

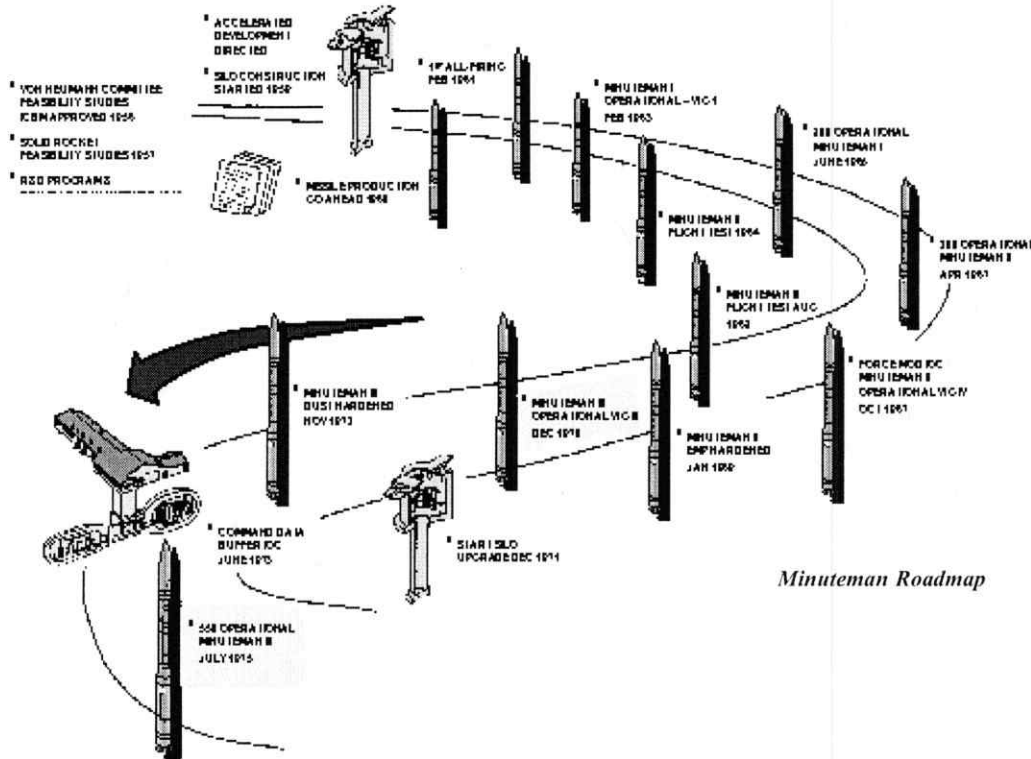
Association of Air Force Missileers AAFM Newsletter

"Victors in the Cold War"

Volume 15, Number 2

June 2007

Missile Targeting and Alignment - Part III



In December we began this series on missile targeting and alignment. This third part includes more articles about targeting through the history of Minuteman, to include the current procedures. Thanks to AAFM members CMSgt (Ret) Hank Habenick and LtCol Andy Kovich for their contributions.

Missile Targeting and Alignment - Evolving with the System - By MSgt (Ret)

Tom Cuddy and CMSgt (Ret) "Chief Pooh Bear" Hank Habenick, MbrNo L264, Cottage Grove, OR

In the December issue, Chief Kelchner explained how this series got started with a question as to the origin of the monuments. The Chief went on to explain the targeting process and the use of the autocollimator, theodolites, etc. For March, many others sent in their own stories about targeting in the great plains, and the aspect of being either bear or snake bait at night during the long walks to the monuments to get everything set up. This article provides additional information and discusses the modifications in Minuteman (MM) that resulted in substantial changes in the way the MM weapon system is targeted and aligned. These changes include MM II and concurrent deployment of the Force Mod command and control upgrade and MM III with the Command Data Buffer upgrade. Chief Habenick (a.k.a. Pooh Bear and Hip Pocket Hank) also explains the ins and outs of the REACT (Rapid Execution and Combat Targeting) upgrade that provided further improvements in targeting and ops crew functions.

