Here come the unmanned and “uninhabited” aircraft.

The Robotic Air Force

At Indian Springs, Nev., an odd-looking Air Force airplane rolled “off the perch” and made its final approach. Its bulbous nose, spindly wings, and overall “upside-down” appearance were striking, though the stenciled names of the pilot and crew chief and its unit markings and other insignia gave the gray aircraft an air of familiarity. The pilot flared the landing, brakes were applied, and another 12-hour mission had come to an end. Yet no one jumped out of the aircraft. No one was aboard.

This was no ghost airplane. It was the RQ-1 Predator, operated by the 11th Reconnaissance Squadron. It is the Air Force’s first operational example of a new breed of unmanned aerial vehicles. Smarter, and expected to be cheaper and more reliable than the drones of decades past, Predator and its new-wave UAV kin are paving the way for what could be extensive use of “robot” airplanes. Designed and built for jobs too boring, hazardous, or expensive for aircrews to fly, UAVs may become a prominent feature of early 21st century air warfare.

“UAVs are going to be a big, high leverage, [high] payoff capability for us,” said Air Force Maj. Gen. Kenneth R. Israel, who heads the Defense Airborne Reconnaissance Office (DARO). “UAVs not only save lives, but they also really are very inexpensive to operate.” Israel added that, in a force structure characterized by a “high-low mix” of aircraft, UAVs could have an important niche. “They make a difference in the way you fight, in the way you think,” he asserted, noting that,

“Robot” planes, like this Northrop Grumman concept for an Uninhabited Combat Aerial Vehicle, could add an entirely new dimension to 21st century warfare. Above right, the present-day Predator UAV operated by the 11th Reconnaissance Squadron already conducts reconnaissance and surveillance missions—providing real-time images in all weather.
in ground war games where UAVs play a role, “everybody ... is watching the sky” for the snooping robotic airplanes.

**UAVs Outside the Box**

Gen. Ronald R. Fogleman, then–Air Force Chief of Staff, said that in the long-range planning process that led to the creation of the Air Force’s new “Global Engagement” doctrine, RAND Corp. produced a study asserting that the Air Force “can no longer ... spend money the way we have been.” Fogleman said he wanted Air Force planners to think “outside the box,” and part of that mandate was to explore emerging technologies “such as UAVs.”

UAVs can be cheap because, without the need to carry life support, instruments, and escape systems for a pilot, they can be any size and can stay aloft or violently maneuver far beyond the limits of human endurance. The absence of aircrew cuts significantly into life-cycle costs.

Missions already being flown by UAVs include point reconnaissance, long-duration surveillance of platoon-size units and headquarters, and real-time imagery of forces on the move, in all weather. UAVs are expected to adopt soon many of the missions now flown by the SR-71 and U-2 in the realm of fast-response, long-range observation of wide areas.

In addition, the Defense Department now has on the drawing board or is testing new types of UAVs that can laser-designate targets, conduct Suppression of Enemy Air Defense missions, and attack heavily fortified, high-value targets with enough speed and stealth to survive and fight again another day. These lethal types are known as UCAVs, for Uninhabited Combat Aerial Vehicles, or UTAs, for Unmanned Tactical Aircraft. Some said that the US is spending almost as much on these classified, combat UAVs as on unclassified reconnaissance models.

Despite what Israel acknowledged is a “dotted” past for UAVs, the armed services continue to have faith that they will indeed prove out as force multipliers, and they anticipate developing a significant dependence on unmanned systems in the future.

The UAVs will feed live information to other sensor platforms and to ground stations where the data will be collated and forwarded to headquarters. They can provide uninterpreted imagery directly to troops on the ground or pilots in the cockpit for a real-time update on enemy activity. They will look over hills, observe staging areas, and serve as radio relays and target designators, providing unprecedented visibility of the battlefield or areas of interest.

