Intercontinental Ballistic Missile (ICBM) Master Plan

Fiscal Year (FY) 14



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AFGSC ICBM Master Plan

December 2013 -

CLINTON E. CROSIER Brigadier General, USAF Director, Strategic Plans, Programs, Requirements, and Assessments (A5/8/9) Air Force Global Strike Command Barksdale AFB LA

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1.1. EXECUTIVE SUMMARY

1.1.1. This ICBM Master Plan outlines Headquarters (HQ) Air Force Global Strike Command's (AFGSC) strategic vision and requirements for the ICBM weapon system to meet the nation's landbased strategic nuclear deterrence mission needs. It identifies force characteristics, ICBM mission requirements, ICBM planning capability needs, and technologies needed for continued system viability. The near-term period runs from the present to Fiscal Year (FY) 2020. Near-term priorities include: 1) replenishing flight test assets and equipment supporting warfighter assessments, and 2) addressing deferred sustainment of equipment directly supporting weapon system command and control (C2) functions. The far-term period extends the vision from 2020 and beyond. Additionally, the ICBM Master Plan addresses the requirement for and opportunities to leverage common technology investments developed by the Air Force (AF), Navy, Army, and others. ICBM enterprise updates to this plan occur every two years, under the direction of HQ AFGSC Director of Strategic Plans, Programs, Requirements, and Assessments (HQ AFGSC A5/8/9). The ICBM Master Plan is the lead Major Command's (MAJCOM) direction to ensure resources support current and projected operational requirements of the Minuteman III (MM III) weapon system and a potential follow-on ICBM system. The outcome of the Ground Based Strategic Deterrent (GBSD) Analysis of Alternatives (AoA) will inform major sustainment modifications to ensure compatibility with future capabilities, therefore reducing investments incurred by maintaining Minuteman III to 2030 while simultaneously acquiring the follow-on ICBM.

1.1.2. Currently, the MM III is the only ICBM weapon system deployed by the United States. First deployed in 1970 with a service life goal of 10 years, the MM III service life has been progressively extended to the year 2000, then 2020, and most recently to 2030 as directed by the FY07 *National Defense Authorization Act*. Robust sustainment efforts are required to adequately address logistical and operational effectiveness issues of the legacy weapon system and its associated infrastructure and support equipment. A disciplined systems engineering approach that includes research, development, test, and evaluation will continue to guide future activities by the Air Force Nuclear Weapons Center (AFNWC), Air Force Research Laboratory (AFRL), and other organizations as directed by HQ AFGSC. The ICBM Master Plan provides the vision and direction for sustaining and modernizing the nation's ground based deterrent capability.

1.2. PURPOSE

1.2.1. The ICBM Master Plan forecasts sustainment, modernization, and recapitalization needs across the entire weapon system. These needs are based on direction provided by the Nuclear Deterrence Operations (NDO) Core Function Lead (CFL) in the annual *Core Function Support Plan* (CFSP) document. Direction given in the NDO CFSP conforms to previously established and validated requirements documents, United States Strategic Command (USSTRATCOM) needs, AFNWC technology assessments, and the ICBM Systems Directorate weapons system performance assessment and sustainment activities. Additionally, the *ICBM Master Plan* is the basis for and informs the AFNWC's *ICBM Systems Directorate System Roadmap*. The ICBM community uses the *ICBM Master Plan* to ensure AFGSC Program Objectives Memorandum (POM) inputs to the DoD Budget Estimate Submission for the President's Budget adequately reflect NDO Service Core Function commitments, as well as weapon system requirements and objectives. HQ AFGSC and the Assistant Secretary of the Air Force for Acquisition, Global Strike Division (SAF/AQPN) shall keep Air Force Materiel Command (AFMC), Air Force Program Executive Officer for Strategic Systems (AFPEO/SS), and AFNWC informed of resource and budget decisions made by the CFL, Headquarters Air Force, and Office of the Secretary of Defense during the requirements and resource allocation process.

1.3. SCOPE

1.3.1. The *ICBM Master Plan* incorporates strategic planning, programming, technology, and budgeting information and serves as guidance for the ICBM community to plan requirements and justify budget submissions. Careful analysis is essential for planning projected replenishments, upgrades, and modifications to the weapon system. The *ICBM Master Plan* covers the Minuteman III weapon system and next generation recapitalization activities in the Future Years Defense Program (FYDP) and beyond. Minuteman III weapon system and AFGSC-managed items include five broad categories: Aerospace Vehicle Equipment, Operational Ground Equipment, Support Equipment, Real Property Installed Equipment, Infrastructure, and other (AFGSC-managed items).

1.4. ASSUMPTIONS

The ICBM Master Plan is based on the following assumptions:

1.4.1. USSTRATCOM will continue to assign ICBMs against high value targets requiring a high probability of damage expectancy.

1.4.2. Force size/structure may change depending on policy and arms control agreements.

1.4.3. Four Force Development Evaluation flights will be conducted per year.

1.4.4. The Department of Energy may implement future nuclear warhead stockpile changes.

1.4.5. The AF will retain the capability to upload Multiple Independently-targetable Reentry Vehicles (MIRVs) on the Minuteman III.

1.4.6. Minuteman III effectiveness will be maintained throughout the stockpile-to-target environment through 2030 by implementation of major system-level modifications, as required.

1.4.7. Recapitalization is required for ICBMs to remain a viable deterrent through 2030.

1.4.8. Major subsystem investments will be adaptable to a follow-on system.

1.5. MAJCOM OBJECTIVES

1.5.1. AFGSC has two main objectives for the ICBM force. The first is to continue maintaining the Minuteman III weapon system through 2030 as mandated by Congress and specified in the 2010 Nuclear Posture Review. The second objective is to preserve a GBSD capability through 2075, as spelled out in the GBSD ICD. An analysis beginning in FY13 will identify potential materiel solutions and courses of action for maintaining such a capability until 2075. It is AFGSC's responsibility to ensure investments made in the near-term to support the 2030 mandate can be leveraged into the technologies and infrastructure needed for an enduring GBSD capability.

1.6. FORCE CHARACTERISTICS

1.6.1. The 2010 NPR reaffirmed the Triad concept of ICBMs (Minuteman III), Bombers (B-52Hs and B-2As), and Submarine Launched Ballistic Missiles (SLBMs). ICBMs provide value to the Triad with high reliability and accuracy, assured connectivity, hardness against attack, prompt response, and continual availability in a nuclear conflict. ICBMs provide significant advantages to the U.S. nuclear force posture, including extremely secure command and control, high readiness rates, and relatively low operating costs.

1.6.2. MM III's high alert rate, secure real-time two-way C2 communications systems, quick weapon system reaction timing, and shortest total time to strike the target offer national leadership with a prompt response capability. Promptness and real-time communications maximize Presidential decision time in a nuclear crisis. Deployed on day-to-day alert in geographically dispersed, hardened facilities, the Minuteman III force presents a targeting conundrum for adversaries, which is inherently stabilizing.

1.6.3. As the number of nuclear strategic delivery vehicles decrease, the value of the ICBM to our nation's deterrent capability increases. As the total number of nuclear warheads decreases worldwide, the relative survivability of the ICBM increases, improving stability. Without ICBMs, surprise attacks against a small number of bomber and submarine facilities could adversely alter the balance of forces.

