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The United States Air Force's Land-based Intercontinental Ballistic Missile Program

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For 50 years, land-based Intercontinental Ballistic Missiles (ICBMs) have been part of America's primary strategic deterrence capability, the nuclear-armed Triad that also includes submarine-launched ballistic missiles and long range heavy bombers. The land-based ICBMs are managed under the U.S. Air Force's ICBM Prime Integration Contract (IPIC), awarded in 1997 for 15 years to an industry team led by Northrop Grumman Corporation. The team is currently carrying out a major modernization of the land-based ICBM system to ensure its readiness for meeting Air Force mission requirements.

Mission Requirements

In the post-Cold War era, strategic nuclear weapons may no longer occupy center stage – however, they are still vitally important. The international environment remains a dangerous place. Twelve nations now have nuclear weapons, and 28 nations have ballistic missiles that can be used as delivery systems for these armaments. Consequently, America must continue to rely on its land-based ICBMs, and therefore must keep upgrading them to maintain the advantage as technology of adversaries improves and poses increasing threats to the nation's security.



Today, however, these land-based nuclear ICBMs fit within a strategic deterrence system that extends beyond the traditional Triad to also encompass planned conventional capabilities and the emerging layers of the nation's missile defense system now being developed by the Defense Department's Missile Defense Agency (MDA). In this age of asymmetric warfare, America and its allies must operate across an expanding breadth of challenging missions. Maintaining strategic dominance, not only in defense of the homeland but also in shaping the choices of countries at strategic crossroads, calls for having deterrence capabilities that can be tailored to particular



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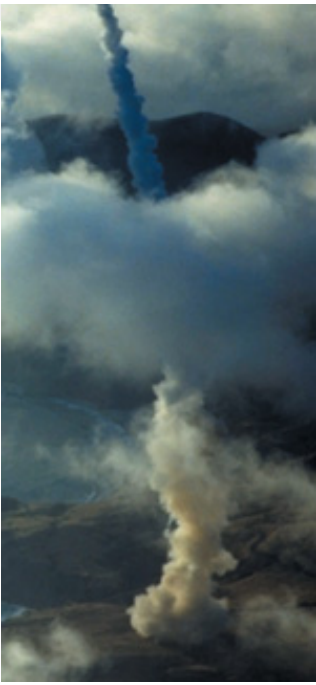
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emerging threats or hostile actions – that provide the President with a wider, more flexible range of options.



Within the current strategic deterrence system, land-based nuclear ICBMs provide ready deterrence, complement defensive response capabilities, and are tied into an advanced battle management network that enables near-real time Intelligence, Surveillance and Reconnaissance (ISR), a common operational picture (COP), decision making aids, battle damage assessment and multi-level information assurance. In the future, commanders will be able to exploit the synergistic effects of the combined offensive and defensive systems in all military domains -- air, ground, sea, space, and cyberspace.

In addition, these ICBMs themselves will eventually be taking on a new offensive assignment within the strategic system.

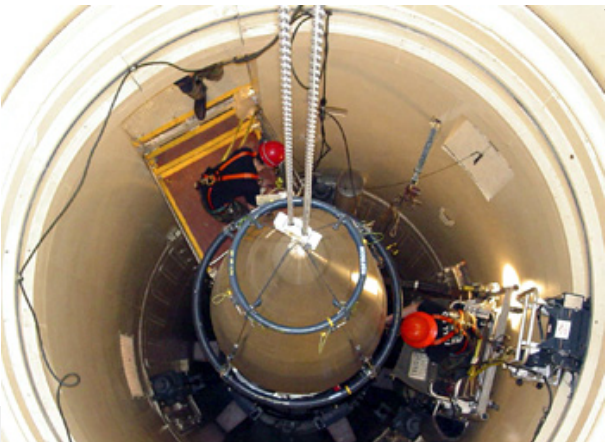
The need to defeat attacks against the United States may sometimes require combatant commanders to interdict fleeting targets at global range. For that reason, U.S. Air Force space and missile professionals are analyzing all options for developing and fielding a capability for a prompt, precise conventional long range strike.

As the Commander of United States Strategic Command (USSTRATCOM), General James E. Cartwright, has described it, this capability, termed Prompt Global Strike, would generate effects without being hindered by factors of time, distance, basing rights, over-flight considerations or undue risk to American servicemen and servicewomen.

The military's most immediate move to meet this need is the Navy's modification of the Trident submarine to launch conventional ballistic missiles. Ultimately, however, USSTRATCOM hopes to have the Air Force's ICBM specialists develop a land-based Prompt Global Strike capability, to be fielded by 2018.

Such efforts are in line with the recent QDR's direction that America's military should be prepared not only for reacting to crises but also for taking preventative actions that keep problems from escalating into crises.

Capability For Mission Support – Silo-Based ICBMs



With the recent retirement of the Peacekeeper missile, the nation's land-based nuclear ICBM deterrent consists entirely of Minuteman III missiles. The missiles are dispersed in hardened silos to protect against attack and connected to an underground launch control center through a system of hardened cables. Launch crews, consisting of two officers, perform around-the-clock alert in the launch control center.



