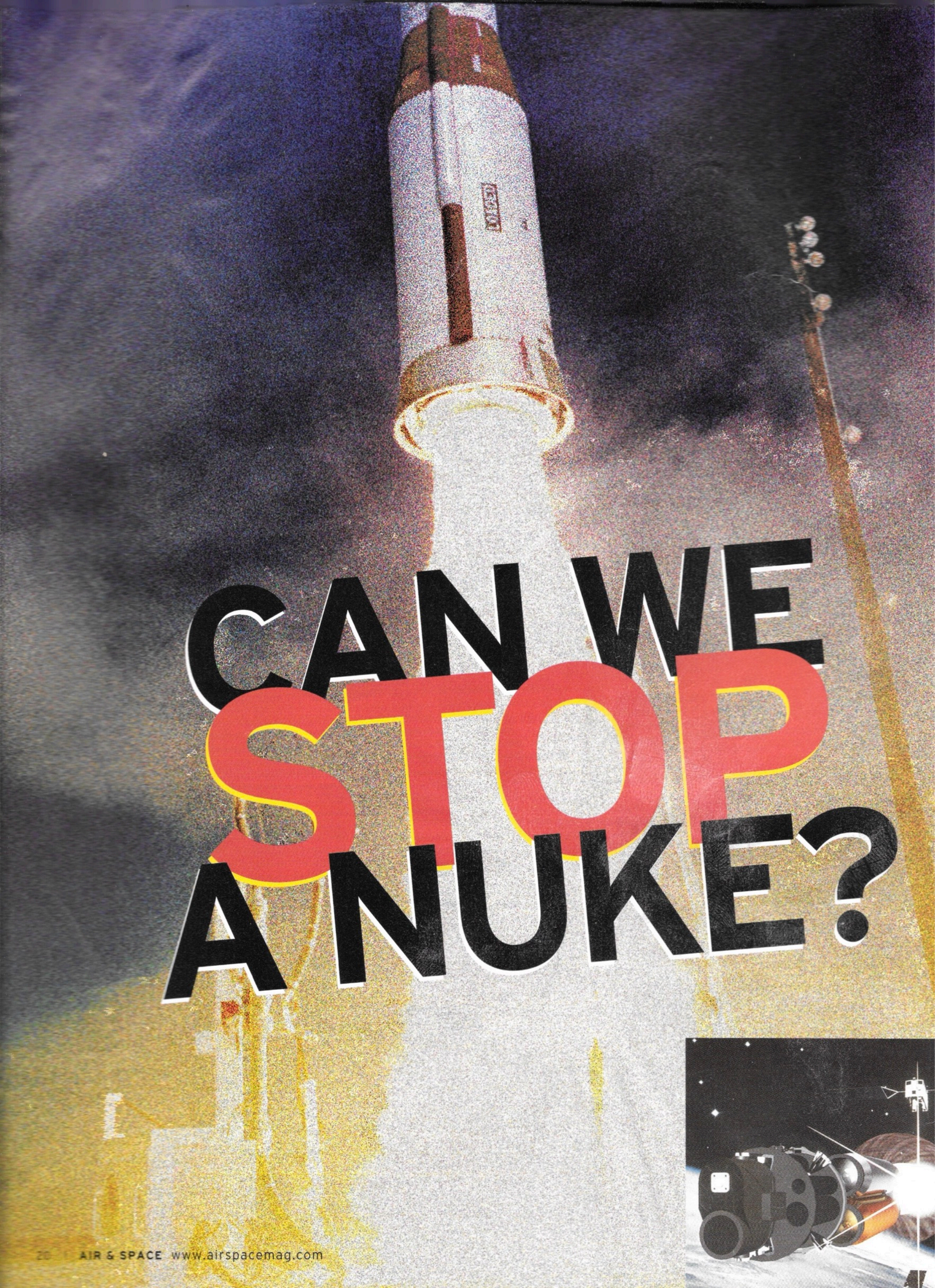


CAN WE STOP A NUKE?