In a recent interview, Israel dis-
played a chart describing two dozen drones that are currently in the inventory or are serving in an evaluation or test capacity. Of the UAVs in the pipeline, he said, “It looks like a lot.” He noted, however, that, despite the efforts of the last 15 years to get UAVs fielded, only a few have actually seen action.

**Flip-Flop**

The general explained that UAV work represents roughly 30 percent of DARO’s overall budget, which also funds operations of the SR-71, U-2, and RC-135 Rivet Joint aircraft. He anticipates, however, that the division between “evolutionary” programs such as the manned systems and “revolutionary” efforts such as UAVs may “flip-flop” in the next few years, with as much as 75 percent of DARO’s budget going to UAVs and their sophisticated ground stations and sensors.

Israel noted that Army Gen. John Shalikashvili, the Chairman of the Joint Chiefs of Staff, has instructed the Pentagon to “move quickly to evaluate cost-saving trade-offs between manned and UAV reconnaissance systems” and that this has created tensions.

“We’re having a tremendously intense debate about what we are going to do in this country in terms of our UAV technology,” he said, adding that UAVs will compete with manned systems as well as satellites for money and missions. The issue is of great importance, given the military’s high emphasis on precision guided munitions. “This area of Intelligence, Surveillance, and Reconnaissance is something we better get very serious about,” Israel asserted.

The Senate Appropriations Committee, in a draft of its report on the Fiscal 1998 defense spending bill, said the Pentagon has put too much emphasis on UAVs, at the expense of manned systems like the RC-135, U-2, and SR-71. The Senate panel said it was “discouraged” at the slow progress of UAV development and believes that needed upgrades to manned, “proven systems ... have been consistently sacrificed for almost 20 years’ worth of yet-to-be realized” UAV potential. The subcommittee said it is “time to review DoD’s entire UAV strategy.”

Israel believes that the UAV debate will have profound impact on all other systems. “If you do it right, you can have an impact on the [size of] the inventory of munitions, on what kind of airplanes you buy, and how many you buy.” Such thinking is behind the Pentagon’s plan to invest at least $3 billion from Fiscal 1997 through Fiscal 2003 on UAVs dedicated to ISR.

At the low end of the UAV spectrum is a family of “tactical” vehicles, which includes Pioneer, Hunter, and Outrider.

Hunter, built by TRW, was to be the common short range/tactical UAV for the Navy, Marine Corps, and Army, but development problems caused the Pentagon to pull the plug on the program after seven systems were delivered. The paid-for Hunters were put into storage, but some have been taken out and flown to test sensors and operational concepts as a generic UAV.

Due to the delays caused by terminating Hunter, the Pioneer system will get modifications and spares support for another seven years of service to bridge the gap to the new system, dubbed Outrider, built by Alliant Techsystems. The Outrider—a stubby airplane with joined wings—will fly at 15,000 feet, take off and land on dirt strips, have an electro-optical and infrared sensor with an option for synthetic aperture radar in the future, an endurance on station of three to four hours. It is flown remotely by an operator at a joystick-style console. The contract demands that the cost per unit be reduced to $300,000 by the time the 100th air vehicle is built. Due to problems in the program, a decision to go ahead with full production has been delayed until later this fall.

In the midrange of UAVs is the Predator—dubbed the Medium-Altitude Endurance UAV—which is now moving into full production. The Predator’s altitude is 25,000 feet, with a range of 500 nautical miles and an endurance of about 20 hours on station. More than 60 air vehicles are planned, with production stretching beyond the turn of the century. Built by General Atomics, Predator has been an indispensable source of imagery in Bosnia, its electro-optical, infrared, and synthetic aperture radar sensors providing proof of Serbian heavy weapons movement in violation of agreements. The Air Force was assigned operational control of Predator last year, taking over from the Army, but the Navy supervises the program and its funding. Predator is flown remotely by a rated pilot at a cockpit-like console.

