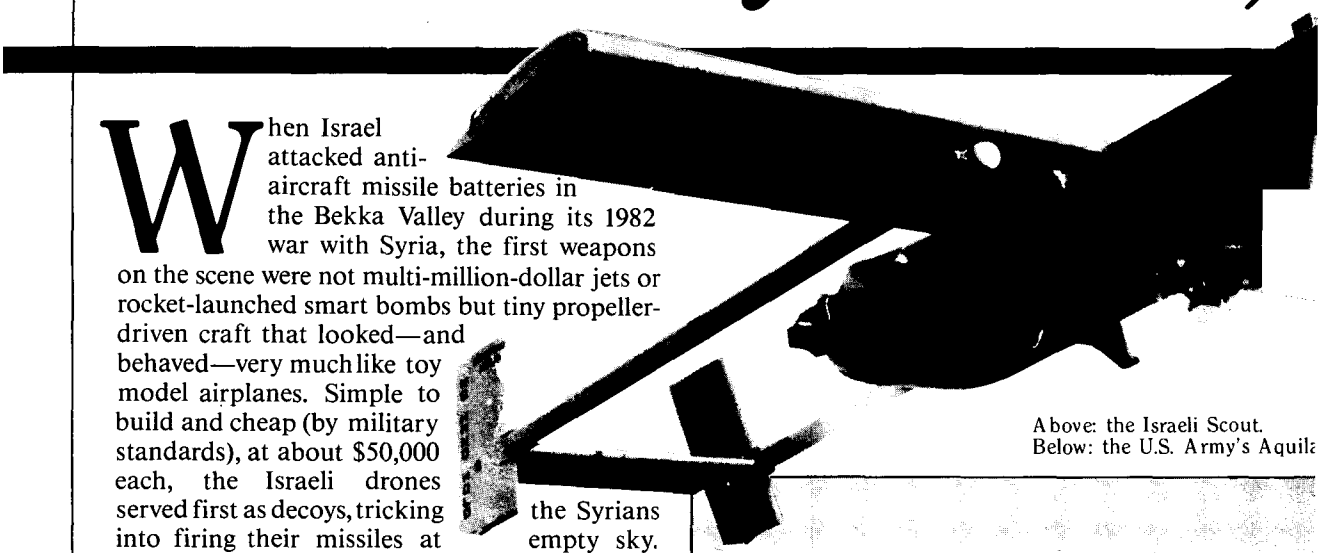
The future of air battle may lie in planes that operate without pilots. But the U.S. Army can't build them as quickly or as cheaply as th

The Army's $800,C



Above: the Israeli Scout.
Below: the U.S. Army's Aquila

When Israel attacked anti-aircraft missile batteries in the Bekka Valley during its 1982 war with Syria, the first weapons on the scene were not multi-million-dollar jets or rocket-launched smart bombs but tiny propeller-driven craft that looked—and behaved—very much like toy model airplanes. Simple to build and cheap (by military standards), at about $50,000 each, the Israeli drones served first as decoys, tricking the Syrians into firing their missiles at empty sky. Then, with the Syrians' radar at full power, Israeli ground forces launched radar-seeking missiles towards the batteries. Meanwhile other little drones with television cameras were circling, unnoticed, around Syrian positions. As Syrian forces moved to defend the missile installations, Israeli commanders were able to see exactly what was coming. By the end of five days' fighting, 54 Syrian aircraft and 19 missile batteries had been destroyed; only one Israeli plane was lost.

A year later, aircraft from the carriers *John F. Kennedy* and *Independence* attacked the same installations. Two American planes went down. No combat drones were employed because the U.S. military doesn't have any.

Not that it isn't working on them. The U.S. Army has been trying to build a model airplane for nearly a decade; its drone project, called Aquila, began in 1974 and at present is scheduled to produce an operational unit by, perhaps, late 1987. And so far the Army has managed to hold the cost of its model plane to a mere $830,000.

Gregg Easterbrook is a staff writer for The Atlantic *and a contributing editor of* The Washington Monthly.

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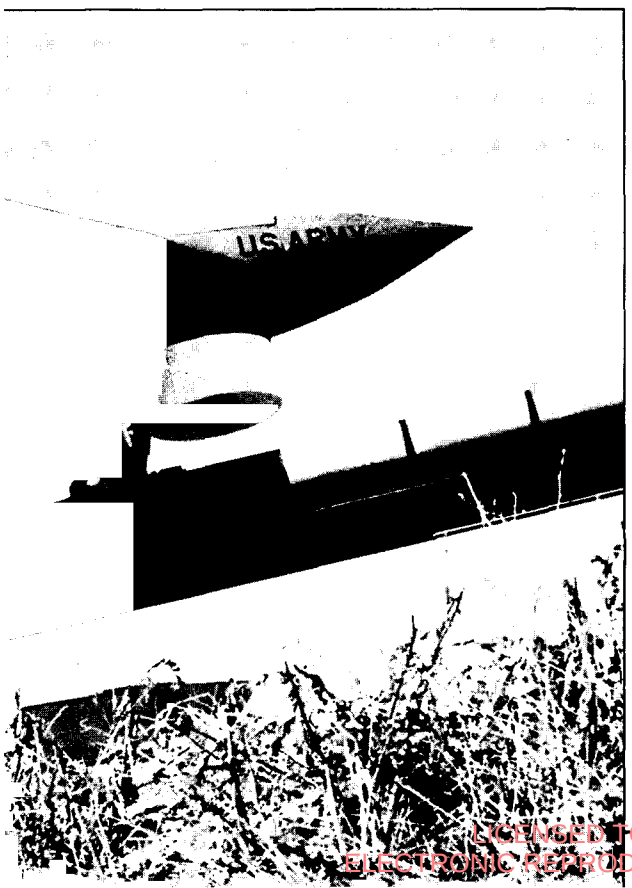
)0 Model Airplane

By Gregg Easterbrook

The Israeli drone project began just a year earlier. But operational drones were in the hands of Israeli Defense Force commanders by 1978. Initial development of the drones cost an Israeli company about half a million dollars; so far the Army has spent $590 million trying to develop drones. Total development costs for an improved drone Israel uses today are estimated at $30 million; the Army now says that by the time it fields Aquila it will have spent at least $1.1 *billion* on development alone. (There is more money in next year's budget for research on Aquila than for the Air Force's Advanced Tactical Fighter project.) Overall, Aquila's costs have risen some 433 percent in the past five years and now stand at $2.44 billion. But never fear, the General Accounting Office notes that the real cost will be "substantially" higher.



