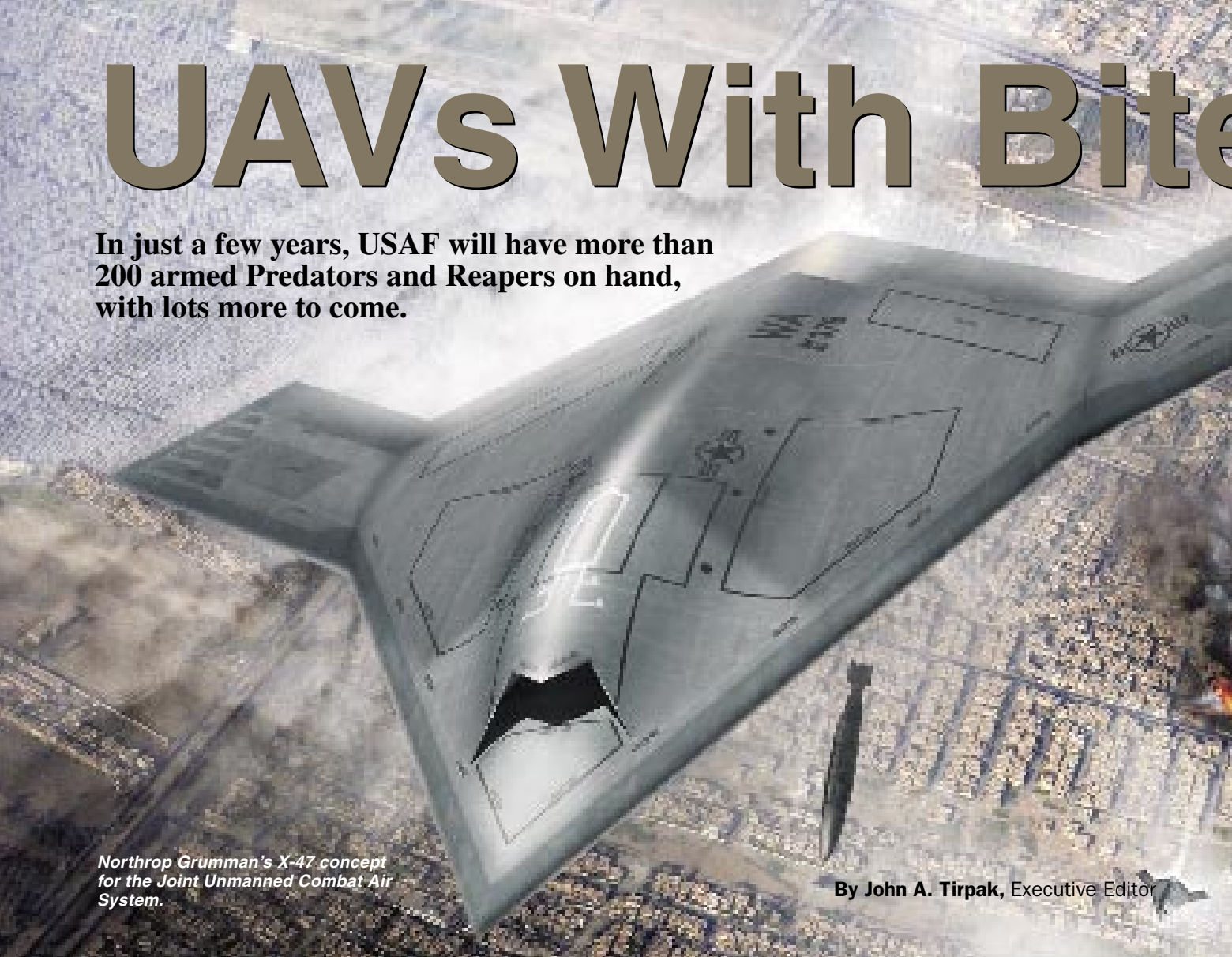




# UAVs With Bite

**In just a few years, USAF will have more than 200 armed Predators and Reapers on hand, with lots more to come.**



*Northrop Grumman's X-47 concept for the Joint Unmanned Combat Air System.*

**By John A. Tirpak, Executive Editor**

**R**obotic air vehicles are beginning to replace some of the Air Force's manned combat aircraft. Soon, they will be handling a major share of the service's strike mission. The first steps in this transition already have been taken in the field of fighter-class aircraft. Classified projects now in development seem sure to cut into the manned medium and heavy bomber roles, as well.