WHAT THE LATEST ROUND OF MISSILE DEFENSE TESTS PROVES.

BY BEN IANNOTTA

ON SEPTEMBER 1, 2006, a handful of uniformed U.S. service members and Congressional staffers gathered in a windowless room in the headquarters of the Missile Defense Agency, tucked within a row of nondescript buildings on a low hill overlooking the Pentagon. The guests waited anxiously in the room, called the Management Information Center, watching several large computer displays on the wall in front of them.

They were about to find out whether the Missile Defense Agency could stop an intercontinental ballistic missile by shooting it down with an interceptor missile. This would be the first test of an interceptor launched as though the country were responding to an actual attack on its homeland. Previous interceptors were fired from Kwajalein Atoll in the Pacific Ocean; this one was to be launched from California.

The target rocket had been fired by U.S. forces on Kodiak Island, Alaska. On the screens in the Management Information Center, a red line, progressing southward from Alaska toward the west coast of the United States, represented its position. The target missile's path was similar to the trajectory that a Taep'o-dong 2 long-range missile launched from North Korea might follow. The difference, of course, was that if the September test failed, the Kodiak-launched target would splash down harmlessly off the Baja peninsula.

The anti-missile system that is, by the order of President George W. Bush, being fielded as it is developed, is a complex web of layered defenses, each aiming at a separate missile threat. Some are meant to thwart missiles as they rise from the pad (the pre-boost phase), while others are designed to destroy them as they descend toward the target (the terminal phase). The flight time between the two phases is called the "midcourse." Midcourse defenses are the only ones currently fielded against long-range threats, like ICBMs.

The focal point of the agency's September test of its Ground-based Midcourse Defense system was the interceptor missile, launched from Vandenberg Air Force Base in California. According to plan, it would rise out of Earth's atmosphere and release an infrared-seeking projectile called a "kill vehicle" that would collide with the target somewhere over the Pacific.

Watching the red line's progression across the screen in the information center, Air Force Lieutenant General Henry "Trey" Obering, director of the Missile Defense Agency, had something to prove besides the capability of hitting a bullet with a bullet.

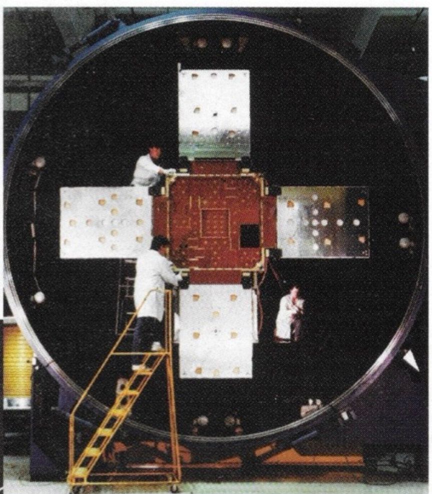
Obering, who had spent seven years helping NASA launch space shuttles, compares the feelings surrounding a missile test to the emotions evoked by a shuttle launch: "It was kind of scary, because with all the models and simulations, you just didn't know exactly what was going to happen until it did."

With this test, his agency was attempting to redeem itself for a series of failures that had called its competence into question. The lack of midcourse interceptions in the MDA program also suggested that that the technology was not mature enough to handle the task.

Since they were initiated in 1997, midcourse defense test flights have had mixed results. Between October 1999 and July 2001, three of five intercept tests had ended in success. But there had been a four-year lull in midcourse intercept launches, and only failure when they restarted.