Why can't the Pentagon build a model plane? And why is there such a drastic difference in price between U.S. and Israeli versions of a simple, straightforward idea? One designer of Remotely Piloted Vehicles (RPVs) closely connected with Aquila put it this way: "The Israeli military is interested in defending their country. The U.S. military is interested in defending their budgets." What happened to Aquila is a case study not only in how to increase defense spending without improving readiness but also in how outside designs and innovative ideas that don't fit smoothly with territorial imperatives will be ignored—until it's too late.

Aquila Sunrise

Israel's RPV program began with an American engineer named Al Ellis, who today lives on a sailboat in a California harbor but who was, when the 1973 Middle East war broke out, living in Tel Aviv. Ellis convinced an Israeli electronics firm, Tadiran, to let him build a model airplane that would carry the Sony Minicam, just developed for television news crews. There was little enthusiasm for Ellis's idea among Israeli army officers, but since a prototype could be assembled for minimal cost, Tadiran went along. Within five months Ellis's RPV was flying, sending back pictures of ground that was miles away or behind hills. Tadiran called its product the Mastiff; soon Israeli Aircraft Industries, to which

Ellis initially had proposed the idea, was building a competitor, the Scout. The Israeli military ordered some of each and had them in the field by 1978. Both drones looked like something your cousin Burt would enter in the high-school science fair—cobbled together from model aircraft parts and store-bought electronics, riveted and welded by hand, with bicycle training wheels for landing. But they worked.

Ellis says there is a simple explanation for how his drones were built so quickly and cheaply. "The key to my success was that the company I was working for had absolutely no knowledge of mini-RPVs. They were an electronics firm. So they gave me complete control and said take it, run it any way you want." Thus Ellis was able to work without specifications, guidelines, or regulations. "When I wanted to hold a test flight, I held one," Ellis said. "I didn't have to notify 30 generals, and I didn't have to file flight plans." Most important, Ellis had no army officers hovering over him, making mischief. "Occasionally some colonel would walk in and say, 'Gee wouldn't it be nice if this could . . . .' I'd say, 'Out! Get out!' and I had the authority to throw him out. In military-run projects everybody's trying to get his own two cents in, and pretty soon your weapon has been designed by a committee." Contractors, Ellis added, usually let themselves off the hook by rationalizing, "If the customer is dumb, that's his problem. Give him whatever he wants."

Shlomo Nir, a Tadiran executive, notes that military procurement projects in Israel differ from those in the U.S. in an important respect: they are privately run. "Here the government doesn't have enough funds to invest in development," Nir said, "so they prefer to let private companies work on their own. Then they decide what to buy. In the case of the Mastiff we got it finished so quickly there was no time for the military to add frills."

In other words, Israel doesn't have enough money to build weapons wrong.

In its early stages, the Aquila program was following the same principles. The initial work was done in 1974 and 1975 by a small company called Developmental Sciences Inc. DSI was thrown together hurriedly in the early 1970s by Gerald Seemann, then an engineer for McDonnell Douglas, and Gordon Harris, a Cal Tech engineering professor. Harris was sitting on a government panel that was trying to think of a company qualified to do a drone feasibility study. No one knew of such a firm, so Harris said, "Why don't we give a contract to Developmental Sciences?" The panel approved, even though it hadn't heard of the company—not surprising since it wasn't formed until later than night.

DSI formed a joint venture with Lockheed and won the first Army contract to build Aquila experimental vehicles. It built 38 through early 1976 and also went to work on an RPV design of its own, which, the company thought, would eliminate some flaws—mainly a very high price and a needlessly small payload—that were creeping into the Aquila program. In 1979 the Army asked for bids on fullscale Aquila production, estimating a program cost of $563 million. Lockheed dropped DSI as a partner as well as several small-business subcontractors, hoping to get all the work itself. DSI asked for a "fly-off" between its drone and Aquila—a full-scale competition between two working prototypes built by two competing companies. The Army refused; the Pentagon dislikes fly-offs because, with annoying regularity, the wrong guy wins. Lockheed took over on a sole-source basis and DSI was out.

Soon costs were rising, complexity was increasing, and deadlines were slipping. When Aquila might have been used over the Bekaa in 1983 it wasn't ready; instead an American pilot died.

Van Versus Caravan

Aquila had trouble just getting off the ground. Its main functions—reconnaissance and "real time" battlefield surveillance, meaning obtaining information on what the enemy is doing right now—were in competition with another Army project of the mid-seventies, SOTAS. SOTAS was to be the Army's answer to AWACS—a large, long-range radar surveillance system borne by helicopters. Although it would have been extremely expensive to build and, in combat use, very vulnerable to jamming and attack, SOTAS (and a successor system called JSTARS) enjoyed considerable support in the Army's upper echelons because of the image of technological glamor it would project. Then along came another idea for battlefield surveillance: cheap, small, silly-looking model airplanes. Take a wild guess as to which the Army went for.

