

MINUTEMAN III GRP PHASE I



Air Force ACAT IC Program

Total Number of Systems:	500 missiles deployed
Guidance Replacement Program (GRP):	652 guidance units replaced
GRP Program Costs (TY\$):	\$1889M
GRP Unit Costs (TY\$):	\$2.9M
GRP Production:	
Propulsion Replacement Program (PRP):	607 boosters remanufactured
PRP Program Costs (TY\$):	\$2589M
PRP Unit Costs (TY\$):	\$4.3M
PRP Production:	1QFY01

Prime Contractor

Boeing

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

Minuteman III is an intercontinental ballistic missile (ICBM) deployed in hardened silos. Minuteman III and Peacekeeper together form one leg of the Strategic Triad that provides strategic nuclear deterrence for the United States. Operational basing support for Minuteman III includes missile alert facilities, hardened launch facilities, and underground launch control centers. Each launch control center controls ten hardened launch facilities and is manned by a two-person combat crew on 24-hour alert. Each unmanned hardened launch facility, located several miles away from its launch control center, contains one missile. Minuteman III bases are currently located at F. E. Warren AFB, WY; Minot AFB and Grand Forks AFB, ND; and Malmstrom AFB, MT.

As *Joint Vision 2010* looks to the future of America's armed forces, it also provides a vision for America's continuing strategic requirement. As an important component of the Strategic Triad, Minuteman III contributes directly to *precision engagement* with its flexibility to retarget these weapons when required.

BACKGROUND INFORMATION

Peacekeeper is to be taken out of service when START II enters into force. At that time, 500 Minuteman III missiles will be all that remains of the U.S. land-based ICBM force. The Air Force has embarked upon several life-extension programs aimed at keeping Minuteman III viable well beyond the turn of the century. These programs include: (1) replacement of aging components of the guidance system; (2) remanufacture of the solid-propellant rocket motors; (3) replacement of standby power systems; (4) repair of launch facilities; and (5) installation of updated command, control, and communications equipment.

The *Guidance Replacement Program* will replace the guidance computer, signal converters, and power distribution components while retaining the current Minuteman III inertial measurement unit. The Guidance Replacement Program is expected to preserve current Minuteman III accuracy and reliability while enhancing supportability. This program is needed to prevent a projected decline in reliability due to aging electronic components and unavailable replacement parts.

The *Propulsion Replacement Program* will replace the aging solid propellant in the three stages of the Minuteman III booster by refilling the existing motor cases. During the initial phase of the program (Technology Insertion), changes will be made to the existing motor designs and processes to replace unavailable or environmentally unacceptable materials, components, and processes; and to correct known hardware problems. The Propulsion Replacement Program is required to preserve current Minuteman III effectiveness and suitability characteristics.

TEST & EVALUATION ACTIVITY

AFOTEC has conducted Early Operational Assessments on both replacement programs, and also collected extensive information during Hardware-in-the-Loop testing. The Early Operational Assessments are primarily audits to see that: (1) documentation is complete and consistent; (2) design efforts are linked to operational requirements; (3) the system has good prospects of being ready for operational testing when scheduled; and (4) test and evaluation resources are in place. The results of both Early Operational Assessments were satisfactory.

The Guidance Replacement Program combined testing activities include weapon-system integration testing at the Strategic Missile Integration Complex at Hill AFB, Pathfinder testing at Vandenberg AFB, nuclear hardness testing at Little Mountain, UT, and software maturity evaluations at various locations. The Strategic Missile Integration Complex testing progressed from early functionality tests to regression testing of the evolving Guidance Replacement Program operational software. The Pathfinder testing placed the Guidance Replacement Program guidance set atop an inert missile in a Vandenberg launch complex and exercised the functions normally expected of a missile in alert posture. The Guidance Replacement Program IOT&E began in late May 1998. The first of two Guidance Replacement Program test flights was conducted on June 24, 1998. The second flight was conducted on

September 16, 1998. The Guidance Replacement Program IOT&E final report was issued in April 1999. The Milestone III decision is currently scheduled for 1QFY00.

AFOTEC completed a second Operational Assessment for the Propulsion Replacement Program in FY99. Combined developmental and operational test activities monitored and assessed on the Propulsion Replacement Program include:

- Static firings on versions of all three Minuteman III stages.
- Software system testing for compatibility with the targeting program and flight program constants tape.
- Verification of the physical and electrical compatibility with the instrumentation and command destruct systems required for flight-testing.