The Predator MQ-1 is leading this transition. A familiar feature of Air Force combat operations for more than a dozen years, the spindly Predator has evolved dramatically. It is no longer simply a loitering "eye in the sky" but rather a versatile weapon system capable of destroying a couple of ground targets on its own or in collaboration with other aircraft. It is in great demand, and the Air Force is acquiring Predators as fast as it can absorb them.

Now in early production is a souped-up version of the Predator, the MQ-9 Reaper. Its combat payload—missiles and bombs carried on underwing hardpoints—roughly equals that of an F-16 fighter. In the Reaper, the Air Force has found a craft that truly combines the powers of a potent strike fighter with the capabilities of a reconnaissance drone.

Both Predator and Reaper will be joining the Air Force's inventory in increasing numbers over the next decade, even as the service divests itself of older manned fighters such as F-15s and F-16s. In fact, many Air National Guard units will be trading in their aircraft for Predators.

## **220 Combat Drones**

The Air Force envisions fielding 15 Predator squadrons by 2010. For some years, the first squadrons have been

active at the Air Force's unmanned aerial vehicle "schoolhouse," Creech AFB, Nev. More recently, the 163rd Air Refueling Wing at March ARB, Calif., began swapping its KC-135 tankers for Predators. The first Reaper unit, the 42nd Attack Squadron, was activated at Creech in November. This unit will train MQ-9 pilots and sensor operators.

The Air Force now has provisional plans to buy some 170 Predator MQ-1s by 2010 and acquire 50 to 70 MQ-9s by around 2012, for a total of 220 or more of the combat-capable drones. At present, the service plans on retiring a comparable number of F-16s over the same period.

With UAVs taking on new importance, USAF has acted to straighten out its terminology. The service in recent years took to using the term "system," which meant a constellation of four



Northrop Grumman illustration

Predators, a ground control element, and a launch-and-recover element. This description was confusing and has now been dropped. USAF, instead, refers strictly to individual air vehicles.

“My guess is, we’ll probably crank out about 40 more Predators this year,” said Thomas J. Cassidy Jr., president of General Atomics Aeronautical Systems, which makes the Predator and Reaper. He estimated that the Air Force, in filling out its squadrons already slated to buy Predator, will acquire 250 MQ-1s and “maybe quite a bit more than that.” He also forecast a demand for 150 Reapers just for USAF. Once the service sees what they can do, Cassidy claimed, “there’s going to be a lot of demand for them.”

That’s not just idle talk. Cassidy noted that General Atomics last year used its own money to build 10 Reapers—which it calls Predator Bs—and sold all of

them. It is anticipating orders from the militaries of Australia and Britain as well as US users ranging from the Department of Homeland Security to the Department of Agriculture. As a result, General Atomics is building capacity that exceeds what is needed strictly to fill the Air Force’s orders.

The company is building two Reapers per year now. Plans call for ramping up to four systems in 2008 and eight in 2009. There are 21 on order so far. Each year, moreover, General Atomics has been retrofitting six older Predators to a newer configuration.

“Since the original airplane [MQ-1], we’ve added upgraded computers, fuel-injected engines, different propellers, ... upgrades to the ground stations,” and reliability enhancements, Cassidy said.