The last time the missiles flew, in December 2002, the kill vehicle did not separate from the interceptor that carried it. Two years of work followed, during which Obering took over the Missile Defense Agency. Engineers

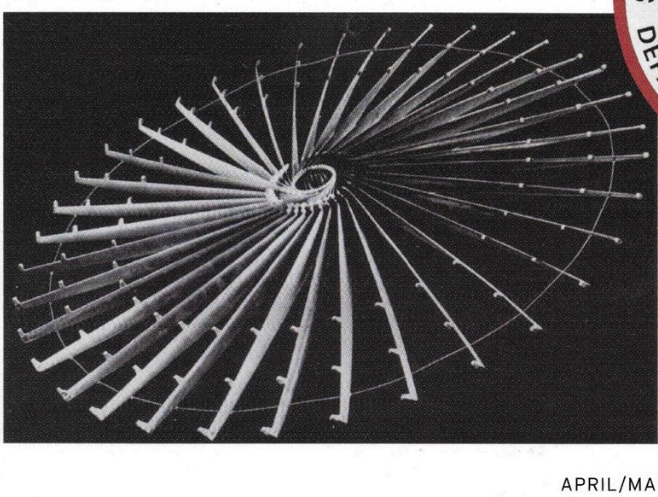
OPPOSITE: MISSILE DEFENSE AGENCY; BELOW: NASM



Strategic Defense Initiative staff build a satellite (left) to measure the distortion of lasers in space.

The first missile defense concepts were space-based; Brilliant Pebbles (left) used tiny bullets to thwart warheads.

OPPOSITE: MISSILE DEFENSE AGENCY; RIGHT: DEPARTMENT OF DEFENSE



Some kill vehicles from the 1980s featured 15-foot aluminum ribs that would open just before colliding with a missile.

from Raytheon Company cleaned up the design and began production of the kill vehicles at their Tucson, Arizona facility.

The first midcourse intercept of Obering's tenure was supposed to take place on December 15, 2004, but on that day the interceptor never appeared. A launch computer refused to let the interceptor leave its test silo on Kwajalein. The $10 million test target, already arcing through the fringes of space, fell into the sea.

Orbital Sciences Corporation, the interceptor's Dulles, Virginia manufacturer, had programmed the rocket with the tolerances of a satellite launcher. When a few status reports failed to reach the interceptor's flight control computer, it aborted the launch as though there were an expensive satellite aboard. The problem was fixed by writing a new line of computer code.

Obering's team tried again in February 2005. This time the interceptor refused to leave the silo when one of three support arms designed to keep the rocket upright during an earthquake failed to retract. Another $10 million target was wasted. Shoddy work at Kwajalein was blamed for allowing saltwater to seep into the base of the silo, making the air humid and causing glue in the support arms' hinges to swell.

After that, even the most vocal supporters of the missile defense plan advocated by President George W. Bush blasted Obering's agency. One Republican congressman from Alaska, Terry Everett, then chairman of the subcommittee that oversees missile defense, declared that he and his fellow members "were disgusted by the failings, because to be honest with you, it didn't appear to be brain science."

Inside the missile agency's headquarters in September 2006, the red line of the target grew on the display map for 16 minutes and 40 seconds before a blue line appeared on the southern California coast: A brigade with the Army's Space and Missile Defense Command had launched a single long-range interceptor from a silo at the Vandenberg base. So far, so good—at least the interceptor was airborne.

IF THE UNITED STATES comes under attack, plans call for interceptor missiles in Air Force bases at Vandenberg and Fort Greely in Alaska to roar out of holes in the ground to the fringes of space, where they would release the 155-pound kill vehicles.

Even as interceptors are being deployed—the U.S. has already fielded 14 interceptors in Alaska and two in California—the Missile Defense Agency must continue to develop the system through a series of $100 million tests. To accomplish this, the agency has a $10 billion annual budget that by 2016 is expected to climb to $15 billion, according to the Congressional Budget Office.

