

The Air Force's fleet has dramatically increased its capability over time, allowing inventory numbers to come down. But even the most powerful aircraft can't be in two places at once.

# Arsenal of Airpower

By James C. Ruehrmund Jr. and Christopher J. Bowie

The breadth of the Air Force's expanding missions is revealed in a startling statistic: Even if the service retired its entire fighter, bomber, and ICBM inventories, USAF spending would decline by only about 25 percent. The bulk of Air Force spending today goes to air mobility, space operations, enablers of joint forces, and intelligence-surveillance-reconnaissance capabilities.

After 1962, spending on joint force support grew by almost 40 percent, consuming about 45 percent of the budget in the past decade. Today, combining operational overhead with joint-force enablement, only 25 percent of the budget remains dedicated to combat forces.

As shown in Fig. 1, the Air Force began a period of significant growth

in 1950, with the confluence of the outbreak of the Korean War, the growing Soviet threat, and the Eisenhower Administration's adoption of nuclear deterrent strategy. The service reached a peak of more than 26,000 aircraft in 1956. A masterful advocacy campaign by USAF illustrated airpower's value to the new strategy, and resulted in nearly 50 percent of the military budget belonging to the Air Force.

Shortly thereafter, the advent of ICBMs led to three major adjustments in the service's force posture.

First, to reduce vulnerability to a Soviet first strike, the Air Force fielded a large force of tankers. This increased the number of heavy bombers that could be airborne at a given time, and extended their range such that they could now

strike their targets from bases within the United States.

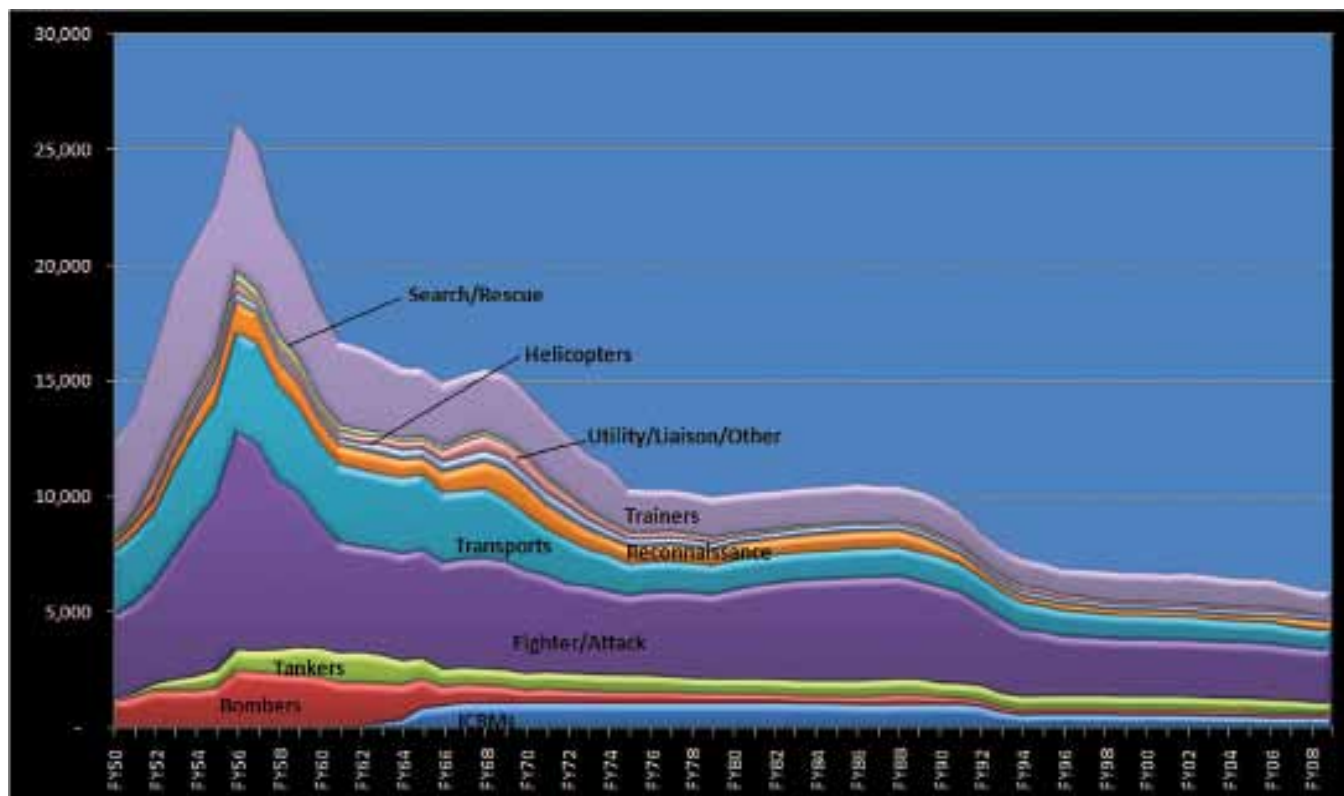
Second, as the Air Force began deploying ICBMs—1,000 Minuteman missiles and a small number of Titans—it concurrently retired roughly an equal number of bombers, primarily B-47s.