Little pilotless airplanes were being resisted also by other parts of the Pentagon for other reasons. David Packard, deputy secretary of defense under the Nixon administration and a noted innovator, was pushing for rapid construction of several types of RPVs; the closest he came to success was the cruise missile, which can only follow a pre-set course and can't be "flown" like

Aquila or Mastiff. "The military is factionalized into different groups that only want to push their programs," Packard said in an interview. "There are the carrier admirals, the submarine admirals, the battleship admirals, and so on." Most potential drone missions fell outside any existing bureaucratic categories, a stiflingly strict system known around the Pentagon as "roles and missions."

Obviously the Air Force was frightened of what it saw as a long-term threat to its pride, the piloted plane. But drones represented a short-term threat as well; they might take away Air Force roles in reconnaissance, communications relay, electronic warfare, and ground attack. Dr. William Graham, a retired RAND Corporation analyst, who organized the first U.S. military conference on RPV use in 1972, says that Air Force opposition was intense. "If you are a halfback and somebody proposes the one-back offense, you get very nervous," Graham noted. "You start trying to make up rules about how there always have to be two backs." The Navy saw drones as a threat to its helicopters; a high priority was to put helicopters for reconnaissance and antisubmarine warfare on nearly every fighting ship, right down to destroyers and frigates.

Even in the Army, the service that stood to benefit most from drones, there was considerable opposition. Besides worrying the SOTAS/JSTARS faction, RPVs worried the attack helicopter supporters: the $9 million AH64 Apache helicopter this group longed for was designed mainly as a "platform" for launching antitank missiles. If drones could carry such missiles at a fraction of the cost, the Apache would be in trouble. So would light observation helicopters, of which Army Aviation wanted a new "generation." If the drones could be used also as weapons, a wide array of extremely expensive aircraft- and missile-launched smart bombs being developed under a program called Assault Breaker would be imperiled. So a two-pronged strategy was developed: delay the drones as long as possible and also make certain that, if they cannot be stopped, at least they will no longer be cheap.

Aquila has been doing well on both counts. Besides being slow to take form—only this past April did it make its first flight with a stabilized TV camera that can swivel, a feature Israeli drones had five years ago—it has grown complex and therefore increasingly expensive. Ellis's drone was accompanied by a Ford van that contained a control station; Aquila travels with a caravan that includes a catapult launcher truck, a recovery truck with a net, a control truck, and an antenna station. The recovery truck alone costs $500,000 but enables Aquila to meet what has become a standard U.S. military specification—the ability to operate anywhere in the world under any conditions. The net truck means Aquila can land even if there is no open space in the area; Israeli drones avoid this expense by using a very simple arrester hook when space is short. "How often are you going to be in a situation where there literally is no patch of flat ground anywhere to be found?" asked an engineer close to Aquila. "No runway, no road, no field. Once in a lifetime will you have that situation, and when you do, just let the drone crash. If it cost only $50,000 to begin with, who cares if it crashes? Of course if it cost a million dollars. . . ."

Why can't the Pentagon build a pilotless plane as well as the Israelis can? "The Israeli military is interested in defending their country," explains one designer working on the Army's Aquila project. "The U.S. military is interested in defending their budgets."

Less Is More Expensive

While the Israeli drone may look like a science fair project, Aquila looks like something Darth Vader would launch from the Death Star; it has been worked over from the original designs to give it the kind of zoomy, menacing silhouette generals and George Lucas like.

"Early in the project, when the prototypes were very cheap, we had a few crashes," said a source

involved with Aquila. "Army inspectors came in and said, 'You're using model airplane parts! You can't do that. You have to use mil spec [military specification] parts.' So we started switching from parts that cost a few bucks each to parts that cost thousands of dollars each, and not only did the price soar, but the prototypes became so expensive we were afraid to fly them." In fact when the Army this year decided to request full production authority for Aquila, it did so after just 17 test flights, one of which ended in a crash; this for a system that is supposed to be able to operate hundreds of times reliably under the most adverse conditions. At this writing, a total of 42 tests have taken place (all under the control of Lockheed engineers, not the regular Army troops who would use Aquila) and seven have been classed as failures.

The View from Behind Zio's

Off the spongy asphalt parking lot of a suburban shopping mall in Gaithersburg, Maryland, squeezed in next to a lamp store, an interior decorator, and Zio's Greek Restaurant, is the headquarters of Optelecom, a small electronics engineering company. Optelecom exists on the fringe of Pentagon tolerance; its engineers are mavericks, free-spirited, and opinionated. One has Sierra Club posters on his office wall next to aircraft indentification charts. Another is Dr. Gordon Gould, one of the men credited with inventing the laser beam. Optelecom's current interest is in changing the Army's plans for remotely piloted vehicles. Like much of the innovative end of the drone business, its offices, and its projects, have a Saturday-morning-tinkering-in-the-garage flavor. They also might work.

Optelecom's president is William Culver, a former RAND Corporation and IBM engineer who, in 1972, the year drones became a subject of discussion inside the Pentagon, decided to strike out on his own. Since then Culver has been trying to sell the military, and defense contractors, on two ideas: fiber-optic communications instead of radios, and cheap kamikaze drones instead of multi-million-dollar smart bombs.

A significant portion of the delays and cost escalation in the Army's Aquila program can be traced to its radio system, called MICNS. Radio communication may seem, to anyone who has experienced the smallness and phonic quality of a $59 Sony Walkman, the simplest part of any military task. But on the battlefield, it is not. During combat hundreds if not thousands of radios on both sides will be broadcasting on overlapping frequencies, creating electronic chaos; in addition, jammer systems will be operating on both sides. For a tiny remotely piloted plane, which must stay in constant contact with its base in order to be "flown" and to send back information, communication is a high priority.

The Army's answer, MICNs, is an ultra-tech response to the task—a rotating, high-gain antenna and a high-powered radio set aboard the drone. The radio alone, according to the GAO, will cost $60 million to develop and will add greatly to the cost of each Aquila, since the flying part of the system must carry it. And so far, MICNS doesn't work; its capabilities are so limited that, a GAO report says, the Army "may simply lower the anti-jam specifications and accept the lesser performance."