1.6.4. Adversaries cannot eliminate the ICBM force without substantially reducing their offensive strategic capability, leaving themselves vulnerable to surviving ICBMs, bomber forces and SLBM fleet. The cost to attack ICBM forces is a significant deterrent to adversaries considering a disarming first strike attack, making them inherently stabilizing ("Strategic Deterrence in the 21st Century" Undersea Warfare, Spring 2012 edition by Admiral Richard Mies, USN (retired)).

1.6.5. The ICBM Weapon System is comprised of multiple components. The AVE includes guidance, propulsion, and re-entry systems. The OGE consists of status monitoring systems and command and control systems. Support equipment includes transportation and handling equipment, field support, and test equipment. Infrastructure includes roadways required for transport of missiles and components, launch facilities, missile alert facilities, and power and environmental control systems.

1.6.6. The Minuteman III and follow-on ICBM system must each retain their inherent beneficial characteristics, to both deter and defeat multiple potential opponents through a variety of scenarios and threats.

2.1. ICBM WEAPON SYSTEM CAPABILITIES SUMMARY

2.1.1. The USSTRATCOM strategic deterrence mission requires a safe, secure, and effective nuclear capability. The Capabilities Based Planning Process identifies shortfalls in meeting warfighter needs and feeds the requirements development process so shortfalls can be addressed. AFGSC, USSTRATCOM, and AFNWC continually evaluate the weapon system, through testing and sustainment/engineering analyses, to ensure the ability to meet evolving warfighter needs.

2.1.2. Increasing confidence in the long-term reliability, safety, and security of the stockpile is essential to preserve effectiveness in the absence of nuclear testing. As the stockpile undergoes life extension activities, plans must ensure delivery platforms provide the same warfighting effectiveness, with a stronger emphasis on the safety and security characteristics of the warheads.

2.1.3. ICBM capabilities were most recently assessed during the 2011 GBSD Capabilities Based Assessment (CBA). The CBA assessed the Joint Force's ability to conduct deterrence operations, and should deterrence fail, decisively defeat adversary high value/high payoff targets. ICBM capabilities were omitted from the initial assessment to determine the effectiveness of the Joint Nuclear Force and conventional force effectiveness in several scenarios. Then current ICBM capabilities were folded into the Joint Force to identify gaps and shortfalls in overarching requirements. The gaps and shortfalls were documented in the Initial Capabilities Document (ICD) for Ground Based Strategic Deterrent and later validated by the Joint Requirements Oversight Council (JROC). Materiel Solutions Analysis will be conducted in FY13-FY14 to inform future investment decisions and gap mitigation plans. Continuous assessment of ICBM capabilities is important to ascertain the ability to meet warfighter needs as emerging threats and issues arise.

2.1.4. AFGSC participates in the risk management process led by the ICBM Systems Division through the ICBM Planning Conference and Integration Integrated Product Team processes.

2.2. CURRENT CAPABILITY NEEDS (FY13-19)

2.2.1. Several major Minuteman III modernization and life extension programs (LEP) have either just completed or are currently in progress to ensure maximum system availability and capability. Many of these programs were initiated under the mandate to sustain Minuteman III capability through 2020.

2.2.2. Figure 1 is a compilation of ongoing and forecasted actions, next-generation ICBM planning, and identification of sustainment risks that require continued monitoring until mitigation is accomplished. The objective of this effort is to address sustainment challenges, while ensuring future modernization and recapitalization acquisition efforts remain integrated and synchronized to meet operational requirements. This section establishes the foundation for a more comprehensive ICBM sustainment roadmap, which the ICBM Systems Directorate (AFNWC/NI) is responsible for publishing.

2.2.3. AFGSC/CC established a Battlespace Awareness Tiger Team (BATT) charged with: 1) identifying situational awareness capability gaps in the three ICBM wing complexes; 2) identifying capability improvements/needs to reduce or eliminate the gaps; and 3) developing a Concept of Operations (CONOPS) for the employment and operation of an integrated system that provides consolidated/integrated situational awareness to commanders. BATT findings and recommendations inform immediate and future modernization and sustainment investment decisions to expedite integration of improved battlespace awareness capabilities.



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Figure 1: ICBM Planning (FY13-50)

2.2.4. The AF Corporate Process directs acquisition planning and implementation of program actions to ensure the Minuteman III weapon system remains viable. The need for continued capability demands accuracy, availability, reliability, hardness, and maintainability. This section identifies the sustainment, modernization, and technology needs required to preserve existing capability and address current and future gaps.

2.3. CURRENT CAPABILITY SUSTAINMENT (FY13-19)

2.3.1. Aerospace Vehicle Equipment

2.3.1.1. The Mk21 Fuze Refurbishment Program is needed to meet near-term warfighter requirements. Mk21 Fuzes are already over three times beyond their original design life. The current refurbishment program focuses primarily on solid-state radars, batteries, and flex-cables, returning non-serviceable fuzes to serviceable status through component repair and replacement. Future supporting efforts will expand the scope of the program to repair failed components, thereby maximizing the effectiveness of the refurbished Mk21 Fuzes. This program will continue through 2020, ensuring adequate supply to meet fielding requirements. The ICBM Fuze Program will begin producing replacement fuzes in or about 2020, and they will be integrated into the fielded force in the course of the planned maintenance cycle until all legacy fuzes are retired. Continued fuze refurbishment beyond 2020 and increased aging and surveillance activities will provide risk mitigation for any delays in the ICBM Fuze Program.

2.3.1.2. Guidance repair, refurbishment, and trend analysis is an ongoing effort. This effort identifies negative trends and allows AFNWC to provide mitigation plans to AFGSC and inform need dates for replacement systems. These activities should persist for the life of a guidance system.

2.3.1.3. The Pendulous Integrating Gyroscopic Accelerometer (PIGA) Float Program reproduces Minuteman III accelerometer floats for routine PIGA repairs. This effort addresses potential reliability issues with high-hour PIGAs. With current funding, this effort will address all PIGAs by 2018.

2.3.1.4. Software supportability issues with the Central Data Analysis System (CDAS) will drive an upgrade in the 2018 timeframe. CDAS tracks guidance system configuration, test, and repair data. AFGSC will support this effort during the FY18 POM. AFNWC will ensure cost estimates are available in late 2015 to support POM efforts.

2.3.1.5. The motors delivered under the Propulsion Replacement Program (PRP) were fielded starting in 2001. They have a threshold design service life requirement of 20 years and an objective design life of 30 years. Ongoing Assessment & Aging Surveillance (A&AS) has identified no life-limiting trends for any of the PRP stages. Appropriate A&AS will continue to inform timeline decisions for a replacement program.

2.3.2. Operational Ground Equipment

2.3.2.1. OGE includes equipment for environmental systems, miscellaneous mechanical, ground electronics/power, security, C2 systems, Airborne Launch Control System (ALCS), test facilities/operations, and operations and maintenance trainers. A&AS and sustaining/engineering funding are critical to continue assessing OGE systems/subsystems viability and aging trends through 2030. It is imperative to establish prioritization of ground A&AS and sustaining/engineering funding.

2.3.2.2. The Launch Control Center (LCC) Voice Communication System requires replacement due to diminishing manufacturing sources and parts obsolescence. AFGSC and AFNWC developed a modernization/replacement plan, and AFGSC will advocate for funding.

2.3.2.3. The supply of Cartridge Tape Units used for missile maintenance activities exhausts by FY16. The tape media is no longer available. A replacement program started in FY13 as part of the Codes Systems Media Program, and a new unit will be delivered by FY16.