Third, the Soviet deployment of a growing number of ICBMs raised questions about the utility of the vast interceptor fleet devoted to continental air defense.

As a result, the Air Force began the drawdown of continental air defense forces, numbering about 2,000 aircraft, shrinking it as a proportion of the overall force throughout the 1960s and 1970s, to just a few hundred aircraft.

After the accelerated retirement of most of the air defense fleet in the

FIG. 1 USAF FORCE POSTURE OVER SIX DECADES



**FIG. 2 USAF BUDGET OVER TIME**



late 1950s, the Air Force maintained a force level of about 15,000 aircraft and ICBMs until the early 1970s. As the Vietnam War wound down, the service's force posture declined to a level of roughly 12,000 aircraft and ICBMs. Except for a slight growth during the Reagan years, it stayed at that level until 1991. The next drop was even more precipitous.

With the collapse of the Soviet Union and the reductions ordered under President George H. W. Bush under the Base Force plan, force structure quickly shrank to about 6,500 aircraft.

However, indications are that USAF may reach a new "inflection point" with yet another significant reduction in force levels. At best, forecasts show the Air Force maintaining its budgetary topline, but a decline is more likely. Overall aircraft procurement is low, and the average ages of aircraft are unprecedentedly high, forcing the prospect of imminent retirement for major portions of the air fleet. Given that spending on personnel and operations, as a percentage of the budget, is growing, in all likelihood the USAF inventory is about to shrink even further.

Complicating matters for Air Force planners is variability in the service's budget. As seen in Fig. 2, the nation has invested approximately \$9 trillion in

land-based air- and space power since 1950, averaging \$146 billion per year. Budgets exceeded the average in the 1950s and 1960s, with much of that investment going to strategic forces (bombers, tankers, and ICBMs) and, in the 1960s, supporting operations in Vietnam.

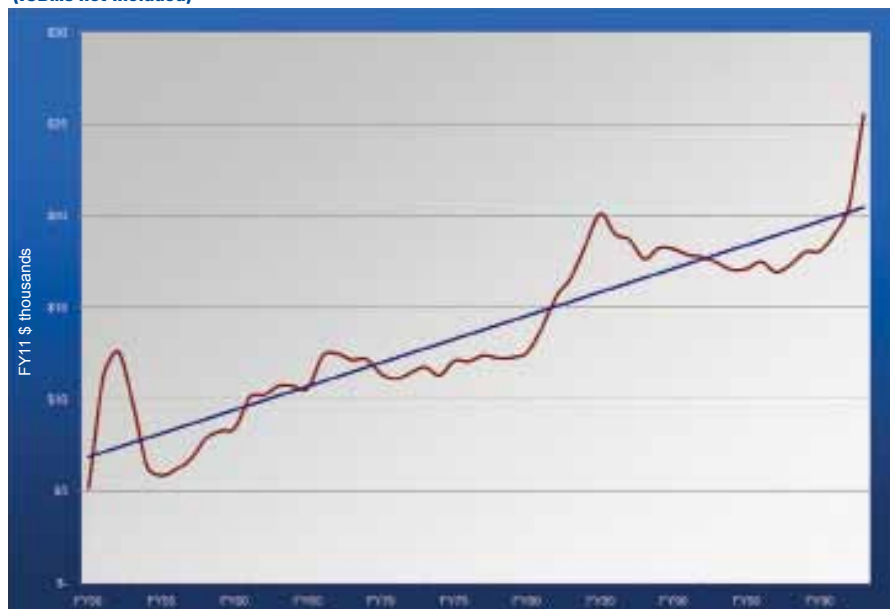
Today's decline in overall force posture closely parallels that of the post-Vietnam budget decline. The

