiday Inn Mountain View in Albuquerque, NM. **Contact:** Maurice L. Hughes, 5201 Roma Ave. NE, Apt. 328, Albuquerque, NM 87108 (505-266-6974).

**Pleiku AB, South Vietnam, Veterans Assn.** Sept. 14-17, 2000, at the Howard Johnson Express Inn in Dayton, OH. **Contact:** Tom Rushnock (724-334-9445) (trush@usaor.net).

**Raven FACs, Laos.** Oct. 19-22, 2000, in Universal City/Randolph AFB, TX. **Contact:** Ed Gunter, 132 Trelawney St., McQueeney, TX 78123-3423 (830-560-2522) (edgunter@aol.com) (www.ravens.org).

**SAC Airborne Command & Control Assn.** Oct. 4-8, 2000, in Montgomery, AL. **Contact:** Steve Leazer, 6141 Bagley Ave., Twentynine Palms, CA 92277-2502 (leazersd@thegrid.net).

**Thunderbirds Alumni Assn.** Nov. 15-19, 2000,

at Caesars Palace in Las Vegas. **Contact:** Denny Weddle, 3900 Paradise Rd., Suite T, Las Vegas, NV 89109 (702-369-8488 or 702-791-2377) (weddle@vegasnet.net) (www.thunderbirdalum.com).

Seeking anyone interested in attending the **Defense Technical Information Center's Annual Users Meeting and Training Conference**, Nov. 6-9, 2000, at the Doubletree Hotel in Rockville, MD. **Contact:** Julie Foscoe (703-767-8236) (jfoscue@dtic.mil) (www.dtic.mil).

Seeking members of **Pilot Class 43-K**, West Coast Flying Tng Cmd cadets, and southeast FTC cadets for a possible reunion. **Contact:** Harold A. Jacobs, 17545 Drayton Hall Way, San Diego, CA 92128 (858-485-9422 or 858-485-5041) (jakes43k@aol.com).

Seeking members of the **1625th Support Sq, MATS, RAF Mildenhall, UK (1960-63)**, for a possible reunion. **Contact:** Marvin Blair, PO Box 14, Ooltewah, TN 37363 (marvinbl1@aol.com). ■

Mail unit reunion notices well in advance of the event to "Unit Reunions," *Air Force Magazine*, 1501 Lee Highway, Arlington, VA 22209-1198. Please designate the unit holding the reunion, time, location, and a contact for more information. We reserve the right to condense notices.

## Bulletin Board

bulletin@afa.org

Seeking **patches** from units that flew the B-57 Canberra, specifically the 90th BS, 3rd Gp, 405th FW, and associated flight patches. **Contact:** Albert Mark, 200 Hearthstone Dr. W., Newnan, GA 30263-5633 (770-253-7041).

Seeking any information on B-17 **Erector Erector Set**, including serial number, wing, squadron, or crew members. **Contact:** Julian B. Williamson, 5351 Ridgewood Rd., Jackson, MS 39211 (sonann640@aol.com).

Seeking photos of **Lt. Otis Whitney**, 736th BS, 454th BG, Fifteenth AF, and **Maj. Kent C. Geyer**, 377th FS, 362nd FG, Ninth AF. **Contact:** Karl Affenzeller, Buchtastrasse 5, Freistadt, Austria A-4240.

Seeking contact with **Majs. Sam Castleberry** and **Albert Grinstead**; **Capt. Roger Flaherty**; **1st Lt. Cecil Smith**; **2nd Lt. Harold Walls**; **SSgt. Huey J. Knight**, **A1C James Ross**, **A2Cs Bruce Fleisher** and **Elmer Reich**, all B-29 crew members with the 307th BW, Kadena AB, Japan, 1953-54. **Contact:** Don Gill, 117 Costa Mesa Dr., The Villages, FL 32156 (352-751-0621) (dgill@iag.net).

Seeking photos and narratives from **WWII veterans** on their most unusual, dangerous, ridiculous, or funny experience during the war. **Contact:** William R. Van Osdol, 2017 Edgewood Dr., Edmond, OK 73013 (405-341-0153) (vanokc@aol.com).