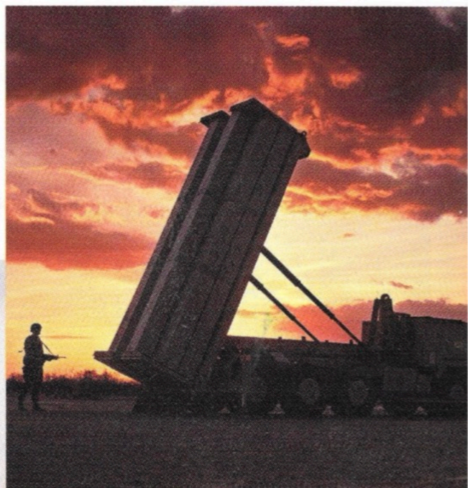
When one looks at what must go right in the first minutes of an actual attack, it's easy to see why Obering's job is unenviable, and his agency's budget so vast.

An attack would first be detected by U.S. Defense Support Program satellites, which sense the infrared radiation of enemy missiles rising from their launch pads. The first generation of this system was launched in the 1970s, but upgrades in new satellites have brought modern capabilities to the space imager system.

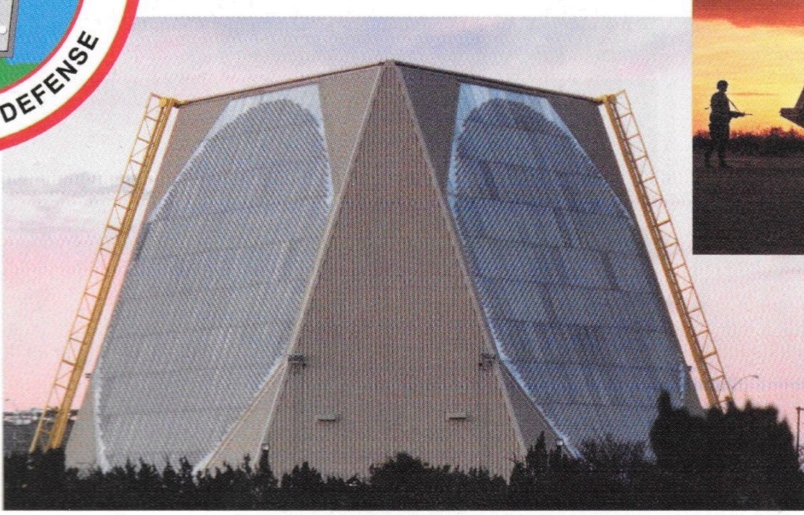
The satellites would tell ground radars where to look in the sky to find the enemy rockets after their engines burned out. The ground radars—someday to be augmented with sophisticated ground and space sensors—would transmit tracking coordinates to U.S. Strategic Command control rooms in Alaska and Colorado, where members of a specially formed Army brigade would pull the trigger on the interceptor missiles.

Computers would feed targeting data to the interceptor missiles via fiber optic cables and satellites. These initial "weapon task plans" must arrive before the missiles blast out of their holes so that their nozzles can be pointed at the incoming warheads.

All that must happen within 16 minutes. Any later and the defense would fall to radar-guided rockets, or "terminal defens-



U.S. ARMY



ABOVE: NASM; RIGHT: COURTESY RAYTHEON

The ballistic missile early-warning system has been in place since 1959. By 2001 the system was upgraded with 12-story phased-array radar sites like this one (right) in Alaska.

Layers of protection mean extra security. Terminal High Altitude Area Defense (above) and upgraded Patriot systems (right) handle theater missile threats.

es," fired as the warheads are falling through the atmosphere toward their intended victims. Most terminal systems, such as variants of the Patriot missile battery and the Terminal High Altitude Area Defense, are designed to target short- and medium-range theater missiles, not long-range ones.

Assuming the interceptor missiles make it into the air by their deadline, information from ground-based radars will provide the interceptors with updated information on the targets' location as they rise to meet them. As the distance closes, the interceptors will release their kill vehicles.

By this time, the enemy missiles will have dissolved into a hail of objects streaking toward the United States at perhaps 15,000 mph. Inside that cloud of warheads, inflated Mylar decoy balloons, shaped and painted to look like real warheads, could distract the kill vehicles, if not for the guidance given by their infrared eyes and small thrusters. If all goes well, each kill vehicle will collide with an incoming warhead at about 18,000 miles per hour.