Culver advocates instead fiber optics of the type now being used to replace wires in telephone cables. Using light as their medium, fiber-optic strands can carry thousands of times more information per size and weight than wires can. Also, they require very little power. Optelecom envisions drones with spools of fiber strands that "pay out" as they fly, like kites on strings. Such drones would be much cheaper, since all the communication hardware would be in the ground station, not on the vehicle, and jam-proof, since there would be no use of airwaves. The strands weigh next to nothing; Culver believes the drones could fly 15 miles or more under realistic conditions without their electronic tails becoming a problem.

His company has done some fiber-optics research on contract to the Army, but as yet, little has come of the work. Optelecom bid for one contract to test fiber spools for reliability but lost to Hughes Aircraft. The controversial issue of this contract was what technique would be used to pull the fiber off the spools at speeds simulating the flight of a missile. Optelecom hand-fabricated an original device that combines an industrial electric motor and two flywheels; it fits on a desk and costs virtually nothing per test run. Hughes proposed using rocket sleds at the White Sands, New Mexico proving grounds to pull the spools, at a cost of $25,000 per test. Hughes won.

"Ours wasn't expensive enough or big enough to look like a military facility, so the Army wouldn't touch it," Culver said. At Optelecom's office the spool-tester sits in a cramped back hall; when it runs, company engineers open a delivery door and let the fibers spill into the alley behind Zio's. "Can you imagine bringing a general or congressman in to have his picture taken next to this?" Culver asked.

Culver's other obsession, the kamikaze drone, is getting equally lukewarm attention. Partly because

Besides the tyranny of mil specs, there are other inflexible Pentagon requirements plaguing the project. The Army decided that Aquila had to be extremely small and imposed a weight limit of 240 pounds; so far the vehicle is 20 pounds overweight—a problem when the overall weight is low. Shrinking components to meet the weight limit has of course made them more costly. "The insistence on micro-miniaturization is the biggest single reason Aquila is so much more expensive than everything else," says Gerald Seemann, president of DSI. The Army, for instance, has just set aside $80 million to develop an infrared night-sight package tiny enough to fit in Aquila.

The weight specification was written despite the fact that there is no indication RPVs need to be so small. Israel's drones are larger and DSI's drone, Sky Eye, weighs nearly twice as much as

it would be cheap: "I've talked to several missile manufacturers about this and they all ask me, 'Why can't you make it cost more?' One vice president of a big missile company came here to visit and said, 'We can't afford to make a cheap missile.' " Partly because it fits no Pentagon organizational slot: "If you're going to disturb the present roles and missions of the United States Army," Culver noted, "they simply do not want to hear about it."

Optelecom proposes an antitank kamikaze RPV with a television camera, a warhead, and a fiber-optic link to a "pilot" miles away. This vehicle would cruise over battlefields at a relatively slow speed, 200-300 knots, slow enough that its operator could spot tanks on the ground; yet fast enough, considering its small size, that it would be difficult to shoot down. Once the target was picked, the drone would dive in and explode. Followers of military procurement follies will recognize that this scheme bears a haunting resemblance to the TV Maverick missile, which failed even in the most carefully rigged tests. But Culver insists there is a difference. TV Mavericks are carried into battle by attack aircraft, whose pilots must scan the battlefield, aim the weapon, and launch it, all the while dodging opposing fire; then the missile's computer takes over, trying to guide it in by analyzing television images of what the pilot last saw.

An antitank kamikaze controller, on the other hand, would have no distractions over his personal safety, since he would be seated miles away from the scene: no matter how skilled and courageous a pilot may be, it is impossible for him not to worry about his own rear end, or about bringing his vastly expensive aircraft home, while hurtling towards people with guns. Since the drone would be guided all the way into the kill by human beings—something as simple as the difference between a tank and a jeep is obvious to every soldier, but costs millions to teach to machines—it would, Culver says, be far more effective than Maverick.

Weapons of this nature would also pose a never-ending threat to Russian forces. The Army's present main antitank weapon, the TOW missile, has only a two-mile range and must be fired by troops with a clear view of their target. This means that soldiers may fire a few missiles, but then they must run, because by firing they have revealed their position to other tanks. Kamikaze drones, coming out of nowhere, could dribble in all day long, like artillery shells, destroying what they hit and driving those they miss mad with fear.

Some official research into this idea has been conducted by the Army's Missile Command at Redstone Arsenal in Alabama. The Missile Command envisions a kamikaze weapon that would be rocket-launched, but otherwise would behave like an RPV—it would have wings, fly slowly, and be able to circle around a battlefield looking for targets. According to Dr. William McCorkle, the Missile Command's director, so far there has been Pentagon resistance to the idea. "We took this proposal to some high Army officials," McCorkle said, "and they immediately fell into arguing about which branch would get it." An effective antitank drone would jeopardize several treasured Army and Air Force systems: among them the Air Force's $125,000 jet-launched "imaging" Maverick missile; the Army artillery division's laser-guided Copperhead homing shell and its plans for an extremely expensive new homing shell called SADARM; the Army aviation division's expensive new AH64 Apache and its $39,000 Hellfire laser missile.

"Army Aviation in particular is not enthusiastic," McCorkle said, "because if you can do all this with cheap drones, why should you have attack helicopters?" McCorkle estimates the kamikaze—presently known by the unlikely name, FOGM, for fiber-optic guided missile—will cost between $10,00 and $20,000 each. "A lot depends on whether we can get the Army to let us leave some of the fancy stuff off," he added.

Aquila, by the way, will carry a Hellfire/Copperhead "designator" package, which is supposed to allow it to guide those weapons by circling around a target while focusing a laser beam on it—a maneuver far more complex than a kamikaze dive. But one that plays the role and fits the mission.