Seeking personnel stationed at **Morris Field, NC**, Jan. 15, 1941, until closing and those who served in the South Pacific with **Thirteenth AF**, 1942-48. **Contact:** Frank L. Pace, 315 W. 15th St., Dover, OH 44622 (330-343-7855).

For documentary, seeking **WWII military veterans** interested in sharing stories about their relationships with their loved ones during the war. **Contact:** The Reunion Project, c/o Hero Produc-

tions, PMB 286, 3807 S. Peoria Ave., Ste. GH, Tulsa, OK 74105.

Seeking information on **Oxnard AFB, CA**, during the 1960s, specifically, physical size and layout, units and aircraft assigned, base and community relations, and personal experiences. **Contact:** George W. Strasbaugh (skipstras@juno.com).

Seeking members of the **428th FS, 474th FG**, between Dec. 5, 1943, and Aug. 19, 1944, who knew P-38 pilot **Robert E. Hartl**. **Contact:** Richard Hartl (719-594-0926).

Seeking anyone who knew **1st Lt. Allan R. Kauffman**, 357th FIS, Nouasseur AB, Morocco, who was killed in an F-86 crash June 26, 1959. **Contact:** Janice M. Oswald (angelshane@hotmail.com).

Seeking photos, stories, and anecdotes on the **428th BS**, Ghisonaccia, Corsica, and Fano, Italy, 1944-45, for squadron history. Also seeking information on **Capt. John E. Moist**, P-47 pilot squadron leader, who died in an airplane crash in Wivenhoe, UK, Feb. 26, 1944. **Contact:** Robert Barefoot, 1705 Pinehurst Ave., Escondido, CA 92026 (760-432-9502).

Seeking anyone who served in the **Panama Canal AF, Caribbean AF, Sixth AF, or Caribbean Air Command**. **Contact:** Robert L. Taylor, 22001 Bluegrass Rd., Ottumwa, IA 52501 (515-938-2773).

Seeking the owner of a **knife** lost during a rescue mission in Vietnam in 1965. The knife is 15 centimeters long with 45485 stamped on one side of the blade and USA on the other. The handle is shaped like an eagle's head. **Contact:** Alexander Oleynick, 2-a Kotovsky St., Apt. 223, Smolensk, Russia 214027.

Seeking former members of **Syracuse University's AAF cadet** training program, 1943, and

information about training in Punta Gorda, FL, particularly the **344th Fighter Training Det.**, January-July 1945. **Contact:** Steve Vaadi, c/o Jim Neville, (315-772-9007) (jdneville73@hotmail.com).

Seeking photos, documents, and personal narratives on **Wheeler-Sack AAF, NY**. **Contact:** Jim Neville, Historical Collection, Fort Drum, NY 13602 (315-772-9007) (nevillej@drum.army.mil).