**Tier III Spin-offs**

Early in the 1990s, the Pentagon
attempted to develop a classified, high-flying, large-payload, stealthy, autonomous, modest-cost UAV to eventually substitute for the U-2 and SR-71. Known as Tier III, the program proved too great a challenge, and the requirement was broken down into two segments.

The top half of the high-altitude/endurance segment, called Tier III Minus, is the Lockheed Martin DarkStar. The vehicle, which looks like a flying saucer with its wings on backwards, will fly at over 45,000 feet and have either electro-optical or synthetic aperture radar sensors. With a range of over 500 nautical miles, DarkStar will be able to fly surreptitiously over hostile territory and remain there over eight hours. The prototype DarkStar crashed on its second flight due to the flight control system not adequately dealing with ground effect, but fixes have been developed that are expected to prevent the problem from recurring. The DarkStar flies autonomously from takeoff to landing, assisted by the Global Positioning System.

The second segment, known as Tier II Plus, is the Teledyne Ryan Global Hawk. Intended as the long-range, high-altitude reconnaissance “workhorse,” the Global Hawk flies higher and faster than DarkStar, with a heavier payload, but is not as stealthy. Global Hawk has a range in excess of 3,000 nautical miles at 65,000 feet, with an on-station endurance of 24 hours. Comparable in size to the U-2, it will have EO, SAR, and IR sensors. Both systems will get a two-year shakedown. For now, plans call for building a total of four DarkStars (which includes the crashed vehicle) and five Global Hawks, down from six and eight, respectively. Both systems use common ground stations, of which two will be procured.

While Israel admits that UAVs have had a checkered history, he believes they will prove well worth the cost of the false starts, but the nation needs to “move from words to deeds.” That is exactly what is happening at Indian Springs, where Predator’s introduction to the force is proceeding.

Where It Begins
Lt. Col. Steve Hampton commands the 11th Reconnaissance Squadron and believes his unit will serve as a “prototype” for the UAV organizations that will follow. Running a UAV squadron is “structurally and philosophically the same” as running any other flying organization, he said.

“Our charter is to normalize the UAV business,” he said. “We continue to work hard to make the rules [of the UAV squadron] look the same” as those in a typical squadron.

“In deployments, we are remarkably similar” to a manned aircraft squadron, he noted. “We file flight plans, get NOTAMs [Notice to Airmen], take weather briefs, ... and we go onto the ATO [Air Tasking Order] like everyone else.”

He is quick to dispel the common notion that UAVs are little more than radio-controlled model airplanes.

“There’s no mistaking this for a remote-control toy,” Hampton said, noting the substantial size of the Predator and its track record in deployments to Albania and Hungary for reconnaissance over Bosnia. Predators became such a problem for Bosnian Serbs that they shot down one.

Hampton’s pilots are mostly hand-picked aviators with experience in everything from F-16s and KC-135s to E-3s and U-2s. They “fly” the Predator from a van containing the pilot, enlisted “payload operators,” and “data exploitation” personnel, who analyze and pass along the imagery received. The pilot sits at a console which resembles the F-16 cockpit and has vision straight ahead through a TV camera. The airplane is not inherently hard to fly, but the limited visibility to the sides and overhead makes for “a bigger challenge, in some ways,” than flying a conventional airplane, Hampton said.

A single Predator “system” consists of four airplanes, the van, generators, and an Army-derived intelligence distribution system called “Trojan Spirit.” It can be deployed in a C-130. At Indian Springs, Hampton is running training with three airplanes and one ground control system. In the deployment to Taszar, Hungary, two airplanes and a GCS were involved.

The final buy of Predators is still being determined, but there could be as many as 48 vehicles and 12 systems under current planning.

Asked what kinds of lessons have been learned from Predator that can be applied to DarkStar and Global Hawk when they come online, Hampton said more thought must be put into the transition from a technology demonstrator to a serving airframe.