—G.E.

Aquila. All the drones are still small enough to be very difficult to see with the naked eye, and, because they are made of a composite plastic that is a poor radar reflector and their metal parts are surrounded by microwave-absorbent foam, they are nearly invisible to radar. But once set, a military specification acquires a life of its own. "When I was designing my drone I didn't even have a weight goal, let alone a limit," Ellis said. "I thought, whatever it weighs, it weighs. What difference does it make as long as it works?" DSI's drone, which the company is selling on the international market, is now available with the type of night-sight instrument the Army won't have for another five years and $80 million. The Army uses a Texas Instruments unit that does the same thing but weighs a few pounds more than the Aquila's spec limit.

Along the way, Aquila's operating procedure has changed. The drone originally was to be used as Israeli drones are used, accompanying troops into the field and being launched near the area of battle. Recently, however, Army brass decided to transfer it to behind-the-lines operation. The drone will be launched from a "centralized" site under rear-area controllers and then "handed off" to forward control. This means that not only will each flight require at least two "pilots"—and two sets of control stations, the most expensive part of the system—but a complex realignment of the Aquila's high-gain antenna must be made twice during its flight (once going out, once coming back). Such antenna "acquisitions" have proved tricky even for space probes supervised by dozens of scientists; under combat conditions, with confusion rampant and radio-jamming a threat, they could be Aquila's undoing, a GAO report recently warned. The Army has yet to conduct a test flight of this complicated feature; it has run only tests in which ground technicians try to acquire an airplane which is "simulating" Aquila. In other words, an essential part of the project, without which Aquila will be useless, has never been tested *at all*. (Nor have any of the 42 flights included an actual test of the laser target designator which constitutes roughly one half of Aquila's reason for being. The laser designator has been tested "on a laboratory basis only," a knowledgeable Army officer involved with the project says.)

But the new operating procedure is a boon to the Army's hierarchy. It transfers command of Aquila from battalion-level officers at the front to desk-bound division-level officers—generals—reposing in the rear. As part of the change the Army announced that the total number of Aquila RPVs to be purchased would be cut almost in half, from 995 to 548, while the number of ground stations—the part of the operation that doesn't do anything—would be increased.

Samurai Drones

While Aquila flounders, other ways of using RPVs are drawing little attention around the Pentagon because they menace the theocracy of roles and missions. Aquila was placed under the authority of the Army's artillery school at Fort Sill, Oklahoma, which means its payloads are designed primarily for artillery-related functions (surveillance, target designation) and its range has been limited to 50 kilometers, 30 kilometers being the maximum range of artillery. Far more flexible designs would be possible—the Israeli drones and the DSI Sky Eye are each designed for a wide variety of operations, operations that would be in the national interest but not in the interest of Aquila's sponsors. "Fort Sill has its own budget, its own fight song, and everything," said William Culver, president of Optelecom, an engineering firm that has done RPV work for the Army. "They are not going to start a project that goes outside their roles and missions, because it might be taken away from them," Culver said, adding, "You must remember that from their perspective this makes perfect sense."

The most promising idea that has received only grudging Pentagon attention is a kamikaze drone that would fly directly into targets and explode. The Army and Air Force have spent billions of dollars trying to develop self-guided smart weapons that can hit targets—especially tanks—precisely. But few of these projects have met expectations, and all have been costly. The main problems with smart weapons are "contrast" and "cognition."

Contrast is the difference between what is being attacked and what surrounds it. Even very sophisticated machines, lacking human intuitive powers, can understand contrast only if the difference between the target and the background is great. Thus heat-seeking air-to-air missiles like the Sidewinder have proved very effective; the contrast between a single 900-degree jet engine exhaust nozzle and an otherwise empty, "cold" sky is easily sensed and grasped by machines. Likewise, radar-guided antiship missiles like the Exocet and the U.S.-built Harpoon are extremely effective because the contrast between a large, slow-moving metallic hulk and an otherwise empty, flat sea is unmistakable. On the other

HOW TO WEAR A SEAT BELT

YOU CAN BE BOTH SECURE AND COMFORTABLE IN YOUR CAR.

It's been proved over and over that seat belts at least double your chances of escaping death or serious injury in a severe accident.

But the freedom of movement allowed by the newer front seat belts has bothered some people. How can the seat belt hold you securely if it appears to have almost no tension?

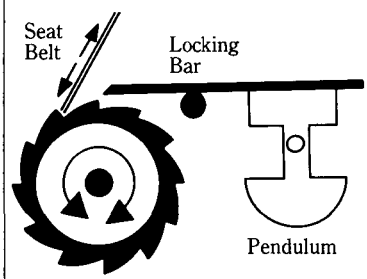
The fact is, the shoulder belt is designed to restrict your movement only in an emergency. In normal situations, you can lean forward or to the side with little pressure from the shoulder belt.

In an emergency, the belts lock up to hold you in place. The inertial reel makes this possible. That's a mechanism as simple and reliable as gravity (as you can see in the accompanying diagram). Inertial reels have been used since the 1974 model year for the shoulder belt in many GM cars. They allow you complete freedom of movement in normal driving. You can turn easily to check traffic or reach to the glove compartment.

Adjusting your shoulder and lap belt. Even the slight tension you feel from the inertial reel is adjustable so there is almost no pressure. Pull the shoulder belt far enough away from you so that, when you let it go, it comes back flat against your chest. Then pull down slightly on the shoulder portion, about one inch, and let it go again.

