Air Force Takes Aim at a Big Bird

The generals are opposed to plans for an inexpensive, fuel-efficient plane that could carry the MX missile

When an expert panel met last summer to consider where to put a new generation of U.S. long-range nuclear missiles, it received hundreds of unusual, unsolicited ideas from the general public. One idea was to put the missiles aboard a fleet of unmanned aircraft flying randomly over the oceans and portions of the United States at the same altitude as private aircraft. Although the idea initially seemed fantastic, members of the panel were attracted to it. Their only suggestion was that humans be put aboard the planes, too.

The panel, chaired by University of California physicist Charles Townes, picked the randomly flying aircraft as one of the best places to put the new MX missiles. Secretary of Defense Caspar Weinberger agreed, and, following his lead, President Reagan announced last October that the aircraft would be one of "three promising long-term options for basing the MX" to be investigated in depth.

It was a major accomplishment for systems analyst Ira Kuhn, Jr., and engineer Abraham Kerem, who developed the odd concept together. To gain such support, they had to get past a series of stumbling blocks placed in their path by the U.S. Air Force, which does not like the idea and has tenaciously tried to arrange its demise. So powerful is the Air Force's opposition that the concept may not be developed, despite the Defense Secretary's and the President's strong support. As a result, the one truly novel invention to emerge from the Administration's quest for a safe place to put the MX is in danger of disappearing from sight.

That invention, now on the drawing board, is a huge aircraft to be constructed largely of plastic reinforced with carbon fibers, which would make it considerably lighter than any other plane its size. Matched with this new material would be propeller engines, either turboprop or diesel, of a type widely used in the 1940's and 1950's. The plane would get such good fuel economy that it could stay aloft for more than 3 days, even while carrying one or two missiles with up to ten warheads each. The missiles would be dropped on parachutes in the event of a nuclear war, and they would ignite during their descent for a 30-minute flight to targets in the Soviet Union.

Although the idea of putting intercontinental ballistic missiles aboard airplanes is not new, this particular airplane is. The Carter Administration, for example, carefully considered building a fleet of short-takeoff-and-landing aircraft that could carry long-range nuclear missiles. In a conflict, the planes would have become rapidly airborne, flown for 6 to 8 hours, and landed on remaining airstrips. The defect of the plan was that the planes could theoretically be destroyed on the ground by missiles launched from Soviet submarines near U.S. coasts, and that virtually every potential airstrip could also be destroyed. Similarly, Weinberger briefly considered putting missiles aboard existing military cargo planes, but these too were vulnerable to destruction and would endure for only a brief period during a conflict. Both schemes would have been enormously costly, largely due to the planes' high fuel consumption.

The advantage of the proposed new plane is that its fuel economy is expected to be five to ten times better. The planes could take off with eight turboprop engines, but fly on only four, traveling at a low speed and attaining lift from wings nearly twice as long as those on a Boeing 747. Most of the fleet could to be kept continuously airborne at a comparatively low operating cost—perhaps $45 billion during its 20-year life-span. The planes would not be vulnerable to destruction on the ground, and the missiles could ostensibly be fired at any moment in a period of several days, not several hours. As Townes says, "Most critically, it would give us time to think"—to ponder the wisdom and degree of nuclear retaliation after a Soviet attack.

The achievement of Kerem and Kuhn, two outsiders in the community of aerospace design, was to envision a radically new design. One reason they were able to do it is their experience in designing much smaller drone aircraft for surveillance, communications, and bombing with conventional munitions, an area where the equipment must be spare yet capable of automatic and reliable operation. Kerem was formerly chief of the advanced design group at Israel Aircraft Industries, and had a hand in development of the highly rated Kfir fighter. But he quit 4 years ago, and now works out of his home near Pasadena, California, doing occasional work for the nearby Jet Propulsion Laboratory and developing small drones for the Defense Advanced Research Projects Agency (DARPA). Kuhn is vice president and cofounder of B-K Dynamics, Inc., a small contractor on the outskirts of Washington, D.C., that does some advanced planning and design work for the Pentagon.

Kuhn initially conceived of a small drone that could carry several cruise missiles and stay aloft for several days at a time, reasoning that it would be a less expensive alternative to putting cruise missiles on the B-52 and B-1 bombers, planes that are primarily designed for other functions. Then he thought of a larger plane that could carry either a Minuteman or a Trident long-range nuclear missile. After submitting a study proposal to DARPA and being turned down, he thought of it as a carrier for the

Early this year, the U.S. land-based force of nuclear missiles became vulnerable to destruction in a preemptive attack by the Soviet Union. The Air Force has worried about this situation for a long time, searching high and low for a better place to put both the existing, silo-based missiles and a new missile, the MX.