Until new sensors are created, finding the real warheads among the decoys requires a shotgun approach: "If I can't discriminate what's a decoy and what's a warhead, I have to launch interceptors at both of those objects," Obering says.

But in September 2006, the goal was to direct a single kill vehicle to a single target warhead, using upgraded tracking radar at Beale Air Force Base in California. The Beale radar was built during the cold war to bounce radar waves off incoming Soviet missiles with just enough fidelity to tell the president: "We have a missile and it's going to impact in the New York or Chicago area," Obering says.

During the hiatus between launches, the missile agency put engineers and software experts to work installing new computer processors and software to enable the cold war radar to track objects with greater precision. Similar work is under way at the Fylingdale early-warning radar installation in England, enabling it to track missiles that might be launched westward from Iran. New sea-based platforms will supplement the early-warning radars. The more eyes available, the better, say planners.

The Beale radar upgrades were but one of many technical goals of September's test. An underlying goal was to restore confidence in the missile agency itself. Obering's reputation was riding on the 55-foot-long missile streaking across the Pacific, receiving guidance (he hoped) from the radar at Beale.

As the witnesses watched, the red and blue lines of the missile flight paths closed in on each other. Suddenly, 23 minutes and 20 seconds into the test, the altitude and velocity numbers froze.

Through an audio link Obering could hear the jubilant reaction inside the fire control room at Schriever Air Force Base near Colorado Springs. "Everybody started screaming," he says. "We knew we had achieved the intercept."

LOCKHEED MARTIN

The Other Missile Threat

WHEN IT COMES TO enemy missiles, an attack on the continental United States is not the U.S. military's only concern. Air Force Major General William Shelton, whose job as commander of the 14th Air Force is to protect U.S. spy satellites, points to a scenario that he considers unlikely but "absolutely catastrophic."

An enemy could launch a nuclear warhead not toward the United States but up and out of reach of the interceptors in California and Alaska silos. "If somebody decided to launch a nuke straight up and explode it, it literally wipes out the low-Earth-orbit satellites," Shelton says.

A nuke set off outside the atmosphere would cause limited and localized electromagnetic pulse (EMP) damage on the ground, but play havoc with satellites around the globe. Particles loosed in an explosion would produce an electromagnetic charge between them. The loose particles would conform to the planet's magnetic field, forming an electromagnetic band around the planet that would fry any electrical equipment in its path.

If North Korea pursued such a high-altitude EMP attack, it could blind nearly all satellites in low Earth orbit. "Now in most cases, you consider that to be self-deterring because you not only take out everybody else's satellites, you take out your own. But for countries that don't have anything necessarily at risk..." Shelton cuts himself off.

Boeing's Airborne Laser aircraft, a heavily modified 747 airliner, is the MDA's best hope for shooting down missiles as they are accelerating toward space, in what is known as the boost phase. It is being prepared for the first inflight tests of its high-powered laser; the first trial intercepts are planned for next year. It is not known if or when it will be deployed for service.

Asked about the threat to satellites from space nukes, Shelton shrugs. "The preferable thing is, in my mind, to address it in what's euphemistically called 'the pre-boost phase.' "

Translation: Destroy a suspicious rocket as soon as possible after it appears on the launch pad.

ALTHOUGH OBERING TOLD REPORTERS that the test showed the United States now had a "good" chance of shooting down a North Korean missile, Marine Corps General James E. "Hoss" Cartwright, as head of U.S. Strategic Command—the man responsible for defending the United States against a missile attack—sounds less convinced of the chances for a real-world success.

"We have another year minimum of the [research and development] for the rudimentary system," he says. "We want to be working with MDA to figure out what bugs are still there. What needs to be worked out? What tweaks?"