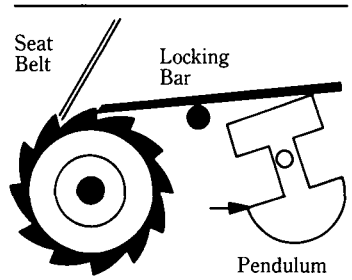
Safety experts suggest allowing no more slack on the shoulder belt than absolutely necessary for comfort. Lap belts should be adjusted snugly as low on your hipbones as possible—not higher where they might damage internal organs in a crash.

How the inertial reel works. *Your shoulder belt is designed to allow freedom under normal conditions, but to lock automatically and restrain you in a collision.*



Ratchet Mechanism

Under normal conditions, *the pendulum and locking bar are in their rest positions. The reel which holds the seat belt is free to rotate. As you lean against it, the belt unreels.*



Ratchet Mechanism

In emergencies, *such as a collision from any direction, the pendulum tilts, forcing the locking bar to engage the ratchet. The reel locks and the seat belt restrains you.*

In a collision, lap/shoulder belts, worn properly, distribute the force across the large, strong bones of your hips and torso. Perhaps most important, belts help keep you from being thrown out of the vehicle in an accident.

What if you are pregnant? The American Association for Automotive Medicine says the dangers of being unbelted in a collision during pregnancy are far greater than the slight chance of injury caused by wearing the belts.

Other advantages of belts. By holding you in a proper driving position, the lap belt provides a feeling of control, keeping you in place on rough or curved roads or in an emergency maneuver. Some people even find that the added support makes driving easier on their backs.

Next time you drive, please take a moment to buckle up. Remember, the seat belt is an effective system to help protect you, and it's already part of your car. Why not think of it as your "Life Belt" and use it.

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hand, heat-seeking missiles designed to attack tanks have not been effective because the contrast between exhaust slats only a bit hotter than the warm ground around them is not great enough for smart weapons to detect, especially when, racing forward at Mach One or faster, they can examine an area for only a few seconds.

Cognition poses a similar problem. "Every six-year-old knows what a 'bridge' is," William Graham noted. "But try explaining it to a machine. You have to load into its memory a picture of every single bridge in the world." Graham said that during World War II the German army tried to disguise temporary bridges by sinking them a foot under the water. "This fooled no one," he said. "Any human being who looked at the scene knew immediately what was going on. However, it would have fooled a smart bomb."

Drones might solve these problems by adding human eyes and understanding to the scene. A

A Revolutionary Approach: Cooperation

Promising military innovations like the remotely piloted drone often are opposed by the services because they don't fit the plan for the most important battle of all—the battle against the other services. During the 1920s and 1930s, for instance, the Navy vehemently fought Billy Mitchell's bombers, and lied, not once but repeatedly, about tests it claimed proved ships could not be sunk from the air. (At one point the Navy bombed the surplus battleship, *Washington*, with what it said were explosives, and when the ship didn't sink, declared victory. Mitchell later found out the "bombs" were sandbags.)

During the 1950s the Army, Navy, and Air Force grappled with each other shamelessly over control of nuclear weapons, and at one point all three services had their own space programs. The Navy and the Air Force seldom leave much money in their budgets for transport ships or planes, since transport would serve mainly Army troops. The Army, in turn, seldom shows much interest in ground defense of harbors and air bases. Sometimes it works the other way around, and good ideas go begging because they do not fall clearly under any one service's jurisdiction. Right now the JVX tilt-rotor aircraft—a cross between a helicopter and an airplane—is stagnating because it isn't clear who should get it, the Army or the Air Force. Tiny kamikaze drones are another idea that could go to either service and, as a result, are going to no one.

Every decade or so the services announce plans to end such infighting, and in late May there came another. General Charles Gabriel, the Air Force chief of staff, and General John Wickham, the Army chief, held a news conference to announce a 31-point "memorandum of understanding" on what Gabriel called a "revolutionary approach" to combat—Air Force-Army cooperation.

The agreement—actually it wasn't exactly an agreement but "the initial step in the establishment of a long-term, dynamic process" that would begin with a bold "study of future realignment of roles and missions"—insures, General Wickham said, that if the U.S. is attacked, "we will go to war jointly." Whew! Good thing war didn't start the day before.

Close reading of the 31 points reveals, however, that the Army and Air Force resolved little or nothing; rather they took some areas of redundancy and split them roughly down the middle:

The Air Force will get future antiaircraft missiles, the Army will get future antihelicopter weapons.

The services will cooperate on development of a common friend-or-foe identification system. Another Whew!

The Air Force gets airborne radar-jamming systems, the Army gets ground-based electronic warfare. And so on.

What's more interesting about the agreement is what it doesn't say. The long-standing argument about air base defense is not resolved; the services merely promise to "jointly develop a plan to resolve" it. Nothing alters the inefficient overlap between the two services' antitank systems: the Army's Apache helicopter, Hellfire missile, and Copperhead shell; the Air Force's A10 airplane and Maverick missile. In fact the "revolutionary" document takes pains to guarantee that the present budget hierarchy will not be disturbed, spelling out both services' right to competing ground attack weapons, and goes on to impose a ridiculously stringent new interservice restriction: A10 airplanes will be allowed to attack only the fringes of a battlefield or 43.5 or more miles behind enemy lines. This is the Army's big plum in the agreement—insurance that the Apache will have a monopoly over fighting tanks at the front—but from a commander's standpoint it is another bureaucratic obstacle to devising creative tactics that will surprise and confuse the enemy, rather than acting out a predictable script on cue.

The memorandum further advances "cooperation" by all but abandoning one of the few interservice programs now in existence, the Joint Tactical Missile, an attempt to develop a big conventional missile that could be either ground- or air-

launched against supply depots and similar targets. It allows the Army to concentrate on its favored approach, MLRS, and the Air Force to concentrate on its favorite, the cruise missile, all the while trying to arrive at a "joint statement of need." Right.