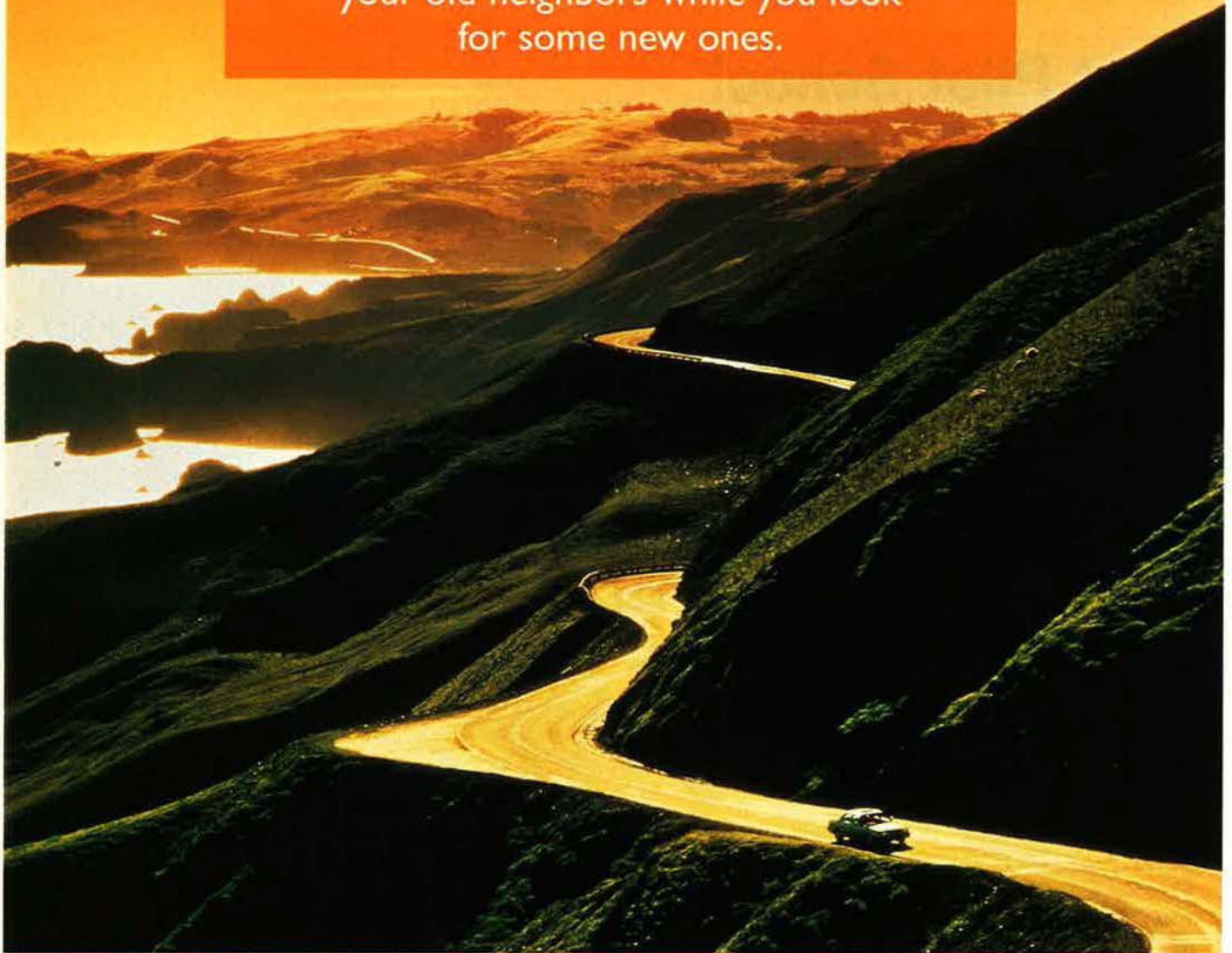
Seeking photos and information on **1st Lt. Don J. Gilliland** and crew of the 36th BS, 28th BG, Eleventh AF, whose B-24 was shot down over Kiska in the Aleutians, April 15, 1943. Gilliland also went to B-17 flight school in Sebring, FL, 1942. **Contact:** Jim Joyce (pager: 800-589-3418) (jjoyce39@aol.com).

Seeking **35mm color slides** of military aircraft from WWII through Vietnam. **Contact:** Warren Thompson, 7201 Stamford Cove, Germantown, TN 38138 (901-754-1852) (migaley@attglobal.net). ■

If you need information on an individual, unit, or aircraft, or want to collect, donate, or trade USAF-related items, write to "Bulletin Board," *Air Force Magazine*, 1501 Lee Highway, Arlington, VA 22209-1198. Items submitted by AFA members have first priority; others will run on a space-available basis. If an item has not run within six months, the sender should resubmit an updated version. Letters must be signed. Items or services for sale, or otherwise intended to bring in money, and photographs will not be used or returned. We reserve the right to condense notices.



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# Pieces of History

Photography by Paul Kennedy

## Test Pilot School



**If it's orange, it must be test.** As these current and historical items show, bright orange is used for everything from flight suits to equipment at the US Air Force Test Pilot School, Edwards AFB, Calif. The school was created in 1944 at Wright Field, Ohio, and moved to Edwards in 1951, where it was once called the Experimental Test Pilot School. It is USAF's graduate school for

aerospace testers—whether pilots, navigators, or engineers. It trains not only USAF personnel, but personnel from other services, industry, and allied nations on how to evaluate research, prototype, and production aerospace vehicles, systems, and weapons. The school is 48 weeks long and, although it is divided into two separate courses—the experimental test pilot course and

the flight test engineer/navigator course—the emphasis is on developing a team approach for test operations.

Memorabilia courtesy USAF Test Pilot School, Edwards AFB, Calif.



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