Also needed is a clearer understanding among the services of what Predator is and does and who can task it, Hampton said.

Tactics are changing for Predator, also, Hampton noted.

Trapped
“At first, we fell into the trap of ‘reporting the news,’” he said. “We were on the ‘scene of the crime,’ showing what was happening.” While that was
dramatic, “I’ve realized ... our job is to ignore that, go over the horizon, and find out what’s not happening yet. ... We were showing the warfighters what they wanted to see, rather than what they needed to see.”


A number of battlelabs were created earlier this year to look at innovative ideas that could, without much expense, improve the effectiveness of the USAF. Not intended as system development organizations, the battlelabs look most closely at operational changes or “off-the-shelf” hardware that could benefit their areas of concern.

The UAV Battlelab was located at Eglin AFB because “we wanted to tap into the good ideas” that arise from the testing and training that goes on there, Grasso said. Before the battlelab, “there was no conduit” for such ideas to go up the chain of command. The test infrastructure already at Eglin also played a role in the selection.

In addition, the Air Force wanted to separate the battlelab from the UAV squadron so that the squadron was “not distracted” doing experiments for the battlelab. “We can’t task them to do anything,” Grasso said. The battlelab will have 25 people, in order to stay “small and focused,” he added.

The battlelab will “demonstrate a new capability, report what we found, and make a recommendation to the corporate Air Force” on whether the idea should be implemented.

Grasso said his organization has been “looking around for opportunities” to do UAV experiments with “surrogates; ... you don’t have to have a UAV for some concepts.”

He may be able to use Hunter vehicles for a demonstration, or he may turn to some of the target drones at Eglin—like the QF-4s, QF-106s, and BQM-34s—or he may simply use manned aircraft based at Eglin, like F-15s, to “fly around and act like you’re unmanned.”

Among the first experiments the battlelab will conduct will be the use of UAVs to conduct surveillance around the perimeter of an Air Expeditionary Force base. “Force protection is hot right now,” Grasso said. The experiment will be conducted jointly with the Force Protection Battlelab.

Some of the first things to be looked at for greater use of UAVs will be “basic enabling” technologies—such as collision avoidance equipment so UAVs can work on more ranges. Later on, it may be possible to use UAVs in a “hunter-killer” role in the Suppression of Enemy Air Defense role.

“You would use the UAV as the hunter with a precision locator ... and hand off the target to an F-16 with the HARM Targeting System,” Grasso said.

The Air Force Requirements Office has said it plans to begin development of a SEAD-capable UAV in 2001, with a deployment as early as 2004.

**Industry Interest**

Industry has been working hard to develop concepts for UCAVs. Various companies have shown off artists’ concepts of UCAVs performing in all manner of roles but mainly in the stealth/precision strike role. Unfettered by the need to stay within the physical limits of a human being, such aircraft could pull 20-g turns, fly upside down for extended periods, and take on missions no human pilot could endure.

After reconnaissance, “I think the next area that starts to make sense for UAVs is some sort of unmanned attack airplane,” Fogleman said. “Something that can carry a load of ordnance over a distance, to go ... precisely attack a target.”

He envisions “a truck-like vehicle, whether it’s stealthy or unstealthy ... that can leverage the tens of thousands of cheap Joint Direct Attack Munitions that we’re going to have in the inventory” over the next 20 years.

Grasso sees the UCAV as “off in the distance.” He said, “We could go demo next year, ... dropping precision munitions off a UAV. But a lot of people have to be convinced” that it would be safe to put bombs in the “hands” of robots.

“There are a lot of command and control things to work through,” Grasso said, to give war planners the confidence that a robot airplane would have the same caution about dropping ordnance in the right place as a human being, and that may be “some time off, yet.” Some, like Hampton, argue that day is not that far off.

However, Fogleman noted that for UCAVs to become a reality, “You’ve got to put a surrogate brain in that airplane. And that’s not going to come cheaply or easily.”