2.3.2.4. Three components of the ICBM Security Modernization Program effort are Concrete Head Works, Fast-Rising B-plug, and Remote Visual Assessment (RVA). The concrete enhancement is complete. Fast Rising B-Plug and RVA will complete by the end of FY14.

2.3.2.5. Planned sustainment activities for the B-plug Secondary Door Control Assembly include circuit cards and firmware, requiring replacement in FY18, and the Energy Storage System requires replacement beginning in FY20.

2.3.2.6. The guidance and control liquid cooling unit suite is increasingly difficult to support due to parts obsolescence. A projected guidance replacement program could mitigate this sustainment risk. If a guidance replacement program is not implemented by 2018, a detailed sustainment GCLC action plan is required by 2018.

2.3.2.7. Oxygen Regeneration Unit is currently unsupportable, with numerous parts not procurable, and the active filter media is beyond its established shelf life. AFGSC prioritized replacement efforts during the FY15 POM.

2.3.2.8. Numerous refurbishment actions are required for missile suspension wire ropes, Launch Facility (LF) shock isolation, hydraulic control units, blast valves, launcher closure multiplying linkage, and ballistic gas generators. AFGSC and AFNWC will determine appropriate strategy for refurbishment, replenishment spares, or replacement to support planning and programming.

2.3.2.9. AFNWC is not conducting Aging and Surveillance testing on LF/LCC lead acid emergency batteries. Therefore, the basis for the 25/28-year planned service life is not supported by analysis data. AFNWC should evaluate changing batteries based on manufacturer's service life estimate and work with AFGSC/A4M and 20 AF to build the new battery replacement requirement into the sustainment baseline and missile maintenance yearly workload. This effort would use sustainment funds so AFGSC has the latitude to prioritize and fund this activity when necessary.

2.3.2.10. Capacitors contained within many ground electronics power supplies require replacement due to age related issues. AFGSC and AFNWC will develop an appropriate strategy for this effort in time to support planning, programming and implementation.

2.3.2.11. LF/Missile Alert Facility (MAF) Metal Oxide Varistors used for circuit protection will require replacement beginning in FY18. Determine appropriate strategy for this effort by FY16.

2.3.2.12. ALCS equipment requires replacement. Synergistic opportunities exist with the projected needs for a LF Ultra High Frequency (UHF) Radio Replacement and the Block Upgrade program to the Navy E-6B airframe. These modernization programs should be coordinated and linked unless other factors require independent replacement actions. USSTRATCOM requires that AFGSC implement a two-way secure communication capability in the Minuteman III weapon system, to increase flexibility and restore "Peacekeeper-like" functionality that allows the ALCS to retarget, interrogate, and receive status from LFs. AFGSC will leverage the completed Long Range Planning study on ALCS communications to prepare future CFSP and POM inputs.

2.3.2.13. The Strategic Targeting Applications Computer System (STACS) utilizes unsupportable hardware and software. Additionally, it produces 9-track tapes as a deliverable media. Production of 9-

track tapes ceased in 2004, and the existing stock is quickly becoming depleted. A replacement program was started in FY13 and projected initial delivery in FY15.

2.3.2.14. AFGSC and AFNWC will develop a strategy to update operations and maintenance subsystem trainers by FY16.

2.3.3. Support Equipment

2.3.3.1. The Re-entry Field Support Equipment (RFSE) Program replaces existing test equipment used to certify Mk12A and Mk21 Re-entry Vehicles (RVs). The first production unit is scheduled for FY15 and the program will complete by FY17.

2.3.3.2. The Electrical Electronic Equipment Test Set-Vandenberg Replacement Program was initiated in FY10 to replace aging and obsolete test support equipment, including message generators for production and pre-launch checkout of MOD-7 test wafers. This program is scheduled to complete in FY14.

2.3.3.3. AFGSC and AFNWC will develop a strategy for replacement of Ground Maintenance Automated Test Sets. A replacement is required by FY19 to support operations through 2030.

2. 3.3.4. Numerous support equipment items for propulsion, guidance, reentry vehicle, electronics, and specialty equipment are becoming increasingly difficult to support due to parts obsolescence and vanishing vendors. Develop a strategy and way ahead that drives a priority in the annual sustainment budget.

2.4. CURRENT CAPABILITY MODERNIZATION (FY13-19)

2.4.1. Aerospace Vehicle Equipment

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	Mk21 Fuze Refurbishment						
	ICBM Fu	ze Program					
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Figure 2: Aerospace Vehicle Equipment

2.4.1.1. The 2010 Nuclear Posture Review Report requires off-loading of MIRV to a single RV. AFGSC missile downloading is integrated with unit-scheduled maintenance actions and is scheduled to complete in FY14.

2.4.1.2. The Air Force ICBM Fuze Program leverages common development in the Navy's Mk5 Fuze Program to provide W87 replacement fuzes that are also compatible with the W78/88-1 LEP. The program approach is being adjusted by designing a single fuze compatible with both the W87 and the W78/88-1 LEP. Program funding adjustments will be balanced with fuze refurbishment and sustainment costs, and Mk21 Fuze refurbishment efforts will ramp down as W87 Replacement Fuzes are fielded.

2.4.1.3. AFGSC continues to support the Joint AF/Navy W78/88-1 LEP effort, to include funding for Lead Project Office support for the LEP and AF ICBM Fuze efforts. The SECAF notified the Chairman of the Nuclear Weapons Council of the Air Force's continued support of the 6.2 Feasibility Study for the W78/88-1 LEP. However the 16 Oct 13 Defense Management Action Group recommended to the

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Nuclear Weapons Council that the LEP be postponed indefinitely. A final decision will not be rendered until early 2014. The outcome of the decision will shape the future of a common weapon with the Navy.

2.4.1.4. AFGSC, AFNWC/XZ, and AFNWC/NI will use ICBM Dem/Val Guidance Application Program (GAP) funds to continue development of the critical enabling technologies needed to support a future guidance program in the mid 2020 timeframe. USSTRATCOM requires these new technologies to support their operational mission requirement. The program must evaluate architecture solutions to reduce ownership costs and facilitate new maintenance and security concepts, while significantly increasing mean-time between failure and reliability. The program will also mitigate numerous sustainment risks, reduce logistics support associated with the existing navigation unit, reduce guidance depot/peculiar support equipment, and potentially eliminate the need for a replacement guidance liquid cooling unit. The guidance modernization architecture should consider eliminating the need to open the LF launcher closure and/or the removal of the entire missile guidance set to accomplish internal equipment repairs. The goal should be to remove/replace internal guidance components via the personnel access shaft. This effort leverages Navy design and development technologies from the SLBM guidance industrial base, to support ICBM strategic systems and share common development risks with the Navy.

2.4.1.5. AFGSC and AFNWC will conduct ICBM Dem/Val Propulsion Application Program (PAP) activities that mature critical technology elements for consideration in follow-on modernization/replacement programs. Trade space will include new booster designs, maximum reuse of existing hardware, or a combination. PAP activities are discussed in more detail in Appendix C. Due to design service life of current motors and development time needed to produce and field replacements, AFGSC will advocate for a Solid Rocket Motor Program start in the FY16 POM.

2.4.1.6. Performance Assessment Data System will require an update to replace obsolete commercial software and hardware. AFGSC will validate efforts for prioritization during the FY20 POM and ensure the ICBM systems directorate cost estimates are available by FY17 to support POM efforts.