One of the few items on which both services found themselves in hearty agreement was that *neither* would consider an airplane called the Piper Enforcer. This is an antitank plane based on the World War II P51 Mustang, which many military analysts believe would actually make a better ground-attack weapon than jets or helicopters. (The National Guard, for one, issued a report two years ago endorsing it.) Although the Piper Enforcer has performed well in many tests (see "The Better, Cheaper Plane the Pentagon Didn't Want," George E. Hopkins, March 1977), and is now in operational demonstration at Edwards Air Force Base, both services bitterly oppose it. For one thing, the Piper Enforcer was privately developed. For another, it isn't state-of-the-art-gee-whiz technology. But worst of all, it costs less than one-fourth what Army and Air Force antitank aircraft cost.

Also part of the agreement—missed entirely by the press—is a decision to "defer" for at least five years the ambitious Assault Breaker program. Assault Breaker, an idea beloved by many defense intellectuals and endorsed by presidential candidate Walter Mondale, was on paper the greatest do-everything wonder weapon of all time, promising not only to hit enemy tanks far behind the lines but to hit them square on the tops of their turrets, their weakest points. Trouble is, not only did it not work in tests, but if it did work, an Air Force study found, during combat it would cost more than *$1 billion a day* to operate for a *single corps*. To put that number in perspective, the total U.S. defense budget is less than a billion dollars a day. Watch to see if Congress restores funds for Assault Breaker development.

Finally, the Air Force agreed to halt development of the Air Force tank—a gun-and-missile armored vehicle it was designing to defend air bases. General Gabriel says next he will conclude a cooperation pact with the Navy. Will he volunteer to give up *Cobra Judy*—the Air Force's *ship*?

—G.E.

kamikaze RPV designed to attack tanks, for instance, would have a television camera in its nose and would be carrying a warhead. A "pilot" sitting safely behind the lines would be able to perform the cognitive function of telling the difference between a tank and a big rock and steer the drone into the tank, where it would explode. (See sidebar, "The View from Behind Zio's," page 16.) Such a weapon should, in theory at least, be a great deal cheaper than smart bombs. For one, it would fly more slowly; the rocket power and stress-resistance required to build speed into precision-guided missiles is expensive. For another, it would carry no computers or inertial guidance: merely explosives, a camera, and a radio or other link to the controller. Smart bombs are so costly largely because they work by throwing a computer at the enemy.

By the same token, RPV kamikazes would be even more deadly to ships than cruise missiles like the Exocet because the ways these missiles can sometimes be fooled or "spoofed" would never fool a person. A primary ship defense system today consists of projectors that launch a cloud of confetti-sized aluminum chaff as an antiship missile approaches. Sometimes a smart missile's radar will lock onto the chaff rather than the ship, and the vessel escapes. No person viewing the scene would fall for this trick.

Kamikaze drones would have other advantages over smart weapons. They would not have to be "delivered," at great expense and risk, by aircraft; they could fly themselves to the attack point. And being cheaper, they would not have to be perfect. Instead of striving for "kill probabilities" of 100 percent, the Pentagon might instead build lots of cheaper RPVs with a 50 percent chance of success.

This feature would be particularly useful in airfield attacks. Runways have proved the hardest target for smart weapons to hit; flat and nonmetallic, there is scarcely any contrast with the grass or dirt that surrounds them, which makes automated recognition almost impossible. During the Falklands War the British staged three attacks on the airfield nearest the Argentine troop concentration, attacks carried out with their most modern, high-technology, antirunway bomb, under only light antiaircraft fire and no opposing fighters. All three attempts missed.

Yet a reliable antiairfield weapon would be an extremely effective deterrent since it would allow American forces to, in effect, shoot down large numbers of Soviet planes simply by destroying air bases. (This would be especially true in the "scenario" that most troubles NATO planners, that of an all-out surprise attack by the Warsaw Pact countries. Under those conditions—when, presumably, all Soviet planes would be in the air at once—destroying runways could effectively destroy most of the Soviet air force within an hour.) At present the Army and Air Force are working on antirunway weapons of great complexity—terminally guided warheads of special concrete-breaking bomblets, to be mounted on the MX, Trident, or similar large

missiles. Such a weapon inevitably would defeat its own deterrent value because the Soviets would be forced to assume, whatever we might say, that its warheads were nuclear. And it might not work anyway. Even the MX's accuracy could not ensure a hit on a runway, where circular-error factors of perhaps 50 feet would be required.

On the other hand, a kamikaze drone might be able to attack a runway by landing on it. And attack a reinforced concrete aircraft hangar of the type many countries are constructing by landing and taxiing into it.

Ultimately, Graham thinks, RPVs will replace manned aircraft for most combat functions. The reason, he believes, is that antiaircraft missiles will continue to increase in quality and quantity to the point that flying simply won't be safe. "At present there's a relatively small number of missiles and most of them can be ducked by a good pilot," he explained. "But remember, we've been in the missile-building business for only 20 years. Already every air force is afraid to fly at high altitudes, so they are coming down towards the deck. Down there the cheap missiles, like the Stinger, can get them." Missiles, he points out, will always be less expensive than the aircraft they attack, so as time passes they will outnumber aircraft by a greater and greater margin. "They've already made the surface ship extinct, although the Navy won't admit it," Graham said. "Aircraft are next on the list."

It is important to point out that this is not necessarily bad. Why should the country have to build extremely expensive airplanes? And why should brave pilots have to be killed in them? With the cost of an Air Force F15 now nearly $40 million, with the cost of the pilot's training at several million dollars and the value of his life too great to measure, an all-RPV future may be not only inevitable but appealing.