Reagan buildup enabled modernization, but little growth in force levels. With the end of the Cold War, the budget again declined, followed by force levels. Once the force posture stabilized in the early 1990s, USAF was able to maintain its numbers, living off the fruits of the Reagan buildup.

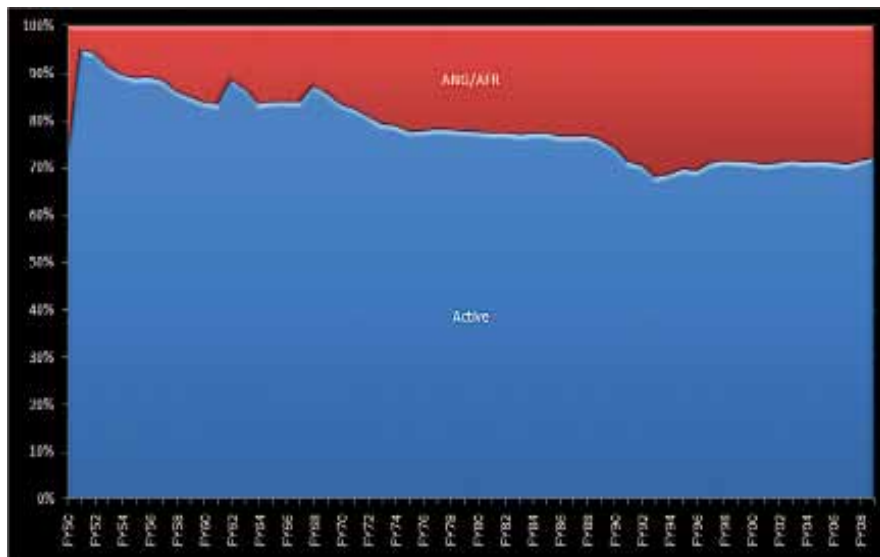
Defense spending increased following the terrorist attacks in the US on Sept. 11, 2001, but little actual pro-

**FIG. 3 COST PER TOTAL ACTIVE INVENTORY AIRCRAFT**

(ICBMs not included)



**FIG. 4 THE GROWING ROLE OF THE AIR NATIONAL GUARD AND RESERVE COMPONENT**



curement of new systems took place, while operational demands grew.

It is hard to maintain force levels for significant periods of time because the cost of personnel, equipment, spares, and fuel all grow over time. An F-15 Eagle, for example, cost more than an F-4 Phantom II, which in turn cost more than an F-100 Super Sabre. The average cost of a flying hour over the past decade is around \$23,000 (in constant Fiscal 2011 dollars), compared to about \$11,000 in 1985, and roughly \$4,800 in 1970. Fig. 3 provides a view of the steady overall increases in costs by simply dividing the annual USAF budget by the total number of aircraft fielded that year. The trend rises steadily.

Attempting to maintain force levels and critical capabilities in the face of budget variability and inexorable cost growth, USAF has employed various strategies to extract maximum capability for lower cost. Like the other military services, USAF is one of the few agencies in the US government that has undeniably increased in capability while its share of the overall federal budget has declined. In 1960, the Air Force accounted for 21 percent of total federal expenditures; by 2000, that number had dropped to just 4.7 percent.