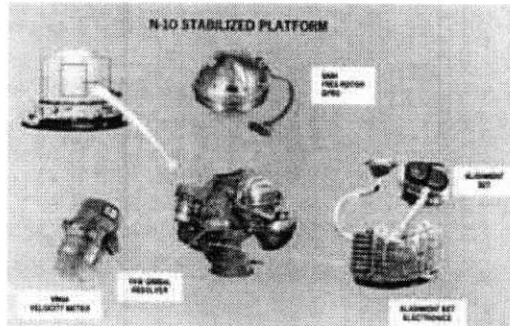
The challenge in writing this article was how to describe just the changes in the MM ICBM that relate to targeting without describing all of the associated weapon system changes. Perhaps at some point in the future it might be appropriate to document the basic history of MM and the evolution that has occurred since its inception, and continues today

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The Mission of the Association of Air Force Missileers -

- Preserving the Heritage of Air Force Missiles and the people involved with them
- Recognizing Outstanding Missileers
- Encouraging Meetings and Reunions
- Keeping Missileers Informed
- Providing a Central Point of Contact for Missileers

Targeting - (Continued from Page 1)



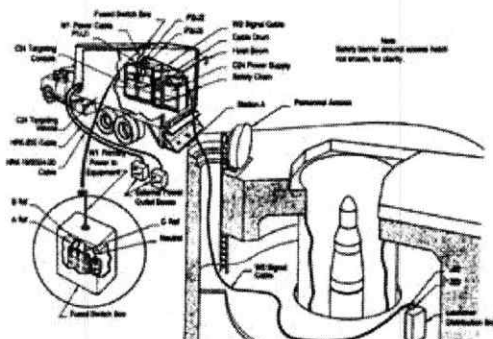
Minuteman I Guidance

Minuteman I Targeting

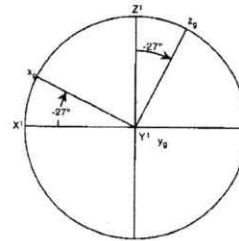
As Chief Kelchner noted in his article, MMI and Titan relied upon the location of Polaris, the North Star, for alignment of the Inertial Measurement Unit (IMU). In MMI the NS10 inertial guidance system platform contained two gyroscopes each having two degrees of freedom and 3 accelerometers (VM4A Velocity Meters). The N10 IMU used a gimbal system but it did not use gimbaled rings - its design utilized an inside/out gimbal structure.

The three axis gimbal system had limited rotational freedom, the inside/out gimbal design was chosen at the time because slip rings were still considered unreliable. The instruments were oriented on the platform to minimize Guidance and Control (G&C) miss due to instrument errors.

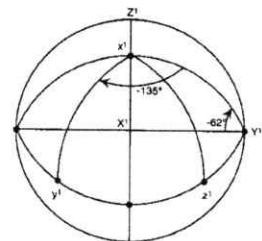
The stable platform used a two axis level detector mounted on the stable member for leveling the platform to local gravity, and a mirror and autocollimator for azimuth alignment. The platform was aligned so that the X axis pointed down the desired launch azimuth, which is still done today. The instrument alignment and platform orientation ensures that each VM4A velocity meter is being used to sense downrange acceleration when the missile is in-flight, reducing individual accelerometer error contributions.



Minuteman Targeting Van and LF



Gyro and Platform Relationship



Velocity Meter and Platform Relationship

Legend:
 $X'Y'Z'$ = Platform Alignment Coordinates
 $x'y'z''$ = Velocity Meter Coordinates
 $X_y Z_y$ = Gyro Coordinates

NS10 GPS Instrument Coordinates

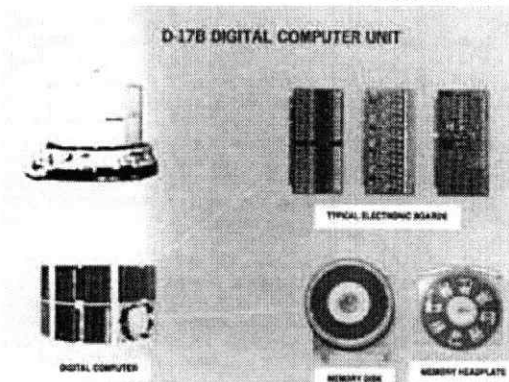
The targeting van mentioned in previous articles was used to load the tapes in the D17B missile flight computer Digital Computer Unit (DCU). The DCU memory was a spinning disk which rotated at 1 revolution every 10 milliseconds or 100 revolutions per second.

It is also important to note the LF configuration for MMI - careful examination shows that the collimator bench took up a lot of wall space in LER 1, because azimuth alignment capability was +/- 60° from north. When aligned due north, the collimator was actually at a 90° azimuth (aligned to the east). Anytime the missile target was changed a team had to dispatch to realign the collimator and the missile - they were rotated to the new launch azimuth together.

Now that we have recapped how MMI, let's look at the timeline for the overall MM development. The roadmap graphic depicts the timeline effectively, shows MM evolution and how the evolutionary changes overlapped the deployment process.