2.4.2. Operational Ground Equipment

Figure 3: Operational Ground Equipment

2.4.2.1. ICBM Cryptography Upgrade (ICU) II will continue as planned with Initial Operational Capability in FY17. The 2007 ICBM Operational Safety Review mandated remote code change and

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irreversible transformation capability implementation in the Minuteman III weapon system. This program incorporates a continuous signal lock-out solution to correct Nuclear Command, Control and Communications (NC3) message processing outages.

2.4.2.2. Minuteman Minimum Essential Emergency Communications Network Program Upgrade (MMPU) incorporates new terminals supporting communication at higher Extended Data Rate with the Advanced Extremely High Frequency (EHF) satellite system. AFGSC supports continued production, deployment and sustainment of legacy Minuteman Program and its upgrade MMPU.

2.4.2.3. AN/FRC-175 ground satellite terminal provides UHF MILSTAR reception of Emergency Action Message (EAM)s to the LCCs. AFGSC supports continued production, deployment and sustainment of the AN/FRC-175 and/or projected upgrades.

2.4.2.4. GRC-208 UHF Receiver is a hardened communications link for LCCs providing C2 with ALCC, ABNCP, NAOC, and local UH-1Ns providing ICBM security/maintenance support. AFGSC should prioritize a replacement program during future POM deliberations.

2.4.2.5. AN/GSC-42 UHF Radio provides Wing Command Posts EAM reception and Force Reportback capability. Global ASNT increment II, currently unfunded, is projected to replace the AN/GSC-42/FRC-175.

2.4.2.6. Weapon System Control Console Printer (WSCCP) will require replacement in the FY17 timeframe due to supportability. AFGSC prioritized/submitted a WSCCP replacement program during the FY15 POM.

2.4.2.7. The performance of the current LCC Voice Control Panel (VCP) has degraded. A LCC Voice Communications Control Panel (VCCP) Replacement Program will replace the current VCP, providing quality voice communications required to perform the ICBM mission. AFGSC prioritized/submitted an FY15 POM submission supporting this effort.

2.4.2.8. Higher Authority Communications/Rapid Message Processing Element (HAC/RMPE) Service Life Extension Program (SLEP) replaces HAC/RMPE Peculiar Support Equipment/Test Support Equipment and replenishes HAC/RMPE spares. The program also replaces aging electrolytic capacitors. AFGSC prioritized/submitted a replacement program in the FY15 POM.

2.4.2.9. Strategic Automated Command and Control System (SACCS) provides the primary nonsurvivable command and control capability for receiving and disseminating secure EAMs and forcedirection messages supporting strategic bombers, reconnaissance aircraft, mobilization aircraft, tanker support aircraft, and the ICBM force. Support to modernize the program will be addressed in future POMs.

2.4.2.10. Minuteman Codes System Media program modifies Wing Codes Processing System (WCPS) software to accommodate any type of data on compact discs. This effort is scheduled to conclude in FY15.

2.4.2.11. The ALCS Procedures Trainer hardware/software modification ensures uninterrupted training for ALCS crewmembers. This program is scheduled to be completed by FY14.

Support Equipment FY13 FY14 FY15 FY16 FY17 FY18 FY19 FY20 FY35 Near-term Mid-term Far-term PT Replacement PT Replacement Transportation TE Replacement Program **TE Replacement** Handling MT Replacement MT Replacement Filed Suport/Test RSFE **GMATS** Replacment **RSFE Replacement** Equipment EEETS-V

2.4.3. CURRENT CAPABILITY SUPPORT EQUIPMENT(FY13-19)

Figure 4: Support Equipment

2.4.3.1. The Payload Transporter (PT) III Replacement (PTR) Program was initiated to provide a functional replacement for the aging PT. The only improvement in capability is to provide a security refresh to meet nuclear transportation protection requirements. The PTR is funded through FY14. Changes to the PT Periodic Depot Maintenance Cycle should be considered when determining availability for maintenance activities and resulting needs for replacement units.

2.4.3.2. Transport-Erector (TE) Replacement Program was initiated in FY13 to provide a replacement for the aging TE. TEs were used extensively during deactivation/mission realignment and propulsion replacement activities. The TE was fielded in the 1980s, with a projected 10-year design life based on supporting four booster moves per wing/per year. Past workload exceeded the TE's design life and parameters by well over 70 years. Current unit availability is at critical levels (8 of 19). TE operations were halted 13 times since 2006 due to structural issues (cracks in frames and welds, hoist failures). Current refurbishment efforts are limited in scope to keep the current fleet operating until replacement. The TE replacement program is currently funded, with production scheduled to start in FY15. Changes to the TE Periodic Depot Maintenance Cycle should be considered when determining availability for maintenance activities and resulting needs for replacement units.

2.4.3.3. Force Development Evaluation assets are critical to validating continued system reliability and demonstrating deterrence. Multiple replenishment efforts must begin in FY15 to avoid a gap in ICBM flight and ground testing. A new telemetry wafer and flight termination system must be developed and produced. Mk21 test aeroshells require test antenna windows for the duration of the Mk21 service life. For Simulated Electronic Launch Minuteman (SELM) testing, squadron dated simulators require recapitalization.

2.4.3.4. The Reentry Support Equipment Replacement Program plans to replace a 30-year old Reentry System (RS)/RV depot test suite. Due to the suite's age, it became unreliable, and efforts to sustain and support the test suite were unaffordable. Most of the electronic sub-assemblies are no longer supported by the original vendors, therefore, refurbished or used equipment is unavailable. This program will procure a replacement for the Low Frequency Instrumentation Console (LFIC), Radio Frequency Instrumentation Console, Test Control Station, and Interface Adapter Systems with a system based on a common architecture, such as the DoD Family of Automatic Test Systems (ATSs) and new Test Program Sets. AFGSC prioritized/submitted an FY15 POM submission supporting this effort.

2.5. Technology Needs (See Appendix C: Technology Roadmap Summary)

2.6. FAR-TERM CAPABILITIES

2.6.1. Far Term Capabilities Sustainment

2.6.1.1. Aerospace Vehicle Equipment (AVE). All AVE sustainment needs require attention in the Current Capability Needs timeframe. Any sustainment actions deferred to FY20 or beyond would be a result of funding priorities and will be captured in the next revision.

2.6.2. Far Term Operational Ground Equipment

2.6.2.1. A study of the Hardened Intersite Cable System, which provides connectivity between LFs and LCCs, is necessary to determine replacement, repair, and/or upgrade due to obsolescence. If cable replacement is not available in future years, the weapon system will either degrade or become inoperable. The study should look at continuing sustainment of current cable suppliers, find new sources to qualify cable replacements, and look at alternatives (e.g., fiber) and develop an appropriate strategy for this effort in time to support planning and programming in FY26.

2.6.2.2. Supportability issues will necessitate replacement of the Launch Control Panels, Launch Enable Panels, and associated Mechanical Code Units. This equipment contains the codes necessary for positive control (launch when authorized) and nuclear surety (prevent unauthorized launch). AFGSC and AFNWC will determine an appropriate strategy for this effort, including the ideal timing for replacement.

2.6.2.3. A significant portion of the Very Low Frequency/Low Frequency (VLF/LF) equipment is Commercial Off-The-Shelf hardware and is subject to parts obsolescence and diminishing manufacturing sources within the next 15 years. With new communication capabilities (e.g. waveforms), the VLF/LF terminal will need to be replaced beginning in FY20. AFGSC must determine appropriate strategy for this effort, in time to support planning and programming.