Cartwright would be on the front lines of any future missile attack. He is also the major customer of the tools MDA develops. The Army Space and Missile Defense Command, whose brigades fire the interceptors, is part of Strategic Command's purview. Speaking about the missile defense system he may have to use, he is open in airing doubts: "Are there components that fail in 50 days instead of 100 days? When they fail am I left completely disadvantaged?"

Perhaps cognizant of the differing assessments of Obering, Cartwright, and others, President Bush split the difference in public comments after the test: The United States now had "a reasonable chance" to intercept the Taep'o-dong 2, he said. "At least that's what the military commanders told me."

Some interested observers of the Ground-based Midcourse Defense test give the system an even smaller chance of success. Philip Coyle, 72, a former nuclear weapons designer at the Lawrence Livermore National Laboratory in California, is now an advisor to the Center for Defense Information, a left-leaning think tank in Washington, D.C.

In August 2000, as assistant secretary of defense for test and evaluation at the Pentagon, Coyle advised President Bill Clinton not to develop or field the ground-based interceptors that would eventually become the centerpiece of Bush's proposed missile defense plan. In Coyle's opinion, too many unanswered questions about the system's readiness remain.

He points to the lack of tests against countermeasures, delays in the advanced radar designed to differentiate decoys from warheads, and the small number of test successes as evidence that the system being developed could not handle a real-world threat.

"[The Missile Defense Agency] sort of dumbed-down the threat...because nobody believes they can handle 10, 20 or 100 missiles from North Korea," he says.

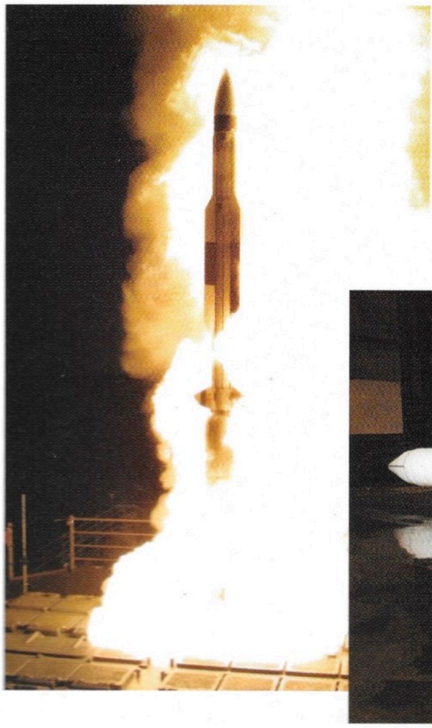
Sending solitary target missiles into the air as targets and successfully intercepting them gives the American public and policymakers a dangerously false confidence in the system, he adds.

Indeed, with so many elements of the missile defense system still in development, the successful September test assumed only the simplest of threats—a single missile with no decoys or countermeasures. Earlier MDA tests used spoofing, including balloons in 2002 tests and specially designed parts that, after they break away from the missile, mimic warheads in shapes and temperatures. Coyle and other critics say the decoys are too easy to discern from the mock warheads, nullifying the positive results.

Coyle's real target is not just the system's technological flaws, but the entire strategic justification for missile defense. Success, he argues, could be more dangerous than failure.

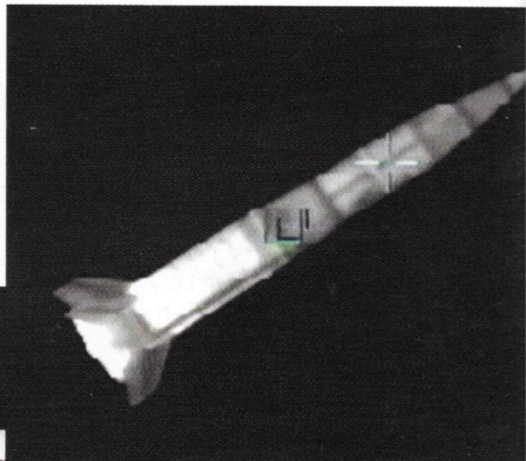
Consider China, he says: "If they believe, like we hope North Korea would believe, that we have a missile defense that works, they're likely to do what Russia did many years ago, which is build hundreds or thousands of warheads and ICBMs so they can overwhelm the most futuristic missile defense system we can imagine."