USAF officials say that Predator and Reaper, despite their developmental relationship, are not comparable systems. Predator still is viewed mainly as an intelligence-surveillance-reconnaissance (ISR) platform with a bit of strike ability; USAF calls it a “killer scout.” On the other hand, the muscular Reaper is described as a “hunter-killer” and is grouped in with USAF’s other attack aircraft. At 6,000 pounds, the heavyweight Reaper is far beefier than the under-1,000-pound Predator. The Reaper also costs twice as much as the MQ-1, say industry officials.

“It is a standard strike-attack aircraft, so it is an additive capability to the F-15s, F-16s, F-15Es, and, of course, the bombers,” noted Col. Steven Pennington, the operations group commander on the Air Staff in Washington, D.C.

In Pennington’s view, the Reaper does not represent “a new mission.” The MQ-9 “I think of [as having] an F-16’s strike-like capability,” but it just “doesn’t have a man in it,” said Pennington. “When I think of the Predator, I think of an RC-135/U-2-like capability that happens to also have two AGM-114s [Hellfire missiles] on it.”

### Like an F-16

The Reaper is deemed comparable to the F-16, in that it flies at about the same altitude, has sensors comparable to the F-16’s Sniper or Litening pods (see “Eyes of the Fighter,” January 2006, p. 40), and carries a similar weapons load.

Unlike the F-16, however, the Reaper can remain on station “18 to 24 hours, minus transit time” to and from the target area, Pennington said. That is

an advantage over the manned fighter. The F-16’s comparative advantages, besides the inherent flexibility of being manned, are its speed and ability to engage in a turning dogfight.

Like any other aircraft, effective use of the Reaper requires that its operators strike a balance between endurance, weapons load, and altitude. Fuel and weapons can be traded, if need be, to achieve a desired flight altitude or time on station. In its max-load state, the MQ-9 can’t reach its maximum altitude.

The Reaper can carry as much as 3,000 pounds of external payload. That payload typically is depicted as eight Hellfires, two 500-pound Joint Direct Attack Munitions, and two Sidewinder air-to-air missiles. However, the aircraft can also carry laser guided bombs and other types of ordnance.

At present, USAF officials expect eventually to fit the Reaper with the 250-pound-class Small Diameter Bomb, giving it ability to hit 16 targets with precision on one mission. That is about where the B-2 bomber was during Operation Allied Force in 1999.

Each Reaper costs about \$7 million, far less than the F-16, which cost more than \$30 million each. However, the low cost of the Reaper isn’t the big attraction for the Air Force, Pennington said. The attraction is its persistence.

“An F-16 in the target area, assuming you have to penetrate, is going to be [there] five to 10 minutes, and then it’s going to leave,” explained Pennington, who added that, in the close air support mission, an F-16 could orbit the battlefield for perhaps 30 minutes before having to leave to refuel. The Reaper, though, could hang around above the target area for many hours, either in the “CAS stack” or “physically overhead if you think you know where the bad guys are.” The Reaper could act as a persistent forward air controller for other airplanes, too.

“When the bad guy shows up—in a vehicle, a person, or a tank—you take care of him, or ... act as an air FAC” and call in other strikers, Pennington said.

The big drawback to the Reaper is that it flies slowly. Covering roughly 500 miles from a home base to an operating area will take it three hours, with the return trip taking another three hours. Even so, it could still put in as much as 24 hours over the target area.

### Why it Grew

The Reaper grew larger than the Predator because the Air Force wanted



**A Predator is checked at Balad AB, Iraq, after a mission. USAF will buy 170 MQ-1s over the next few years.**

to take the aircraft well above the threats posed by anti-aircraft artillery and man-portable anti-aircraft missiles, Pennington noted. Also, going to a higher altitude permitted “wider sensor coverage of the ground.”

The Air Force has considered giving the Reaper an air refueling capability, looking especially at refueling the airplanes from the back of tanker helicopters using the probe-and-drogue fueling technique employed by the Navy. Given that it already can stay airborne for a very long time, however, USAF officials have dropped those plans.