2.6.2.4. The WCPS produces coded material for various code components. With adequate funding, the current WCPS is supportable through 2030. A WCPS replacement program is projected for the FY20 timeframe as a risk mitigating measure through 2030, and will position the WCPS to support GBSD beyond 2030.

2.6.2.5. There is no long-term sustainment plan for Remote Visual Assessment (RVA), the closedcircuit video system employed at the LFs. AFGSC and AFNWC will develop a strategy for long-term RVA sustainment and technology refresh requirements. Modification requirements are identified to integrate the RVA and MAF Closed Circuit TV systems for consolidated presentation to security forces at control centers.

2.6.2.6. The LF Trainers require refurbishment in the FY20-25 timeframe in order to ensure uninterrupted training. AFGSC and AFNWC will develop a strategy to accomplish this effort, in time to support planning and programming.

2.6.2.7. Support Equipment. Sustainment needs for support equipment are addressed in the current capability needs timeframe or by future modernization/replacement programs.

2.6.3. Far Term Modernization

2.6.3.1. Current missile field communications lack sufficient range and bandwidth to support real-time situational awareness to mobile forces, connectivity to geographically separated centers, expanded data transfer throughput, and a common operational picture. AFGSC provided direction to AFRL to identify

candidate technologies and architectures that support more robust, endurable, rapid, and secure C2 capability for missile field operations.

2.6.3.2. ALCS Support Equipment Replacement Program modernizes the software, develops new interface test adapters and video test equipment, and moves the workload to a supportable test platform to provide ALCS testing through 2030. This program will complete in 2021. AFGSC will coordinate support equipment requirements with the ALCS upgrade program, as required.

2.6.3.3. SELM equipment is critical to ground testing and is comprised of aging equipment with most items facing obsolescence. This equipment is heavily used and is the primary source for electronically testing operational systems to determine reliability. AFGSC and AFNWC will develop an appropriate strategy to modernize this equipment, using supportable technology, including a transport designed to carry the specialized equipment.

2.6.3.4. The Control Monitor Training Device procedures, operations, and maintenance trainers require hardware, software, and system upgrades in the FY20-FY25 timeframe to ensure training capability is maintained. AFGSC and AFNWC will develop an appropriate strategy to support planning and programming.

2.6.3.5. The Missile Transporter (MT) Replacement Program is projected for the late 2020s. The replacement program must be deconflicted with Periodic Depot Maintenance requirements and synchronized with any follow-on propulsion upgrades.

2.6.4. Next Generation Capabilities/System Attributes

2.6.4.1. Regular modernization efforts have extended the life of the Minuteman III system for several decades. However, the infrastructure consisting of the facilities, C2, and power systems has seen few improvements during this time. Additionally, it is becoming increasingly problematic to sustain and integrate new technologies into the existing system due to compatibility issues, component obsolescence, and loss of the legacy vendor base. Moreover, the operating concept is a manpower-intense baseline which could possibly be reduced through implementation of modern technologies and automation. The 2010 NPR and GBSD CBA affirmed the need for a CONUS-based ICBM deterrent capability. Current plans call for maintaining the Minuteman III through 2030. The GBSD AoA will evaluate alternatives to maintain capability through 2075.

2.6.4.2. The 2013/14 President's Budgets fund GBSD activities, including an AoA and associated concept refinement activities for potential materiel solutions. The AoA will inform and focus the sustainment, modernization, and recapitalization strategy for the ICBM force. The AoA will examine viable ICBM follow-on concepts and materiel solutions to support the Air Force's strategic deterrence and global strike missions, preserve strategic stability, prevent success of a preemptive nuclear attack against the U.S., maximize the single shot high probability of kill against all target hardness classes, and achieve lower life cycle costs.

2.6.4.3. While the *ICBM Master Plan's* focal-point through 2030 is sustaining and modernizing the Minuteman III force, planning and development for an ICBM follow-on is necessary to meet the combatant commanders' (COCOM) capability requirements beyond 2030. Figure 5 depicts a notional schedule for ICBM sustainment, modernization, and recapitalization over the long-term. Current and near-term investments not only serve to extend the life on Minuteman III but also act as the beginning of the transition to GBSD. GBSD technical development beginning in FY17 will incorporate previous technical development activities. All efforts will be developed from a common set of GBSD

requirements. This strategy is designed to ensure there are no duplicate investments in a subsystem for both sustainment/modernization and GBSD purposes.

FY 15	FY 16	FY 17	IB	FY 19	FY 20	FY 21	FY 22	51 23	FY 24	FY 25	FY 26	FY 27	FY 28	FY 29	FY 30	FY 31	52 32	FY 33	£1 34
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Figure 5: ICBM Follow-on Schedule

2.6.4.4. The following capabilities and associated attributes are COCOM-validated and JROC approved under previous strategic deterrence analysis and directly support the GBSD Joint Capability Assessment. Additionally, this GBSD capability/attribute list reflects both NPR and Nuclear Strike Senior Warfighter Forum analysis.

2.6.4.4.1. Effective: Deliver required effects/services under normal and wartime conditions; high operational effectiveness against all strategic target classes.

2.6.4.4.2. Reliable: Perform with confidence under normal and wartime conditions; high reliability to ensure a high probability of success.

2.6.4.4.3. Responsive: Operate within specified time constraints; high availability with connectivity to a secure, redundant, and immediate C2 capability.

2.6.4.4.4. Survivable: Maintain acceptable operational capability under wartime conditions; overcome and/or minimize impact from attack during all phases of missions/operations.

2.6.4.4.5. Secure: Minimize likelihood and consequences of unauthorized access; positive control of weapon system during all phases of mission/operations.

2.6.4.4.6. Safe: Minimize likelihood and consequences of exposure, error, or accident; safe operation during all phases of missions/operations.

2.6.4.4.7. Flexible: Provide options and react to changing conditions; scalable and tailorable range of postures and operations.

2.6.4.4.8. Global: Conduct worldwide operations; maintain ability to hold all assigned targets at risk.

2.6.4.4.9. Sustainable: Maintainable, feasible, and executable across the system's lifetime, while maintaining affordable life cycle costs.

2.6.4.4.10. Adaptable: Provide or enable new capabilities; common/modular weapon system components to improve performance/sustainability.

2.6.4.4.11. Transportable: Compatible with mobility aircraft, ground transportation, and handling equipment; safely/securely transport weapon system components.

2.6.5. Far-Term Technology Needs (See Appendix C: Technology Roadmap Summary)

3.1. ICBM INFRASTRUCTURE

Infrastructure	FY13 FY14 FY15 FY16 FY17 FY18 FY19 FY20		FY25	FY30	F.Y35	FY40	FY50
	Near-term	Mid-term		Fai-ter	m	and the second second	
Power	Diesel Replacement Minuteman Power Panel Auto Transfer Equip/MMPP						
Roads			Defense Act	ess Roads (DAR)	The Mary Mary	E MANAGE	
Water			LF Waste Dis	posal/MAF Water	The second s		

Figure 6: RP/RPIE

AFGSC A4/7 Missile Engineering Office (MEO) has overall responsibility for engineering management and program execution of ICBM Real Property (RP) and Real Property Installed Equipment (RPIE). AFGSC A4/7 MEO Life Extension Assessment Program Team will continue in-depth system studies as necessary to determine additional RP/RPIE restoration and modernization requirements. RP/RPIE currently can support and continue to meet requirements through 2030. This will require an aggressive inspection and maintenance program in order to ensure the long-term function of the facilities. In the interim (now to 2020), the RP/RPIE will be repaired, upgraded, or replaced, as needed. This approach will continue throughout the objective period (FY10-FY30). The RP/RPIE will be maintained from FY20 through FY30 to ensure maximum flexibility facilitating a possible Minuteman III follow-on operational system deployment.