Although force levels are lower, the capability of the current force, in almost all respects, far exceeds that of the huge Air Force of the 1950s. Today's Air Force can constantly survey the planet with a variety of space and air-breathing systems; precisely strike

any point on the globe within hours; deploy airpower with unprecedented speed and agility; and provide secure, high-bandwidth communications and navigation to the entire joint force.

Over the past 60 years, the Air Force strove to eke out every last measure of efficiency to keep force levels at the "agreed upon" level. Historical budget analysis indicates that the spending on "overhead," such as bases, service schools, training, etc., has dropped 16 percent since the early 1960s. While a significant achievement, the ability to extract more from overhead is probably limited, since most of the low-hanging fruit has already been picked.

### Service Lives

USAF has also steadily increased the role and responsibilities of the Air National Guard and Air Force Reserve, both of which can provide capabilities at a lower cost than active duty units. For example, Fig. 4 shows the percent of the Total Force provided by the Guard and Reserve as compared to the active component. The overall percentage of forces in reserve components increases over time, primarily due to a corresponding shrinkage in the active component. In the case of tankers and airlift units, the Air Guard-Air Reserve percentage of the fleets grew to nearly 50 percent, enabled partly by the fact that a Guard or Reserve member can support airlift or tanker operations overseas and still be home to meet civilian commitments. This is not the case for most Army, Marine Corps, or Navy units. However, con-

straints come with increased reliance on the Air Guard and Air Reserve organizations. Balance between active and reserve components must be maintained, because the active force channels manpower to the reserve.

Advances in aircraft structures, materials, and upgrades now enable the Air Force to keep equipment in service far longer than originally planned. Thus, for a time, USAF could maintain force structure while buying fewer aircraft.

As Kevin N. Lewis of RAND Corp. noted in 1990, the Air Force procured more aircraft between 1952 and 1956 than it did between 1956 and 1990. Indeed, the 1950s total of more than 12,000 aircraft exceeds the total aircraft procured from 1956 to 2011.

The KC-135, built in the late 1950s and early 1960s, was planned as an interim tanker solution. Instead, the Air Force has continued to upgrade the KC-135 and expects to fly the veteran tanker until 2040.

Another example is the Minuteman ICBM. First deployed in the early 1960s, the Minuteman III remains on alert today through regular upgrades and refit.

The B-52, also produced in the late 1950s and early 1960s, flew in the Vietnam War and continues to fly combat missions over Afghanistan.

In the 1950s, fighters had service lives of five years or less, while the service lives of modern fighters now extend beyond 30 years.

These long operational lifetimes are a tribute to the US aerospace industry, which over this lengthy period has improved safety and reliability, reducing the need for attrition reserves. The US aerospace industry has consistently developed and produced the best military and support aircraft in the world.

Fighters procured in the 1950s—such as the F-86, F-84, and F-80—were bought rapidly and in large numbers, and they were retired in the same manner, as can be seen in Fig. 5.

The Air Force shifted to a quality-over-quantity emphasis in the mid-1950s to rapidly procure Century Series aircraft—F-100, F-101, F-102, F-104, F-105, and F-106—but kept most of these fighters in service for 20 years. That tenure was significantly longer than the service lives of their predecessors, flattening the sharp curve of the 1950s.

Then came the F-4, comprising more than one-third of the fighter force by the mid-1970s, followed by the F-15,

F-16, and A-10. Each of these post-Vietnam fighters remains in service today, and will probably fly and fight for another decade or more, attesting to the remarkable longevity of these systems.

Cutting-edge design and subsystem upgrades have helped modern aircraft maintain effectiveness over long periods. A new F-16C Block 50 is a significantly more capable aircraft than an F-16A procured in the 1980s.

A related point is that aircraft designed with multiple missions in mind from the outset tend to have the space, weight, power, and cooling capacity necessary to easily adapt them to emerging missions. Consider the case of the F-106 interceptor and the F-4 multirole fighter. Both were conceived at about the same time and were equally “cutting edge,” but the

F-4 proved much more adaptable due to broader Navy requirements for a fighter-bomber. The F-106 today is long gone, while the F-4 still flies with several allied and foreign air forces.