A variety of communication systems provide the President and Secretary of Defense with highly reliable, virtually instantaneous direct contact with each launch crew. Should command capability be lost between the launch control center and remote missile launch facilities, specially modified Boeing 707 airborne launch control center aircraft automatically assume command and control of the isolated missile or missiles. Fully qualified airborne missile combat crews aboard airborne launch control center aircraft would execute the President's orders.

The Minuteman weapon system was approved for development in 1957, and Minuteman I was deployed in the early 1960s. From the beginning, Minuteman missiles have provided a quick-reacting, inertially guided, highly survivable component to America's nuclear Triad. Minuteman's maintenance concept capitalizes on high reliability and a "remove and replace" approach to achieve a near 100 percent alert rate.

Modernization programs have resulted in new versions of the missile, expanded targeting options, improved reliability and survivability. Today's Minuteman weapon system is the product of almost 40 years of continuous enhancement.

Currently the Air Force has a total of 500 Minuteman III missiles at Malmstrom Air Force Base (AFB), MT; Minot AFB, ND; and F.E. Warren AFB, WY. That number is expected to decrease to 450 as 50 missiles are deactivated from Malmstrom as part of the Quadrennial Defense Review.

Northrop Grumman Contribution



In 1954, the Air Force hired what is today the Mission Systems sector of Northrop Grumman Corporation to provide technical expertise in managing the development of the first ICBMs. This marked the start of 43 years of Mission Systems' service as the Air Force ICBM contractor for systems engineering and technical assistance.

The cornerstone of Mission Systems' ongoing success in this role was the systems engineering orientation that it established for the early ICBM programs –and which, incidentally, was subsequently adopted for other programs by many aerospace companies. Systems engineering has been critical for dealing with the incredibly complex, defense-unique ballistic missile systems, which each include over 5,000 configuration items.

In 1997, under IPIC, management responsibility for the ICBM program shifted from a group of associate contractors reporting to an Air Force System Program Office to a team of subcontractors reporting to Mission Systems as prime contractor (major subcontractors included Lockheed Martin, Boeing and ATK Thiokol Propulsion). IPIC entrusted the Mission Systems-led team with the assignment of ensuring the performance, availability, safety and cost effectiveness of the nation's ICBM systems.

Today Northrop Grumman and its subcontractors are fulfilling these requirements through ongoing sustainment and modification programs that are needed to extend Minuteman III's life to 2030. The programs encompass thousands of missile propulsion, guidance, re-entry and ground system components. Some of the largest programs can be briefly described as follows.

- The Safety Enhanced Re-entry Vehicle program is fitting Minuteman III ICBMs with the Mk 21 re-entry vehicle from the recently

decommissioned Peacekeeper missile force – a change that will provide USSTRATCOM planners with increased targeting flexibility and enhanced safety.

- The Propulsion Replacement Program is remanufacturing motors to replace Minuteman III's aging propellant in stages one, two and three to maintain high booster reliability.
- The Guidance Replacement Program is substituting the NS-50 missile guidance set for aging 1960s vintage guidance electronics, improving flight reliability, system maintainability and nuclear safety.
- The Propulsion System Rocket Engine Life Extension Program is replacing engine components originally produced in the 1970s that had a 10-year design life.

Three additional programs focus on enhancing the missile launch control centers and launch facility security.

- The Rapid Execution and Combat Targeting Service Life Extension Program updated the centers' ICBM command and control capability -- giving planners additional flexibility and responsiveness in meeting rapidly changing world situations and evolving mission requirements.
- The Minuteman Minimum Essential Emergency Communications Network program, completed in 2005, upgraded communications in all Minuteman III launch control centers and also connected these systems to the Milstar satellite communications system. This link-up ensured that highly reliable and secure instantaneous two-way communication exists among the launch centers, combatant commanders and the commander-in-chief.
- An improvement to the launch control centers, accomplished through the Environmental Control System program will upgrade climate controls and ensure that electronics and ground support systems are maintained at specified pre-set temperatures.
- Additional enhancements to security, including fast launch facility closure and remote visual assessment, will ensure the continued robust security of the ICBM force.

"The ICBM sustainment and modernization programs continue to meet all our commitments to the Air Force. In 2007, we are celebrating our tenth year of delivering programs that help our customer maintain a safe, secure and reliable land-based strategic deterrent," said John Clay, vice president and general manager of Northrop Grumman ICBM Prime Integration Contract.

As the modernization goes on, the Air Force is already looking ahead to consider future enhancements to ensure that Minuteman is viable to 2030 and beyond. Following a recent Analysis of Alternatives focused on this question, the service opted for retaining the Minuteman III force in service by conducting block upgrades to improve the missiles' capabilities and reduce operating costs.

Northrop Grumman looks forward to supporting these future modernization efforts that will ensure the continuing readiness of this critical land-based nuclear deterrent. The company is proud of its long and successful stewardship of America's land-based ICBM programs – and committed to providing its Air Force customer with superior mission-fulfilling systems and expert engineering assistance for many years to come.

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