Obering himself agrees that the system he's fielding will not have "operational capability" until it can handle multi-



U.S. NAVY

Left: An SM-3 interceptor rises from a U.S. Navy Aegis cruiser in 2002. Sea-based defenses are attractive for intercepting shorter-range threats in their midcourse phase. A test last June destroyed a test missile in two minutes. Right: The last thing a kill vehicle ever sees: its target.



MISSILE DEFENSE AGENCY (3)

Kinetic energy interceptors (left) are MDA's multipurpose defense missiles. The 36-foot KEI is twice the length of interceptors fired from the Aegis. A sea-based version may be ready by 2013.

ple missiles. But a "rudimentary capability," in Pentagon parlance, is the first step toward an operational system. Obering says the rudimentary system in place now could shoot down a nuke—if it is coming alone.

"Do we have confidence that the system as deployed today could knock down that [Taep'o-dong 2] that was launched last summer?" Obering says. "The answer is 'yes' because we had the sensor coverage, and we had sufficient inventory of interceptors to handle that missile."

He continues: "Now, if the North Koreans had launched 10 or 15 missiles at us in a wave, could the system handle that? That's a different question."

Since late 2004, the Pentagon has been installing interceptors and training soldiers to control them. Brigadier General Patrick O'Reilly, deputy director of the MDA, says the number of interceptors in Alaska could grow to 21 by the year's end and to 40 by 2011.

Obering is counting on new sensors to aid his misson. Among the most powerful will be the 30-story-high, Sea-Based X-band Radar (SBX), an instrument so powerful, he says, it is able to track and image a baseball flying from the Chesapeake Bay to San Francisco (see "How Things Work: Phased Array Radar," June/July 2006).

If SBX works as advertised, it could make Obering's life much easier. "If I can discriminate what precisely is a warhead, I only need to put maybe one interceptor on that target," he says.

In early January, the massive radar steamed north to show it would be able to operate through the famously rough winters along the Aleutian Islands, which are in the likely path of a North Korean missile.

Another headache has been negotiating siting rights for fixed radars, and deciding where they should be built based on intelligence about future threats.

New eyes in space could solve basing problems. Two prototype Space Tracking and Surveillance System satellites built by Northrop Grumman are due to be launched this November. These could pave the way for a constellation of infrared tracking satellites that would provide near global coverage.

SO, CAN THE U.S. STOP A NUKE? The answer, because of limitations on testing, seems to be that no one will know until the threat is inbound.

Missile defense proponents and developers cheered September's success—a single 23-minute test. But U.S. weapons evaluators typically demand hundreds of hours of operation before a tool of war is placed in the hands of soldiers, pilots, or sailors. The missile tests have shown that the smallest detail gone wrong can derail even a well-planned launch.

It takes hundreds of people months to prepare for an intercept test. Says Pat Shanahan, Boeing's vice president in charge of missile defense, radars must be calibrated in advance so that the fire control computer will know: "MD-80s on their way to Mexico, flying down the coast of California—don't shoot those."

Testing may be an intractable problem. That leaves the military in the position of not knowing how the system will work until it is called on to perform. Only if nuclear warheads streak toward the United States will the question finally be answered, with millions of lives in the balance.

The Sea-Based X-band Radar (right) steams forward on its mobile oil rig platform. Missile defense proponents have high hopes that this powerful instrument will be able to pick out warheads from a cloud of debris and decoys.

U.S. NAVY

An interceptor (right) roars from its silo at Vandenberg Air Force Base, California, during a test last August. More than a dozen are now in Alaska, awaiting targets.

USAF