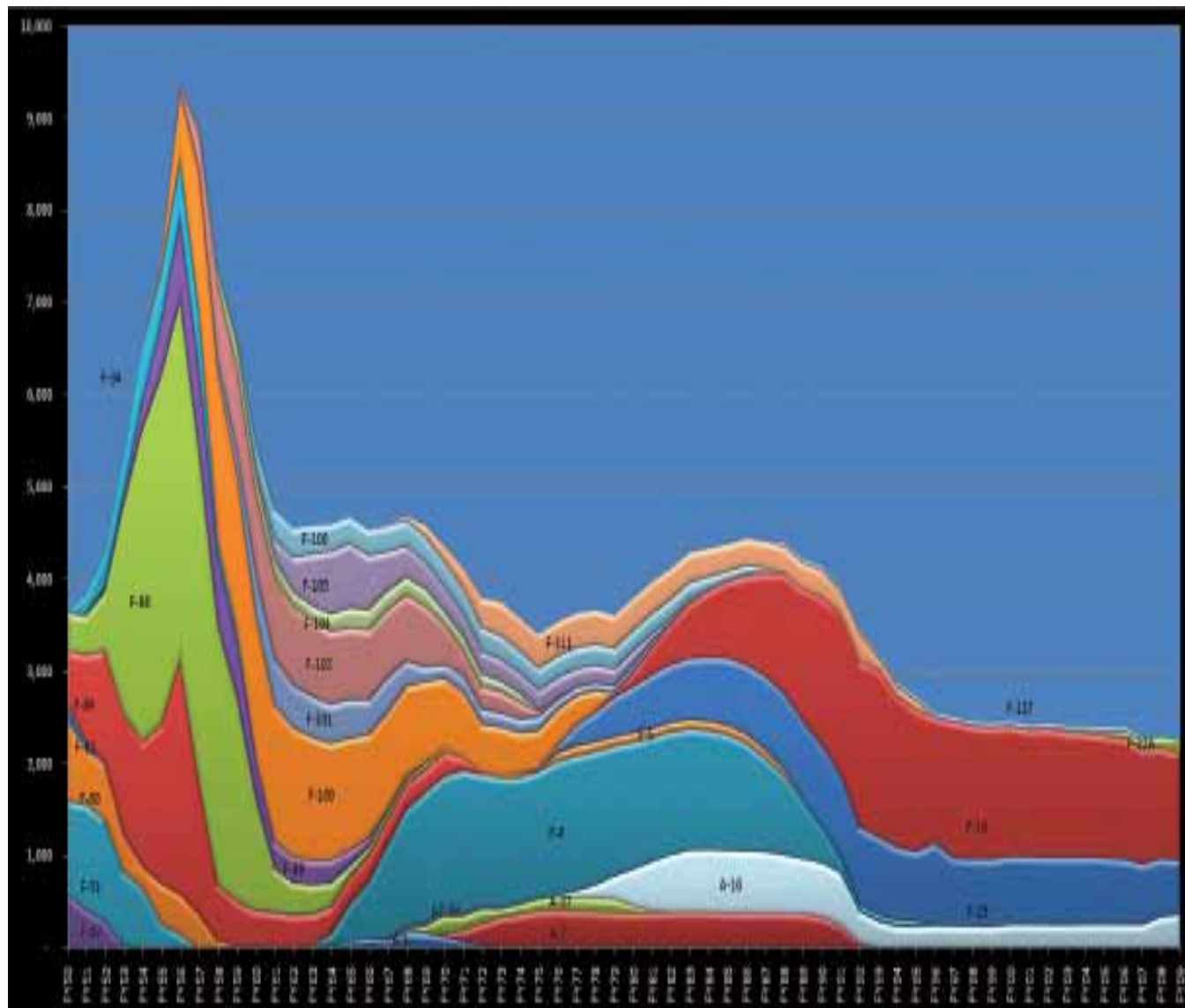
For mobility aircraft, the Air Force was able to increase its airlift capabilities while operating a smaller fleet by acquiring more capable aircraft and making organizational improvements.