TEST & EVALUATION ASSESSMENT

The Minuteman III Guidance Replacement Program has an approved TEMP and IOT&E Plan, and was tested in accordance with the planning documents. A draft version of the updated TEMP for the Propulsion Replacement Program, added to the DOT&E oversight list in 1998, was received in December 1998. An update, incorporating OSD comments, is currently in formal Air Force coordination prior to forwarding to DOT&E for approval.

The Guidance Replacement Program IOT&E was completed in April 1999. The combination of limited flight testing, extensive Hardware-in-the-Loop ground testing, modeling and simulation, and analysis was adequate to evaluate operational effectiveness and suitability. Based on the information collected and analyzed during IOT&E, and the combined developmental and operational test activities preceding it, DOT&E determined the Guidance Replacement Program upgrades to be operationally effective and suitable.

Although Guidance Replacement Program testing was adequate to support the Milestone III decision, several performance parameters are worthy of further analysis with the benefit of additional actual flight data and/or equipment run-times in the operational environment. Estimates of the Guidance Replacement Program upgrades accuracy and reliability should be improved by collecting additional flight data. Collecting more real-world data should strengthen estimates of availability, mean time between maintenance, and service life. Opportunities to collect the necessary data are available. The FY00 Propulsion Replacement Program flights will use the Guidance Replacement Program-modified missiles. FOT&E flights will emphasize the Guidance Replacement Program-modified missiles for the near future. DOT&E and AFSPC will analyze the Guidance Replacement Program accuracy and reliability values demonstrated by these flights. Additional real-world data can be collected as the Guidance Replacement Program accumulates time in the field and during appropriate operational testing events.

In the IOT&E, the Guidance Replacement Program fault detection and fault isolation were rated as "not tested" because there were no opportunities to observe fault detection and fault isolation (no actual faults occurred). AFOTEC had identified fault detection and fault isolation testing as a limitation in the test planning documents. A maintainability demonstration would have inserted pre-faulted modules into the Guidance Replacement Program hardware to exercise the built-in fault detection and

fault isolation circuitry. The Air Force decided in 1993 that a maintainability demonstration was not cost-effective (a decision in which DOT&E concurred at the time). In its place, the System Program Office (SPO) and contractor used modeling and analysis of the integrated circuitry and its built in fault testing capabilities. The Guidance Replacement Program components have thus far operated very long times before failure occurs. Further fault detection and fault isolation data and experience will be accumulated over the next several years with the fielded system.

The second Propulsion Replacement Program Operational Assessment found an issue that could delay IOT&E and hence the program schedule. Due to failures in acceptance testing, delivery of batteries for the test-unique premature separation system may be late. Were this to occur, at least the first of two planned demonstration flights would be delayed.

The Operational Assessment found three further issues that require additional attention. These are range performance, mission software support, and the possibility that funding shortfalls will preclude collecting and analyzing all available accuracy data during flight tests. The range performance of the Propulsion Replacement Program-modified Minuteman III is expected to suffice for full effectiveness against its current target set. However, the requirement to use environmentally acceptable materials has increased Propulsion Replacement Program stage weights and slightly reduced the total propellant volume. These factors indicate a reduction in overall range performance. The range issue requires further attention to ensure that it does not worsen. The software issue concerns the lack of a computer resources life cycle management plan (CRLCMP) specific to the Propulsion Replacement Program software. The ICBM SPO intends to publish the Propulsion Replacement Program CRLCMP by April 2000. The two Propulsion Replacement Program flights represent an excellent opportunity to bolster the limited data base on the Guidance Replacement Program accuracy performance. Due to funding shortfalls, the collection and analysis of radar tracking data during the boost phase are scheduled to be eliminated. Although a credible accuracy analysis can be based on data collected in the target area, boost-phase data are needed for a more complete characterization of the Guidance Replacement Program performance. These data are very useful for developing and refining engineering estimates and models of the Guidance Replacement Program performance. DOT&E expects the Air Force to make all possible efforts to restore these activities and ensure that these data are collected and analyzed. Supplementing the limited information currently available on Guidance Replacement Program accuracy should be an Air Force priority.