Weinberger Drones On

Since the Army now plans to use its drones in a way that is different conceptually from the way Israel uses drones (after all, the Israeli drone has been a success, so we must take pains to avoid duplicating it), direct price comparisons between Aquila and other RPVs have become complicated. Tadiran says, however, that it would sell a complete field unit—six RPVs, control station, launcher, and spare parts—for about one-half the $10 million a similar Aquila system is estimated to cost. DSI, the American drone company, has taken to selling its products on the international market. (DSI recently made a sale to Thailand and is negotiating with several countries in the Middle East.) Its Sky Eye costs $400,000 per aircraft, compared to $830,000 for Aquila. DSI's Gerald Seemann apologizes for his price. "It's only because I am making the Sky Eye in such small quantities, five or ten at a time," he said. "If I could bid on 500 units, like Aquila, I'd cut the price in half again."

The Sky Eye, Tadiran's Mastiff III, and a similar drone built by Israel's IAI all can do more than Aquila. The Sky Eye will carry a 100-pound payload, compared to Aquila's 60 pounds, and carry it twice as far (or stay in the air twice as long). DSI has fired rockets from the Sky Eye; Aquila cannot carry weapon payloads. (After all, the artillery bureaucracy that is building Aquila would be cutting its own throat if it made RPVs a weapon.) The Israeli drones can carry television

A future in which remotely piloted vehicles have come to replace manned aircraft for most combat functions may be not only inevitable, but appealing. Why should the country have to build expensive airplanes? And why should brave pilots have to be killed in them?

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cameras or photographic cameras, returning the film for processing; TV drones can offer useful clues to what is going on right now behind a hill, but complete reconnaissance will probably always require photography. (Think of the difference in clarity between live television images from the space shuttle's bay and the photographs that come out a week later.) At present, however, Aquila is not designed to take photographs and come back with film. Photo reconnaissance is a jealously guarded preserve of the Air Force, which uses multi-million-dollar jets for the purpose.

The Marine Corps, which originally planned to buy Aquilas, has grown so disgusted with the cost and complexity of the project that it has dropped out and now reportedly plans to buy drones on the open market. But the Army still refuses to consider the lower-priced alternatives now available to its mega-money, takes-forever program. Both Tadiran and DSI have been told that an Army purchase is out of the question. "The trouble with these systems," the Aquila project officer told me, "is that they are basically commercial systems using off-the-shelf technology. They don't meet the Army's requirements." When the Marines moved into Lebanon last year and American jets began to fly reconnaissance patrols over the Bekaa Valley—the patrols that led to the shooting that led to the raid in which the U.S. planes were lost—Israel offered to loan the U.S. some drones so that risks need not be taken. The Pentagon turned down the offer.

Recently, at a news conference with the American Jewish Press Association, Defense Secretary Caspar Weinberger expansively announced that the Pentagon had seen the light and had bought some Israeli drones. The drones, he noted, would go to the Navy, not the Army, although press reports of the event skipped over that distinction.

Weinberger gave no indication how many Israeli drones had been purchased, leaving the impression a major policy shift had taken place. According to informed defense industry sources, however, only a handful of RPVs were involved. The exact number is not available because Weinberger insisted it be classifed—although every conceivable procurement detail of nearly every other American weapon, including strategic nuclear weapons, is available. (A recent article in the industry magazine, *Aviation Week*, mentioned the guidance system warm-up time for the Trident D5 submarine missile, which is on the short list of military secrets actually worth keeping.) In fact, Weinberger went so far as to insist that the price of the Israeli drones be classified.

A classified *price*? For an unarmed drone? Sounds like the defense secretary has something to hide, and he does: in this year's budget request Weinberger has asked Congress to approve, in advance, full production funding for Aquila—even though final testing of the system is not scheduled to begin until *after* the money has been awarded. Ten years of foot-dragging have given way to a sudden rush to hand out the money. When the GAO objected to Weinberger's request for full funding before testing even begins, the Pentagon, an agency report notes, countered by saying that "its Defense Systems Acquisition Review Council that would convene at the July 1985 production decision could be counted on to recommend against the Aquila going into production if it were not ready, even if Congress had appropriated production funds." Like any gardener can be counted on to advise against landscaping, especially if you offer to pay in advance.

And as for Al Ellis, the American engineer who designed the first Israeli drone? The Army has refused to consult with him. "I've offered, but they say no," Ellis says. After all, Ellis only knows about model airplanes. ■

Reagan's Secret Plan to Bridge the Gender Gap

By Art Levine

The White House
1600 Pennsylvania Avenue NW
Washington, DC

TO: The President
FROM: Michael Deaver

RE: Gender gap strategy

Women: you can't live with 'em, and you can't live without them.

That sums up the current impasse between the Republican Party and women, who now comprise 53 percent of the electorate. Opinion polls show that women tend to favor the Democratic Party over the Republican Party by a margin of between 7 and 15 percent, depending on the issue. In 1980, they cast six million more votes than men, and if they continue to distrust Republicans—and you, Mr. President— as much as they do, we're in trouble. What's going on—and what can we do about it?

Our political shop here has outlined a multi-part strategy that lets you take highly visible steps to win women voters back into the Republican camp. We're going to show you as committed to equal rights for women, compassionate, and, above all, sensitive to their needs. I already am! Ask Nancy. R.R.

BACKGROUND

Beginning in the 1960s, a small group of far-left Jewish intellectual women in New York City, led by a disgruntled housewife, Betty Friedan, began complaining about their lot. They argued that for too long women had been treated only as sex objects and "baby-makers." Instead, they wanted a broader choice of options in their life, and to be treated as equals at work and at home. Their anger over traditional sex roles focused on what they saw as "sexist" behavior by men, which included everything from our use of terms like "gal," "chick," or "broad," to aggressive sexual behavior by men. Amazingly enough, many of these ideas have filtered into the general population.

Who? So? What's wrong with that? Can't they like that?

On top of this change of "consciousness," women are a growing part of the workforce and resent the fact that they still earn far less

You're kidding!

Art Levine is an associate editor of Mole, *and a contributing editor of* The Washington Monthly.