The airlift force in the 1950s, as illustrated in Fig. 6, was a hodgepodge of types, typically limited in both range and payload. In the 1960s, the Air Force procured its first dedicated jet airlifter—the C-141—followed by the huge C-5. Operation Nickel Grass, which supported Israel in 1973’s Yom Kippur War, highlighted the value of aerial refueling because only the C-5 was capable of reaching Israel without a refueling stop.

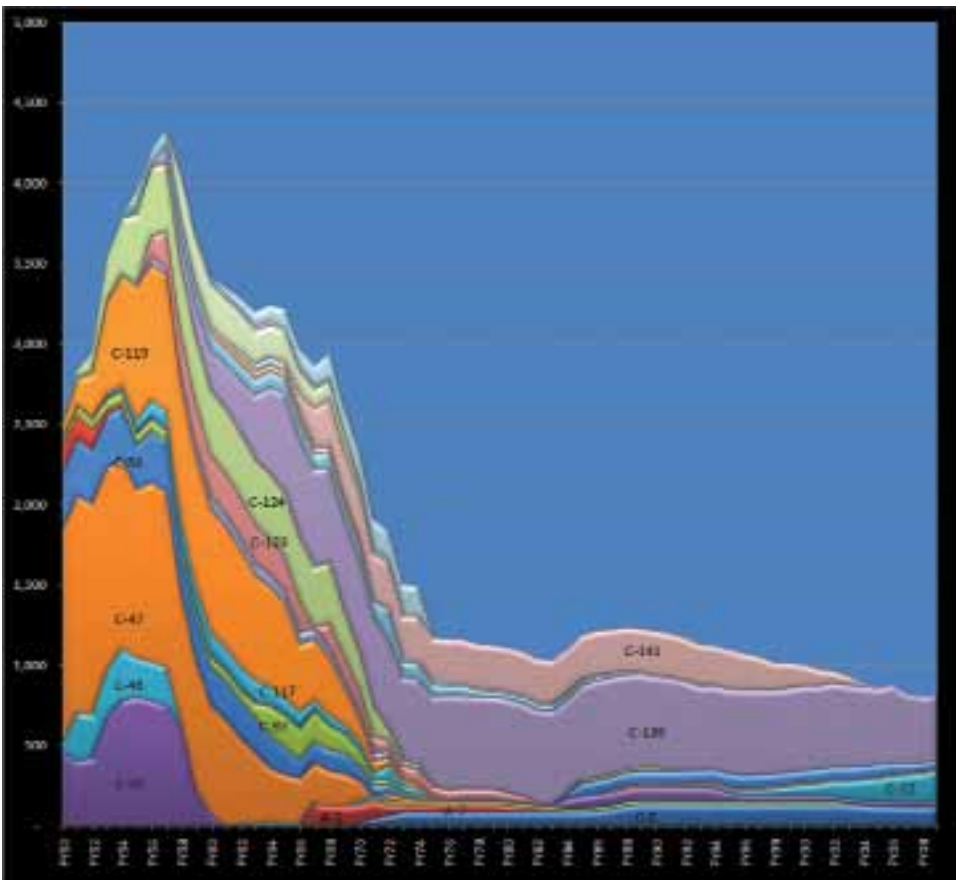
The Air Force promptly retrofitted its fleet of C-141As with refueling receptacles and extended fuselages. The resulting C-141B greatly increased the fleet’s capacity and strategic flexibility, at modest cost. It led to the development of today’s C-17 airlifter, combining the best attributes of the C-5 and C-141 in a single airframe. Today, a single C-17 can carry a payload equivalent to 15 World War II-era C-47s—including bulky loads that could never fit in the C-47—and deliver it worldwide, directly, within hours.