The Reaper is still in its operational infancy. The Air Force will keep on buying the Predator MQ-1 for another four years, at which time operational testing of Reaper will be nearing completion. During that time, 15 squadrons, along with Air Force Special Operations Command, will be fitted out with Predator and develop operational expertise. USAF has yet to decide on the final mix of MQ-1 and MQ-9 aircraft, Pennington said.

Although a single Predator was flown to the point of fuel exhaustion during the early days of Operation Iraqi Freedom in 2003, neither the Predator nor the Reaper are considered expendable munitions, Pennington said. “We plan to sortie them frequently and get the maximum we can out of them,” he said, adding that the Air Force doesn’t view the UAV as a “kamikaze.”

USAF has put the electronic attack mission off limits, though. The service once thought that mission would go to a Joint Unmanned Combat Air System, or J-UCAS, which it was developing with

the Navy. The J-UCAS was to have been a stealthy platform able to fly at high subsonic speed, with onboard sensors and the ability to carry an F-16-like weapons load. It was to have performed the “stand-in” electronic attack role, as well as that of a penetrating strike aircraft which could also loiter over enemy territory.

In last year’s Quadrennial Defense Review, however, senior Pentagon leaders ordered the Air Force out of the J-UCAS program and directed the service to take what it had learned on the effort and apply it to a new long-range strike platform. The Air Force’s J-UCAS money was to go there, too.

Darryl W. Davis, Boeing’s general manager for advanced precision engagement systems and a former man-

ager of the company’s X-45C J-UCAS, said his team was “within seven days” of completing the stealthy drone when the Air Force ordered the company to “cease and desist.”

Davis told *Air Force Magazine* in November that it looked like the X-45C and associated technology developed under the J-UCAS would now be transferred to the Navy, but “those details are still being worked between the Air Force, the Navy, and the Boeing Company.”

### Strike Package

Earlier versions of the J-UCAS, being developed in concert with the Defense Advanced Research Projects Agency, explored the operation of multiple autonomous unmanned combat air vehicles (UCAVs) by a single operator. Boeing simultaneously flew two X-45A models in cooperative missions. The aircraft demonstrated the ability to take off, reach a target, cooperate, and return to base autonomously, feats that earned them permanent homes at the Smithsonian and the National Museum of the US Air Force in Ohio.

Northrop Grumman is also in development with a UCAS for the Navy, and its version is called the X-47. Both aircraft are of a similar, stealthy arrowhead configuration.

The Navy derivative of J-UCAS was in November still nameless but likely to be called something like the NUCAS-D, for Naval UCAS Demonstration. The next phase of the program will seek to demonstrate that a tailless, stealthy unmanned aircraft can safely be operated on, launched from, and recovered aboard aircraft carriers.



**SSgt. Sean Pietre (l) and SrA. Rothschild Pierre-Louis III unload a Hellfire from an MQ-1 in Iraq.**





**The MQ-9 Reaper can carry a battle load similar to that of the F-16 but stay in the target area upwards of 18 hours. The Air Force plans to buy up to 70 “hunter-killers.”**

After that, the Navy is expecting to continue on with development, but its requirements differ from those of the original J-UCAS. The Navy is seeking primarily a persistent stealthy reconnaissance platform with some amount of strike capability. As one industry official said, “big ISR/little strike.” Various options are being considered. While the aircraft likely will have indigenous sensor systems, it may also have a “transparent” weapons bay allowing it to carry additional sensors instead of munitions, or possibly additional fuel.

Since being kicked off the J-UCAS project, the Air Force has been unable or unwilling to be very clear on how it will address the two roles the aircraft was to have filled—electronic attack and loitering deep strike (See “The 2018 Bomber and Its Friends” and “Where Next With Electronic Attack?” October 2006, p. 24 and p. 30.)

Industry and Air Force officials privately confirm part of the reason for the ambiguity is that the Air Force is pursuing one or more classified aircraft programs to address these mission areas.