The first article in this series examined the reasons that U.S. officials became alarmed about missile vulnerability, and the second examined the short-term plan to put missiles into silos. This article explores the Air Force's least favorite long-term basing mode. Subsequent articles will explore the alternatives.

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MX. He contacted a member of the Townes panel and arranged to make a brief presentation to the entire group.

Kuhn told them that the plane—which he had named Big Bird—could be operated from a single base on each coast, from which it would fly over the ocean in a random flight path to prevent detection and destruction by the Soviets. It would fly at an altitude determined largely by the weather, seeking cover from satellites with cameras or infrared detection devices by hiding in clouds or by flying so that its temperature matched that of the seas below. In the event of a superpower crisis, the planes could be flown over the North American continent to further complicate detection and destruction efforts. As Townes says, "there is nothing insuperable about keeping it hidden, it's just a matter of the expense." If the Soviets were somehow to determine the planes' locations and fire a nuclear barrage, the planes could accelerate to about twice their normal cruising speed, ascend to an altitude where the minimum blast effects would occur, and veer in a direction selected at random, making it extremely unlikely that they would be destroyed. As another member of the Townes panel explains, "The Soviets would have to target the United States, the Atlantic, and the Pacific, and they couldn't build enough warheads to do it."

The planes would be equipped to takeoff and land, avoid all other planes, and take any required evasive actions, all without a crew, Kuhn told the panel. One of its members asserted, however, that the MX could not be flown on a robot aircraft because the public would simply never accept it. As Kerem remembers, "after the first presentation, we had a flight crew."

The idea was appealing. According to one panelist, "We thought it was very attractive. But there are two technical hurdles: An airplane that size made of composite materials [reinforced plastic] has never before been attempted. And the engine technology would need some development." The panel wanted an independent opinion, and it asked for a study by the Department of Defense. Weinberger assigned the task to DARPA, the agency that had already rejected the idea once.

DARPA formed its own panel, studied the idea for less than a week, and concluded that the airplane would weigh more than predicted, get poorer fuel mileage, and have to return to its base much sooner. The review group, which based its work in part on an analysis by the Air Force, also concluded that the plane would need a crew of six or eight, not three as Kerem and Kuhn had suggested. Under these conditions, the concept would cost about double what was originally projected. But members of the Townes panel were not impressed. One panelist termed the analysis superficial. Colonel Norris Krone, who directed the DARPA study, acknowledged that "there were some pointed, penetrating questions as to why we thought the numbers were as low as they were, or as poor as they were."

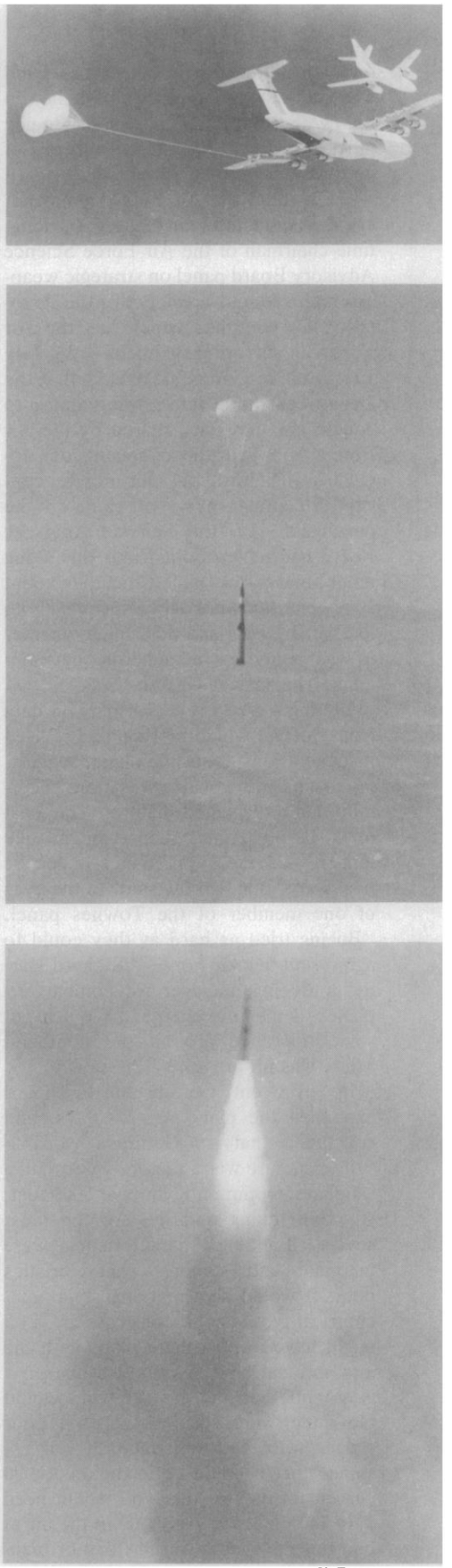
Townes and the others insisted that it be reviewed again, this time by a major aircraft manufacturer. They chose the Boeing Company, Inc., which agreed to do a study for $240,000. Data were classified, and work was limited to a small team. Although incredulous about the plane at first, the team concluded after a month of study that the idea was both technically and economically feasible. It said, however, that the structure would need strengthening and hardening against nuclear blast effects. It also said that the engines should be turboprop, not diesel as Kuhn and Kerem had urged. Diesels get better fuel economy, but Boeing said that turboprops would pose less of a technological challenge.