The C-17 demonstrates how improved performance and organizational changes can generate higher capability at lower cost. The C-17 offers higher availability rates and requires fewer backup aircraft and lower operating costs, compared to a C-141, to transport an equal amount of cargo.

**FIG. 5 USAF FIGHTER FORCE COMPOSITION**



**FIG. 6 EVOLUTION OF USAF AIRLIFT FLEET**



Taking advantage of this, USAF increased the crew ratio from the 3.6 on C-141s to 5.0 on the C-17. This drove the Air Force's decision to replace the aging force of 265 C-141s with (initially) 120 C-17s offering a similar "ton-mile" capability.

### Cutting Into the Bone

The Air Force also adopted new technology to achieve mission requirements at reduced cost. The development of stealth technology is a prime example.

Due to the growing capabilities of enemy air defenses, military planners were forced to dedicate larger numbers of aircraft to each strike package, providing jamming, fighter escort, and defense suppression, all of which required more air refueling. A famous chart released in 1991 illustrated that two stealthy B-2 bombers could carry out a mission that would otherwise require a package of 75 nonstealthy aircraft. The B-2s, though expensive, were considerably more cost-effective than the 75-aircraft gaggle and placed fewer crews at risk.

Further examples are numerous. The development of space-based systems permitted USAF to retire portions of its reconnaissance fleet, such as the Mach

3+ SR-71 Blackbird. The re-engining of KC-135 tankers boosted refueling capacity at less cost than a new fleet. Vast fleets of medium bombers were replaced by fewer ground-based ICBMs.

Still, in the absence of steadily rising budgets, at some point, force levels have to be cut to accommodate rising costs in operations and infrastructure. In these cases, the Air Force has historically elected to divest itself of the aircraft needed for tangential missions.

In the 1950s, the service flew B-17s fitted with lifeboats on coastal search and rescue; fielded Bomarc nuclear-tipped surface-to-air missile systems; and maintained a fleet of assault gliders. The largest divestment, as we have seen, cut the vast majority of continental air defense forces. This significantly reduced force structure and associated costs.

Strategic strike, air supremacy, interdiction, close air support, airlift, and ISR received priority over these less critical missions.

Today, the Air Force has arguably reached a point where all tangential missions already have been eliminated, meaning that if future USAF planners choose to pay bills by reducing force structure, they will be cutting into the bone, reducing fundamental capabilities in core mission areas.

Studying USAF posture trends illustrates how airpower planners adjusted the force to support the changing role of airpower over time. The inventory trends demonstrate a decline in force quantity, but given combat performance, suggest enormous advances in overall quality and capability.

The use of cutting-edge design, where possible, has provided the margin necessary to maintain operational effectiveness over long service lives. This contradicts the current drive to emphasize "75 percent" solutions. Advanced aircraft in turn can leverage "off-board" improvements such as GPS, precision weapons, advanced radars and sensors, aerial refueling, and data links to enable capability growth despite lower force levels.

As past planners grappled with inexorably growing costs and limited resources, replacing medium bombers with ICBMs must have presented a serious culture shock to an Air Force then run by "bomber barons." However, the move enabled the Air Force to meet requirements at lower overall cost.

Similar consternation must have attended the retirement of 2,000 interceptors, but these bold moves paved the way to today's more capable and cost-effective force.

As we move to the future, the force structure procured primarily during the Reagan buildup is reaching the end of its life. The average age of most elements of the force structure is reaching unprecedented levels. This difficult dilemma will dominate the Air Force planning agenda for the next decade or more. Understanding how past planners confronted similar decisions should inform how Air Force leaders today weigh the tough choices ahead. ■

*This article is adapted from a study for the Mitchell Institute for Airpower Studies. The full report and the USAF aircraft inventory database are available at [www.afa.org/Mitchell](http://www.afa.org/Mitchell). James C. Ruehrmund Jr. is a retired Air Force colonel and is currently employed by Deloitte Consulting. Christopher J. Bowie is corporate director of the Northrop Grumman Analysis Center. His last article for Air Force Magazine, "The Unmanned Tipping Point," appeared in the September 2010 issue.*