3.1.1. Power, Roads, And Water

3.1.1.1. The Minuteman Power Panel Replacement Program was initiated in FY10 to replace power distribution panels at LF/MAF/trainer facilities. The ICBM SPO should continue to support this program through scheduled completion in 2015.

3.1.1.2. Implement a standby power solution for the Diesel Electric Units (DEUs) after completion of the Malmstrom AFB DEU replacement project. As Minot AFB and F.E. Warren AFB DEUs were rebuilt with new prime movers only, the alternators will likely require attention due to vanishing vendors.

3.1.1.3. Minuteman Automatic Switching Unit and Minuteman Power Processor Upgrade Program will address obsolescent 1970s-era power system transfer components. AFGSC pursued a program start in FY15. Work will include the necessary civil engineering documents and updated trainers at the on-base training LFs that reflect the upgraded operational equipment.

3.1.1.4. Many local commercial power providers, particularly in the Minot AFB missile field, are operating at their maximum capacity due to increased demand from oil and gas industry growth. This has adversely affected many LFs and LCCs. There is no near-term mitigation option. Future

modernization efforts should consider power availability and develop objective requirements for reduced reliance on commercial power in the missile field.

3.1.1.5. Many LFs throughout the missile complex have conduits between the Launch Support Building and the Launcher Equipment Room (LER), in varying damaged conditions, due to the effects of time and movement of earth. The resulting crushed conduits can cause power issues and allow water into the LER. Crushed conduits and other sources of water intrusion can pose a significant risk to the site. AFGSC and AFNWC formulated an interim solution in coordination with the Environmental Control System program, and a more comprehensive repair effort is in work.

3.1.1.6. The Defense Access Roads (DAR) Program is a centrally managed program keeping the 1770mile road network in useable condition for the safe transit of ICBM boosters, weapons, personnel, and equipment. The DAR program requirement of 295 miles/year is fully funded.

3.1.1.7. Drainage structures/bridges within the DAR system remain unfunded. While an inventory exists to establish a maintenance baseline, an assessment of the assets within the inventory is incomplete. AFGSC A4/7 with the support of the Missile Engineering Office will need to complete the inventory and do an assessment to determine what future investment is needed..

3.1.1.8. RP/RPIE funded efforts. AFGSC A4/7 will continue to prioritize water and waste disposal modifications that address on-site corrosion and water potability issues, as necessary.

3.1.2. Rivet Minuteman Life Extension Program (Rivet MILE)

3.1.2.1. The Rivet MILE Program grew from a need to manage the maintenance of an already mature weapon system through the year 2010 (later extended through 2020). Identified hardness problems, age degradations, and the service life extension to 2020 created a need for on-site Programmed Depot Maintenance. Every funding cycle, AFMC and AFGSC review and approve a list of required tasks. Cost efficiencies are achieved by integrating RIVET MILE personnel and functions into the missile wing structure and eliminating duplication of common efforts such as scheduling, supply, and vehicle maintenance. AFGSC and 309th Missile Maintenance Group (MMXG) are pursuing more efficient alternatives to the current RIVET MILE cycle. The goal is to resolve a greater number of issues when a site enters the process. The program is currently planning to sustain the weapon system through 2030. The final operational solution to deliver an ICBM follow-on capability may drive program content and approach beyond 2030.

4.1. FORCE STRUCTURE/ARMS CONTROL

4.1.1. Nuclear Posture Review

4.1.1.1. The 2010 NPR completed a bottom-up review of nuclear policy, doctrine, force structure, and operations. The NPR provides a roadmap for implementing the President's agenda for reducing risks to the U.S., our allies and partners, and the international community. The NPR places the prevention of nuclear terrorism and proliferation at the top of the U.S. policy agenda and describes how the U.S. will reduce the role and numbers of nuclear weapons. At the same time, as long as nuclear weapons exist, the U.S. must sustain a safe, secure, and effective nuclear arsenal to maintain strategic stability with other major nuclear powers, deter adversaries, and reassure our allies and partners of our security commitments to them. The NPR focused principally on steps to be taken in the next five to ten years. Actions affecting the ICBM force include:

4.1.1.1.1. Reducing U.S. strategic delivery vehicles by 50% of Strategic Arms Reduction Treaty (START) I levels and 30% of the Moscow Treaty level.

4.1.1.1.2. Maintaining the U.S. nuclear Triad under New START.

4.1.1.1.3. De-MIRVing all U.S. ICBMs to a single warhead each to increase stability; however, the ability to upload will be maintained for the Mk-12A and developed and fielded in the future for the Mk-21/21A, based upon force structure decisions.

4.1.1.1.4. Continuing the practice of "open-ocean targeting."

4.1.1.1.5. Further strengthening the U.S. nuclear C2 and maximizing Presidential nuclear crisis decision time.

4.1.1.1.6. Exploring new modes of ICBM basing that enhance survivability and further reduce incentives for prompt launch.

4.1.1.1.7. The AF and Navy are studying LEP options for the W78 and W88 Warheads, focused on the possibility of using common components and technologies for ICBMs and SLBMs to reduce the number of warhead types. NPR direction implementation is expected to come through existing policy guidance, Planning/Operational Orders, and nuclear weapon requirements planning documents.

4.1.2. New Strategic Arms Force Reduction Treaty and Force Composition

4.1.2.1. The uncertainty over ongoing arms control negotiations complicates ICBM long-range planning. Regardless of future force structure, the land-based element of the Triad will require sustainment, modernization, and recapitalization investments through 2030 to ensure a viable deterrent.

4.1.2.2. The focal-point through 2030 is Minuteman III sustainment, as directed in the National Defense Authorization Act for Fiscal Year (FY) 2007. However, early planning and development for an ICBM replacement is required to support warfighter capability requirements beyond 2030. Thus, modifications and technology development efforts should be leveraged into a Minuteman III follow-on system.

4.1.2.3. In accordance with the 2011 *National Military Strategy*, the U.S. will retain a sufficient nuclear force structure to hedge against unexpected geopolitical change, technological problems, and operational vulnerabilities.

5.1. SUMMARY

5.1.1. In accordance with the ICBM Program Management Directive, Minuteman III must maintain weapon system viability consistent with arms control treaties and initiatives, to ensure maximum availability and capability. Minuteman III is required to meet operational requirements through 2030. The current uncertainty over ongoing force sizing complicates long-range planning.

5.1.2. Minuteman III sustainment, modernization, and recapitalization efforts require careful planning and management to ensure the weapon system meets HQ AFGSC and USSTRATCOM mission requirements for deterrence and warfighting capability. Current Long Range Planning indicates the Minuteman III is supportable, with the implementation and execution of the planned programs outlined in this document, and will meet warfighting requirements. To achieve this goal requires a stable investment, system health monitoring via aging/surveillance efforts, and funding for issues identified through the normal sustainment process. Minuteman III sustainment funding must continue until a new or replacement weapon system is deployed or until directed to dispose and demilitarize the current system. The GBSD AoA will inform major Minuteman III sustainment modifications to maximize

return on investment and ensure compatibility with future capabilities to reduce investments incurred by maintaining Minuteman III through 2030 and at the same time acquiring GBSD.