Boeing also concluded that the risk of accidents involving the plane is relatively small, perhaps one accident in 60 years of operation. This was an important determination because the implications of a serious accident would be horrifying. Plutonium causes cancer when inhaled and might be dispersed if the missile's fuel and the warhead's high explosive material were detonated and set ablaze.*

In addition to calming fears of an accident, Boeing said that it agreed with Kerem and Kuhn that a three- to four-person crew would be adequate. In the current design of the plane, only one crew member would be in the cockpit at any time, and the others would be sleeping, reading, or exercising in the lounge area.

The study prompted the Townes panel to recommend the concept highly to Weinberger, who was also impressed. When the Air Force commanders heard about it, however, they did several things. They contacted top Boeing officials, many of whom favored a proposal by President Carter for basing the MX in shelters in the southwestern United States. Boeing had an Air Force contract

*Secretary of Defense Weinberger wants to use a warhead for MX that would incorporate high explosives insensitive to such an accident. The Air Force wants a different warhead, and the matter is being debated in Congress.



Air Force

The first air-launched ICBM

The Air Force tested the concept of an airborne intercontinental missile force in 1974, with this launch of a Minuteman missile from a C-5A cargo plane. The missile descended 8000 feet before igniting.

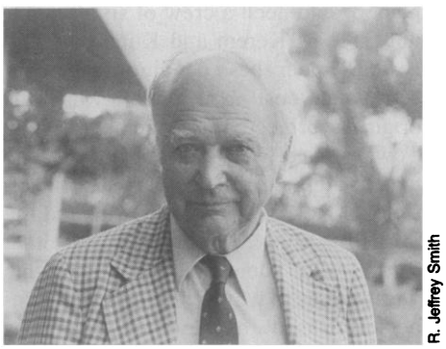
for $1.5 billion to help construct it, and was likely to gain another $8.5 billion in follow-up contracts. The senior Boeing officials ordered that the conclusions of its review team be audited.

Meanwhile, the Air Force commanders also contacted Ivan Getting, the longtime chairman of the Air Force Science Advisory Board panel on strategic weapons and a retired president of the Aerospace Corporation, which has the Air Force as its primary client. "In July 1981, the Air Force got uneasy that the Department of Defense was coming to conclusions not fully shared by the Air Force, and that those conclusions included Big Bird, the air-mobile concept," Getting says. "It came to the conclusion that the Science Advisory Board had never looked into this siting mode, and so we pulled together about 20 people. We were asked specifically to look at Big Bird and determine whether it was ready for engineering development. The answer was no."

Getting's group relied in part on data from Boeing, which by then had revised its conclusions about the plane, suggesting that its performance was more uncertain than it seemed before. The cost might be higher, production might take longer, and more personnel might be necessary, Boeing now said. In the eyes of one member of the Townes panel, "Boeing tried as hard as they could to agree with the Air Force." Richard Hardy, a Boeing manager for combat airplanes, denies the charge. "We just put some tolerance around the numbers. There was no pressure," he says.

In any event, Getting and his board examined the plane for 2½ days, and concluded that—in Getting's words—"the structure was a factor lighter than a sailplane. Optimum flight is at 5000 feet, where lightning and ice are the most severe. Landing characteristics were marginal and stability characteristics poor. It would be a marginal flying machine, if you could construct it. You might have to post flight plans with the international civil aeronautics board. It is so soft that any gust of wind would blow the wings off, and also a poor starter, with a slow launch. It was assumed that it could be in the air for 90 percent of its life, that you would need only 140 planes to have 100 in the air at one time. Never in the history of mankind has there been that kind of efficiency in a military aircraft. We priced it at an acquisition of 400 for 100 in the air, reaching a total cost of $70 billion to $80 billion."