Such projects may be, as one industry official said, “unmanned”—i.e., available in both crewed and uninhabited versions, but they will in some ways rival the capabilities of frontline combat aircraft such as the F-22 and F-35. Development of such systems has been under way for a number of years, predating the QDR process.

### **Black Programs**

Asked in November whether there might be a secret program that could

meet these missions, Gen. Ronald E. Keys, head of Air Combat Command, said the Air Force has “spent a lot of money on programs like that. And these are very important programs to us because our adversaries don’t understand what those capabilities are. They suspect that we’re working on certain things.”

At AFA’s Washington Air & Space Conference in September, Keys had said that the solution to the long-range strike program would probably start out “like we’ve started a number of our high-end technical things, ... as a ‘black’ program, until we understand

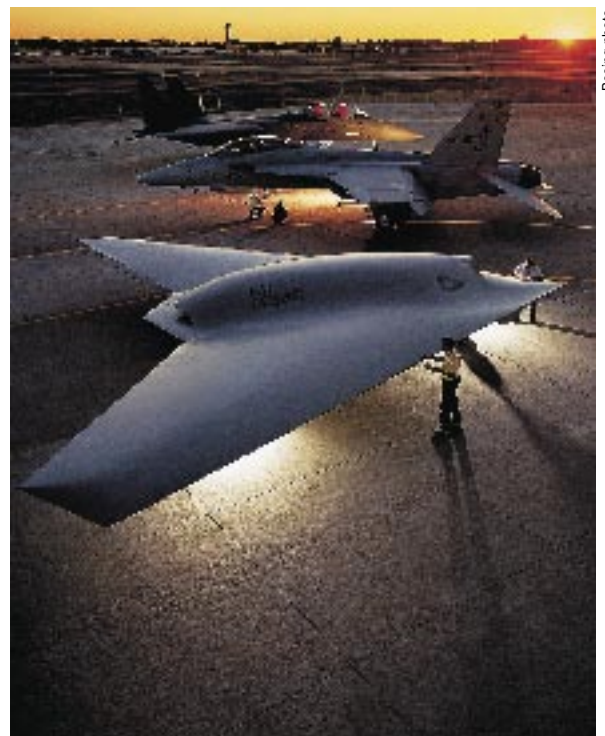
where we’re going.” He forecast that the timetable and cost of the system would probably be open for public discussion, but “the details of what it’s going to look like, how fast it’s going to go, how far it’s going to go, ... its real capabilities ... I’m not sure that we’re interested in letting a lot of people know what those ... are going to be anytime soon.”

There are two backup plans if the secret aircraft don’t pan out or are delayed. General Atomics, which builds the Predator and Reaper is readying an improved model that the company calls Predator C, having all the capabilities of the Reaper but packaged in a new airframe with low observable, or stealth, qualities.

“We’re not really advertising it or talking about it at this point,” Cassidy said in November. “We’re going to fly it before we advertise it.” However, he acknowledged that it will look different from the now-classic profile of the Predator family and that the Air Force has shown interest in it.

Another fallback would be for the Air Force to adopt a version of the Navy’s UCAS, although that aircraft is not expected to be available until 2020, two years after USAF is supposed to have its new long-range strike platform operational. Industry officials, however, said that the two-year difference wouldn’t be onerous and might actually permit some synergy of design, development, and production.

**The J-UCAS was to have been about the size of a standard fighter, as shown in this photo of Boeing’s X-45C with an F-15E and F/A-18F. The Air Force is working on classified programs that will address some of the J-UCAS mission.**





**This Boeing concept, called “Dominator,” can loiter in the target area and either use small submunitions or attack directly. USAF is considering the idea.**

It had long been suspected that Lockheed Martin was building the classified UCAV, because it alone among the major airframe houses doesn’t appear to be involved in any overt UCAV work. However, when it unveiled its secret “Polecat” stealth UAV concept last July, the aircraft seemed more adapted to a high-altitude, long-endurance mission rather than a low-flying dispenser of munitions.