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Appendix A: Requirements/References

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The following is a compilation of ICBM requirements documentation.

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Appendix B: Acronyms

APPENDIX B: ACRONYMS

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A&AS	Assessment & Aging Surveillance
AF	Air Force
AFB	Air Force Base
AFGSC	Air Force Global Strike Command
AFMC	Air Force Materiel Command
AFNWC	Air Force Nuclear Weapons Center
AFRL	Air Force Research Laboratory
AFSPC	Air Force Space Command
ALCS	Airborne Launch Control System
AoA	Analysis of Alternatives
ATS	Automatic Test System
AVE	Aerospace Vehicle Equipment
C2	Command and Control
C4	Command, Control, Communication, and Computers
CBA	Capabilities Based Assessment
CC	Commander
CDAS	Central Data Analysis System
CDD	Capabilities Development Document
CFL	Core Function Lead
CFSP	Core Function Support Plan
СОСОМ	Combatant Commanders
DAR	Defense Access Roads
Dem/Val	Demonstration/Validation
DEU	Diesel Electric Units
DoD	Department of Defense
EAM	Emergency Action Messages
EHF	Extremely High Frequency
FY	Fiscal Year
FYDP	Future Years Defense Program
GAP	Guidance Applications Program
GBSD	Ground Based Strategic Deterrent
GMP	Guidance Modernization Program
GRP	Guidance Replacement Program
GSP	Gyro Stabilized Platform
HAC/RMPE SLEP	Higher Authority Communications/Rapid Message Processing Element Service Life Extension Program
HDBT	Hard and Deeply Buried Target

APPENDIX B: ACRONYMS

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HQ	Headquarters
ICBM	Intercontinental Ballistic Missile
ICD	Initial Capabilities Document
ICU	ICBM Cryptography Upgrade
ISMP	ICBM Security Modernization Program
JROC	Joint Requirements Oversight Council
LCC	Launch Control Center
LEP	Life Extension Program
LER	Launcher Equipment Room
LF	Launch Facility
MAF	Missile Alert Facility
MAJCOM	Major Command
MEO	Missile Engineering Office
MIRV	Multiple Independently-targetable Reentry Vehicles
MM	Minuteman
MMPU	Minuteman MEECN Program Upgrade
MT	Missile Transporter
NDO	Nuclear Deterrent Operations
NPR	Nuclear Posture Review
OGE	Operational Ground Equipment
ORD	Operational Requirements Document
PAP	Propulsion Applications Program
PDM	Program Decision Memorandum
PIGA	Pendulous Integrating Gyroscopic Accelerometer
PMD	Program Management Directive
РОМ	Program Objectives Memorandum
PRP	Propulsion Replacement Program
PSRE	Propulsion System Rocket Engine
PT	Payload Transporter
PTR	Payload Transporter III Replacement
Rivet MILE	Rivet Minuteman Integrated Life Extension
RFSE	Reentry Field Support Equipment
RP	Real Property
RPIE	Real Property Installed Equipment
RS	Reentry System
RV	Reentry Vehicle
RVA	Remote Visual Assessment

Appendix B: Acronyms

RVAP	Reentry Vehicle Applications Program					
SACCS	Strategic Automated Command and Control System					
S&T	Science and Technology					
SELM	Simulated Electronic Launch Minuteman					
SLBM	Submarine Launched Ballistic Missile					
STACS	Strategic Targeting Applications Computer System					
START	Strategic Arms Reduction Treaty					
TE	Transporter Erector					
UHF	Ultra High Frequency					
USSTRATCOM	United States Strategic Command					
VCP	Voice Control Panel					
VCCP	Voice Communication Control Panel					
VLF/LF	Very Low Frequency/Low Frequency					
WSCCP	Weapon System Control Console Printer					
WCPS	Wing Codes Processing System					

APPENDIX C: TECHNOLOGY ROADMAP SUMMARY

APPENDIX C: TECHNOLOGY ROADMAP SUMMARY

C.1. TECHNOLOGY

AFGSC provides guidance to the Scientific and Technology (S&T) community and AFRL through AFMC in accordance with AFPD 61-1, *Management of Science and Technology*. AFGSC, with support from the acquisition and sustainment community, shall identify capability shortfalls or the need to develop a new technology that will satisfy AFGSC vision and future warfighter requirements. The AFGSC ICBM Weapon System Team is responsible for developing the investment roadmap for related science and technology activity for submission to AFMC upon approval from AFGSC/CC. These activities are documented in the AFGSC S&T Guidance document.

In addition, AFGSC guides the ICBM Demonstration/Validation applications programs to mature technologies, explore technology transition opportunities, and ensure preservation of unique skills and technologies critical to ICBMs.

This section will be revised upon completion of a collaborative Technology Roadmap effort between AFGSC and AFNWC.

S&T	FY13 FY14 FY15 FY16 FY17 FY16 FY19 FY20	FY25	FKG0	FY35	FY40	FY/45	FYSO
	Nearterm	Mid-term		Fisit bette			
RS/RV	ICBM	Fuze Program					
	W78/88-1 Life Extensio	an Program (LEP)		the second s			
Guidance	Advanced Guidance Advanced Guidance in Ho	stile Environments					
Propulsion	Domestic Fiber Notor Case						
	ADV Piotor Aging and Survetience						
	Paramona Rocker Propulsion Leannology						
	Suminable Endurshie and Secure Comm						
Other	In-Flight Power Systems						
Den:/Val	FY13 P/14 FY15 FY16 R07 P05 R/19 P/20	PV25	P(30		P/35	P(40	PIS
RVAP	Carbon/Carbon Nosetip Materials/ Proces		2	11	The second		
	Antenna Window Material	Advanced Reentry Vehicle Technologies to Support GBSD Capabilities					
	Pen Aide 1						
PAP	Lango Class Stage 1 Lango Class Stage 2 Lango Class Stage 2 Hazard Class Stage 3 Hazard Classification Hed Class Stage 2 Pedium Class Stage 2 Pedium Class Stage 2 Pedium Class Stage 2 Hazard Classification Hazard Classification Ordanance Technologies		Advanced Propulsion Te	rchoologies to Supp	ort GBSD Capabilitie	a la seconda da la seconda Seconda da la seconda da la s	
GAP	Advanced Acceleromater Advanced Gyroscope Advanced Bill Rai Hard Electronics Rai Hard Advanced Bill	ced Guidance Technologies to Su	pport GBSD Capabil	ities			
C2AP	Future Command /Control Technologies						- 10 - W
d Program /Fille	Unfunded Program /Effort	a designed and a second second second					

Figure C-1: S&T Needs

C.2. TECHNOLOGY GUIDANCE

AFGSC requires technologies that can improve effectiveness, security and sustainability while significantly reducing operations and maintenance costs. In addition, AFRL should investigate technologies to support future solutions for guidance, propulsion, security, reentry vehicles and Command, Control, Communication, and Computers (C4). These efforts should emphasize commonality for use across multi-mission and multi-platform applications facilitating movement away from "stovepipe" solutions.

C.2.1. SCIENCE AND TECHNOLOGY

AFGSC supports the development of ICBM technologies that are coordinated with the Navy strategic applications programs and the S&T community to eliminate duplication and enhance synergy. The

primary goal is to develop common technologies that have applications across multiple missions/platforms. This effort will ensure a responsive infrastructure is in place to support strategic systems. In addition, develop processes to improve efficiencies in manufacturability, producibility and sustainability. Technologies should improve performance, be scalable, reduce total ownership costs, and permit wide-scale changes in current operating concepts. Figure C-2 identifies Technology Needs and their respective criticality (Hi (high), Medium (M) and Enhanced Synergy (Enh)) for the development of a given technology to the continued modernization of the ICBM force. Criticality levels are determined through subject matter expert inputs in the AFGSC Science and Technology process.