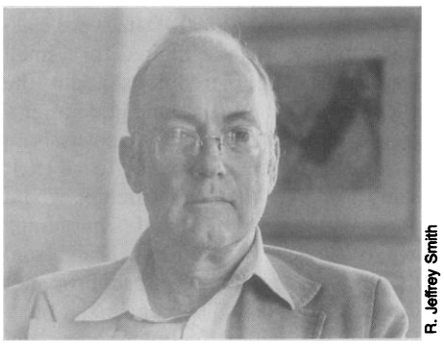
Getting goes on. "The engine was originally to be a high-compression reciprocating diesel, of the sort found on ships, yet the horsepower-to-weight ratio exceeded that of the best jet engine. In every area, it reached beyond what has already been done." Kuhn and Kerem's very purpose, to break with historical aircraft design, was in short a grievous failing in the eyes of the Air Force advisers. The assessment of the advisers was so contrary to that initially offered by Boeing that it suggested they were looking at a different plane. And indeed in some respects they were, according to Townes. "It was based on a misunderstanding of the parameters," he says. "They picked restrictive characteristics and proved that it didn't work very well. I agree that it doesn't, if these are your conclusions. If you pick other characteristics, you will find another conclusion."



R. Jeffrey Smith

Ivan Getting

"It would be a marginal flying machine, if you could construct it."



R. Jeffrey Smith

Charles Townes

"The Air Force was pushing the Carter plan very hard."

Townes is familiar with the Getting group's conclusions, because Getting conveyed them to him directly. Getting says he was asked to do so by the Air Force chief of staff, General Lewis Allen. Nevertheless, Townes and the others held fast, partly because they thought that the plane might be useful even if its performance was degraded somewhat.

Why has the Air Force opposed it so strenuously? Initially, it was because Big Bird threatened to unhorse the Carter Administration plan for basing the MX in huge garages in the Southwest, a plan that the Air Force liked. Townes was a witness to the bureaucracy's single-mindedness. "The Air Force was pushing the Carter plan very hard. A lot of people may owe their careers to it. They had a lot at stake, and had convinced themselves on it. In that environment, anything else looks unattractive by comparison." One reason they preferred the Carter plan is that it was less risky: billions of dollars had already been spent on it. The air-mobile concept was more of a challenge, and might be delayed. Another reason they liked the Carter plan was that it would have permitted missiles to be launched from a fixed point, which provided greater accuracy, a characteristic that the Air Force prizes greatly. Missiles launched from a moving base, such as an airplane, are sometimes considered to be less accurate. According to one Pentagon official, this is not necessarily so. The missiles could be driven to their target by a homing device similar to that on a cruise missile, he says, although this is not now possible. The aircraft location could be precisely fixed at launch. Or the missile could be given special instructions from ground stations or satellites, either of which would convey accuracy. This is not a problem, he says.

A second and more speculative reason for the Air Force's opposition is the fact that the concept directly threatens a broad range of existing Air Force programs. Advocates say that the plane has a wide variety of uses because of its high fuel economy and long endurance. According to R. James Woolsey, a former Under Secretary of the Navy who served on the Townes panel, "It would clearly be better, for example, to have command and control aircraft that can stay aloft, unrefueled, for nearly a week rather than for merely a matter of hours. Ocean surveillance and antisubmarine warfare patrol aircraft would significantly benefit by a manyfold increase in their range and endurance. So could tankers. Our long-range air transport in the 1973 Israeli-Arab war required 6 tons of fuel for every payload delivered, and a recent training exercise for a mere dozen fighter aircraft in the Mideast required the equivalent of 30 C5A's and 32 larger tanker aircraft to support it. These sorts of fuel requirements for transport aircraft are a military logistician's nightmare." Kerem and Kuhn estimate Big Bird's endurance as an orbiting command post to be between 9 and 14 days, without refueling. Existing command posts and AWAC's surveillance planes can endure for about 12 hours without refueling.

Finally, there is the potential explanation, offered by an aerospace industry official, that the Air Force dislikes Big Bird "because they want things to go fast. A plane that travels only 150 knots is antithetical to the culture that Air Force officials grow up in." Woolsey mentions a similar concern, although he says it does not pertain specifically to the Air Force. "We are used to our strategic systems being at the cutting edge of our technology: flying higher, farther, and faster," he says. "It is a bit of an emotional shock to many in the strategic business to consider designing merely a fuel-efficient cargo plane to fly around randomly over oceans or southwestern deserts. It would also be difficult to imagine wearing a white silk scarf while lumbering about in a modern version of Howard Hughes' Spruce Goose. But however psychologically and institutionally interesting such reactions may be, they are negligible considerations, at best."