For the time being, UCAVs are not easily exported, not only because they represent a low-entry-cost combat aircraft, but because they can be counted as cruise missiles under international arms control regimes.

The biggest issues facing the Air Force with regard to mainstreaming UCAVs involve fairly mundane matters, such as giving credit for “flying hours” to ground-based pilots and getting approval to allow UCAVs to routinely operate in civilian airspace.

### Two Kinds of Operators

There are two kinds of operators involved with Predators: pilots and sensor operators, Pennington said.

“What we’re doing is taking current units that had iron [aircraft], or recently had iron, and they’re getting an unmanned air vehicle. And they’re taking their pilots, or their navigators that get a private pilot license and go through MQ-1 training,” and making them Predator pilots.

“Then they’ve got the sensor operators, who will be intel people trained to operate the sensors.”

The Air Force is now trying to plot how it will train UAV pilots in the future, he continued, “namely, how do we select [them], do the initial training,

and then provide those folks to [a UAV] squadron.” He added that “currently and for the foreseeable future, they’re all winged people, whether they’re [wearing] pilot or navigator wings.” However, the service is considering the future unmanned aircraft pilot who comes out of undergraduate pilot training as “a UAS lieutenant.”

Pilots who have come into UAVs from other systems, like fighters or transports, get “gate credit” for their flying hours, which counts for upgrades and promotions, Pennington noted.

One of the goals of the J-UCAS program was to make the unmanned aircraft operator more of a manager of vehicles rather than a hands-on pilot, and it was expected that a single operator would supervise several UCAVs on a mission, getting involved mainly to give consent for weapons release.

With the Predator and Reaper, there’s a similar goal, but it hasn’t been defined yet.

“There were some people who thought one pilot could do four or six, [but] that doesn’t appear to be the case,” Pennington said. He said the right number is probably two or three per operator.

Predator sensors—electro-optical and infrared equipment—were used in Hurricane Katrina, lashed to high roofs because there was no precedent for flying the unmanned aircraft over populated areas. That loophole has been closed, and rules have been established allowing UAVs to fly through special US air corridors to reach an operating area. (See “Aerospace World: Predator Cleared for US Airspace,” November 2006, p. 18.)

Gen. William T. Hobbins, commander of US Air Forces Europe, has set a high priority on integrating UAVs into the NATO structure. The Air Force is developing “standards and requirements for the use of unmanned air vehicles inside the various ... types of controlled airspace,” Pennington noted, although there’s no deadline for doing so.

Perhaps the biggest hurdle facing the smooth transition to a larger UCAV force lies in deconflicting their use among the military services. Each branch has enthusiastically embraced UAVs, and to some extent UCAVs, but has had a hard time coordinating their purchase and use. (See “Smashing the UAV Stovepipe,” February 2006, p. 50.)

### Key Battle

A key battle in this turf war is whether and how the Air Force and Army would coordinate purchase of Predators. The Army selected a Predator variant, called Warrior, to conduct some of its own UCAV-type missions. However, it wants the aircraft to run on diesel—Predator MQ-1 uses aviation fuel—and be under the control of field commanders, operated from ground stations in the field, rather than on a grand air tasking order, operated by reachback controllers at Creech. The two services were supposed to resolve their differences on the issue by May 2006, but had failed to do so by mid-November. However, they had agreed on how to network their systems and make sure that ground troops could just as easily see imagery from a Predator as from a Warrior on field laptops.

Even as that debate was ongoing, the Joint Unmanned Aerial Vehicles Center of Excellence at Creech was putting the final touches on a concept of operations for multiservice UCAV close air support missions. The CONOPS was expected to improve the speed of answering such calls for CAS and to reduce fratricide among the services.

The new long-range strike program represents the greatest possibilities for the UCAV. The Air Force is conducting an analysis of alternatives on ways to address the requirement, and Pentagon officials have said the service will invest some \$5 billion in the program over the next six years. All the major military aircraft companies expect to offer at least some options involving unmanned aircraft. ■