Technology Need Title	Tech Need Date	Target Performance Goals	Criticality	Status
Domestic Fiber Motor Case	2016	Motor case performance equivalent to or better than Toray T1000 fiber	Hi	Being pursued with ICBM Dem/Val on Large Class Stage
Ballistic Missile Motor Aging and Surveillance	2016	Develop advanced embedded sensors with the equivalent or better surveillance tools yielding enhanced flaw detection and resolution	Hi	Being pursued by AFRL/RZ
Advanced Ballistic Missile Guidance	2018	Provide better than Peacekeeper accuracy.	Hi	USSTRATCOM Guidance Capabilities for Intercontinental Ballistic Missiles, 22 Apr 11, identifies the need
Advanced Rocket Propulsion Technology	2018	Provide increased range and reliability with the ability to operate in hostile environments as outlined in the weapon system specification	М	Develop higher efficiency, lighter weight missile stages. Requires new assessments to resolve survivability issues.
Enhanced Strength Materials	2018	Supports improved motor castings, nozzles and throats	Enh	Improves reliability, performance, survivability, affordability and environmental compatibility
In-Flight Power Systems	2020	Flight qualified, hardened battery or alternative power source to control booster attitude	М	Current Ag-Zn battery expected to be unavailable
Ultra Wideband Communications	2022	Develop a survivable, endurable, secure communications capability	Enh	Enhances Nuclear C2
Advanced Guidance	2025	Develop technologies to improve missile guidance performance	М	Supports USSTRATCOM stockpile management.

Figure C-2: S&T Needs

C.3. ICBM DEMONSTRATION/VALIDATION (DEM/VAL)

A key part of the current technology efforts is the ICBM Dem/Val Program. The purpose of ICBM Dem/Val is to sustain critical design and engineering skills to support a responsive infrastructure and to develop technologies that are common with other services and systems to support future Minuteman III modifications and the Minuteman III follow-on system. A clear systems engineering approach must be employed to identify the most beneficial areas that can be leveraged across services and missions, which can result in lower overall costs and best use of technology solutions. ICBM Dem/Val includes reentry vehicle, propulsion, guidance and C2 applications elements. AFNWC/XZ manages the ICBM Dem/Val portfolio, which is executed by AFNWC/NIC, AFRL and industry partners.

C.3.1. REENTRY VEHICLE APPLICATIONS PROGRAM (RVAP)

RVAP analyzes and matures technologies while retaining critical skills and support infrastructure to ensure safer, more reliable reentry vehicles/systems. RVAP demonstrates capabilities essential for the current and/or future land based strategic deterrent mission in relevant environments and pursues collaboration with communities of common interests.

C.3.1.1. Identify and evaluate materials and concepts to support current and future RS/RV capabilities.

- C.3.1.2. Analyze and develop components to support a safer, more reliable RS/RV.
- C.3.1.3. Identify and enhance RS/RV test and evaluation concepts and capabilities.
- C.3.1.4. Conduct ground and flight tests to validate technologies and concepts in relevant environments.
- C.3.1.5. Identify methods to reduce life cycle cost.

C.3.2. PROPULSION APPLICATIONS PROGRAM (PAP)

Propulsion Applications Program develops strategic propulsion capability through projects exploring improvements and/or alternatives to current propulsion systems as well as conducting studies assessing application of new technologies to meet future common propulsion system requirements. PAP assesses opportunities for applying common materials and technology between the ICBM, SLBM propulsion systems and other solid rocket motor propulsion capabilities to demonstrate a potential family of motors capability. *Program Decision Memorandum II (PDM II)*, 25 Nov 07, added \$40M/year through the FYDP and directed advanced propulsion development employing a family of motors construct.

- C.3.2.1. Develop common propulsion technologies and manufacturing processes in a family of motors construct.
- C.3.2.2. Identify and evaluate materials, technologies and concepts to support current and future propulsion capabilities.
- C.3.2.3. Develop and test self-diagnostic health management sensors for real-time propulsion assessment engineering.
- C.3.2.4. Analyze and mature lighter, more energetic propellants.
- C.3.2.5. Analyze the feasibility of less volatile, environmentally friendly propellant.
- C.3.2.6. Qualify domestic source of fiber for future strategic systems.
- C.3.2.7. Develop modern flight controls for future strategic systems.
- C.3.2.8. Identify and enhance propulsion test and evaluation concepts and capabilities.
- C.3.2.9. Conduct ground and flight tests to validate technologies and concepts in relevant environments.
- C.3.2.10. Develop motors with a threshold 30-year service life.
- C.3.2.11. Identify methods to reduce life cycle costs.

C.3.3. GUIDANCE APPLICATIONS PROGRAM (GAP)

GAP ensures the development of strategic capability in response to the NPR, recommendations of the USSTRATCOM Strategic Advisory Group, Commander (CC), USSTRATCOM guidance, and the Defense Science Board Task Force on Nuclear Deterrence. Efforts focus on current and future requirements and technologies, reduced life cycle costs, and increased nuclear surety and safety. Activities leverage the efforts of the S&T community and are coordinated with the Navy strategic application program to enhance synergy and avoid duplication. Key elements include developing responsive technologies with common applications for future strategic guidance capabilities. PDM II, 25 Nov 07, directed the development of advanced guidance technologies and Fiscal Year 2014 (FY14) President's Budget (PB) added \$70M for technology development supporting a future guidance modernization program

C.3.3.1. Develop, prototype, and test solid-state instrument technologies (accelerometers and gyroscopes) in coordination with the Navy Strategic Applications Program.

C.3.3.2. Achieve/Surpass equivalent Peacekeeper levels of accuracy to support USSTRATCOM future guidance, navigation and control capability needs.

C.3.3.3. Analyze and mature sensors with greater than one million hour mean time between failure and a much lower mean-time-to-repair.

C.3.3.4. Analyze and mature advanced sensors that are smaller, lighter, and consume less power. Enhance the modularity of guidance system and subsystem components.

C.3.3.5. Identify and enhance guidance test and evaluation concepts and capabilities.

C.3.3.6. Conduct ground and flight tests to validate technologies and concepts in relevant environments.

C.3.4. COMMAND AND CONTROL APPLICATIONS (C2AP)

C2AP analyzes and matures technologies and retains critical skills to enhance command and control capabilities, including support infrastructure. It addresses capabilities essential for the current and/or future land based strategic deterrent mission in relevant environments and collaborates with communities of common interests as necessary.

C.3.4.1. Develop technologies and concepts for modern information transfer techniques and message structuring while meeting stringent nuclear surety standards.

C.3.4.2. Develop concepts and automated test capabilities to modernize C2 support infrastructure.

C.3.4.3. Develop technologies and architecture concepts to support common operational picture and tactical communications to enhance situational awareness of ICBM facilities.

C.3.4.4. Develop methods for ensuring survivability of modern electronics in a nuclear effects environment.

C.3.4.5. Conduct feasibility studies for ICBM C2 modernization efforts.

C.3.4.6. Evaluate NPR requirement to further strengthen the U.S. command and control system to maximize presidential decision time in a nuclear crisis.



APPENDIX D: EXPANDED FIGURES



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