The chances of Big Bird taking off, either with missiles or military surveillance and communications equipment, are slim. Last December, the House and Senate Armed Services Committees barred the Air Force from spending any money on it in fiscal 1982. Several weeks ago, the House committee voted to extend the ban to fiscal 1983. According to a committee aide, it did this because of assiduous behind-the-scenes Air Force lobbying. "I know of no one outside of Weinberger and maybe some members of the Townes panel who support this idea," the aide says. Part of the problem is general confusion about the dissimilarity of Big Bird to air-mobile options considered and rejected in the past. The Air Force has campaigned against those, and for sound reasons. It has also failed to advertise the novelty of Big Bird. They will come up here like good soldiers and ask for the study money, and then admit that the idea is flawed," the aide says. "One person said that you'd have to make the planes out of non-obtainium."

A Pentagon official who has been following Big Bird says that there are still some important questions to be addressed. The ability of its composite structures to withstand severe weather needs further examination, as does the ability of its engines to hold up in the dust raised by a nuclear blast. Kerem advises more evaluation of the diesel. "I know that the average reaction to 'going back to propellers' is negative, and that the reaction to piston engines on transport aircraft is very negative, so that when I mention the turbo-diesel the reaction is 'let us leave it to cars, ships, etc.' But when I evaluated it for Big Bird, it did considerably better than the advanced turboprops." More analysis is also needed to determine whether the Soviets might somehow threaten the planes between now and the year 2010.

The answers will probably favor the plane's development. Three large aerospace firms—Lockheed, McDonnell Douglas, and Rockwell—think highly enough about it to have designed similar planes of their own in recent months. Boeing has formed an alliance with Kuhn and Kerem and is spending some of its general research funds on refinements of the design. A recent report by the Office of Technology Assessment suggests that air-mobile could easily be made invulnerable to attack.

Officially, the Pentagon wants to spend $83 million to examine Big Bird between now and July 1983, when the Administration is due to select a permanent place to put the MX. Unofficially, it does not look as if Weinberger and Reagan are going to get the chance to put the missile in the air.—R. JEFFREY SMITH

Accident Stalls Test at CERN

An accident at the European Organization for Nuclear Research (CERN) has delayed, possibly until this fall, a key experiment that physicists hoped would verify a central theory of elementary particles.

Everyone involved calls the development a disaster. The most sought after particles in high energy physics right now are the three intermediate vector bosons (the W^+, W^-, and Z^0), verification of which, with their expected properties, would be the key to the recently popular unified theories of elementary particles. These theories attempt to explain, in principle, the entire physical universe within one mathematical framework. CERN's SPS, a proton synchrotron that was modified last year to permit collisions between oppositely circulating beams of protons and antiprotons, is the only accelerator in the world with enough energy to create the vector bosons. CERN's two detectors designed to catch these particles are run by large European groups headed by Carlo Rubbia (the UA1 detector) and Pierre Darriulat (UA2).

The accident happened in UA1 late in March, when the detector was about to be moved into place for the experiment. Prior to moving the UA1 detector, a section of vacuum pipe, which runs through the detector and through which the particle beams travel, must be heated to 150°C to drive away contaminants which can lower the vacuum. To keep the sensitive electronics of the detector cool, a stream of compressed air is blown through perforated tubes in the space between the vacuum pipe and the inner surface of the detector. As luck would have it, the SPS compressed air system had been drawing unusually heavy loads and an engineer decided to link this system with a second one located elsewhere at CERN in order to get more pressure. The linking, as near as anyone can tell for the moment, resulted in a sudden surge of air which dislodged years of accumulated dust and dirt in one or both of the systems. This dirt has coated the central part of the UA1 detector, which is an assembly of six drift chambers for tracking the paths of electrically charged particles created in proton-antiproton collisions. The UA1 drift chambers contain almost 23,000 wires, most of which carry 3000 to 30,000 volts. Depending on how extensive the cleaning operation must be, it may take 44 to 64 days to put UA1 back into operating condition, Erwin Gabathuler, CERN's director of research, said last week.

But the delay could be longer than that. Work on the SPS is divided into discrete periods of time. During period 1, SPS is being operated in its fixed target synchrotron mode, and the proton-antiproton run was scheduled to begin on 26 April in period 2. CERN considers the UA1 experiment important enough to delay the collider run, and Rubbia suggested simply reversing periods 1 and 2, with fixed target operation continuing in April and May and colliding beam operation commencing in June. Some of the large fixed target groups who have been having their own problems with breakdowns find this schedule inconvenient and are pressing to delay the collider run until September. CERN management promises a decision by the week after Easter.—ARTHUR L. ROBINSON

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