The unique aspect of the MM weapon system is the fact that the basic system design continues to evolve after 44 years of active service. Early on, MMI had not even completed deployment, when MMII started coming on line, and MMIII followed closely on the heels of MMII,

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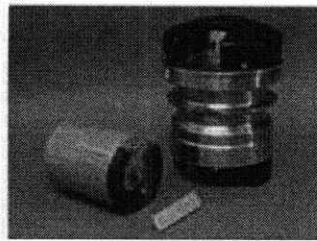


D17 Digital Computer Unit (DCU)

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PIGA



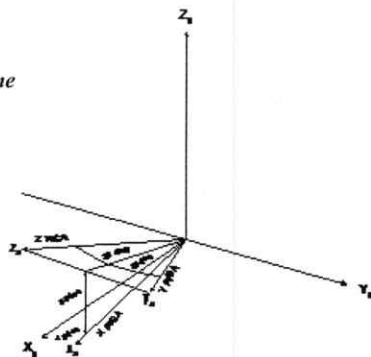
Gyrocompass assembly and Gyro

Also with the advent of MMII, those long walks to the monuments were no longer required. The GSP on MMII was a radical departure from the GSP in the NS10.

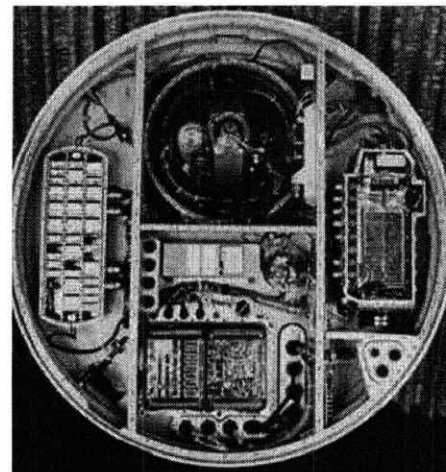
The new GSP utilized a gimballed platform, and mounted on the stable element or turkey body of the new GSP was a batch of new instruments. While the GSP continued to use the proven G6B4 gyroscopes, the VM4A velocity meters were replaced by the Draper Labs Pendulous Integrating Gyroscopic Accelerometers, or PIGAs. The PIGAs were mounted in a scrunch configuration.

Possibly the most important GSP change that affected targeting was the addition of a Gyro Compass Assembly (GCA). With the addition of the GCA, every missile was placed in the silo the same way, with the zero degree missile body rotated toward true north. This resulted in a lot of now unused collimator bench space, since the collimator would always remain aligned with due east. However, collimator alignment and RMADs were still performed since the collimator continued to serve as the primary azimuth reference, even though the GI-T1B gyroscope in the GCA was used to sense the earth's rotation and could effectively be used to identify north. Trips to the monuments were a thing of the past since another new piece of support equipment accompanied this upgrade called the Azimuth Laying Set (ALS), a GCA in a box. Using the ALS, RMADs could now be shot in LER 1 without having to venture out to

PIGA Coordinate Frame



the monuments off-site. The GCA also allowed the missile guidance set to orient the GSP to different launch azimuths without having to rotate the autocollimator and missile to the new target azimuth. Part of the operational flight program change that accompanied MMII was the inclusion of a missile roll command during stage one flight that allowed the missile launch azimuth to be changed, and yet ensure that the missile's flight trajectory would not result in gimbal lock of the GSP. Beginning with MMII, the flyout roll eventually positions the missile body toward the earth regardless of launch azimuth, which ensures that the necessary gimbal freedom is present in the GSP for the missile to fly successfully to Stage three thrust termination and RV deployment. The MMII was first emplaced in the Wing VI configured LFs in the 321SMW

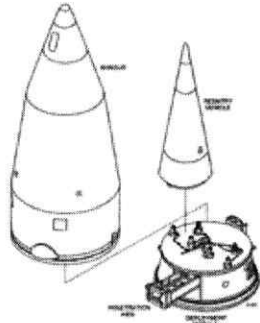
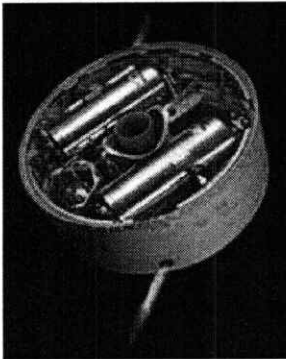


NS20

and 564SMS. The B System (WS-133B) had a completely different ground system than the A System (WS-133A). The B System also brought the total number of MM on alert to 1000 missiles. Shortly after the B System joined the operational force, the Air Force decided that the improved command and control and nuclear surety upgrades MMII developed should be deployed in the entire force, thus the Force Modernization Program for the WS-133A System was born and the system was redesignated WS-133AM. Following closely on the heels of the MMII development was the decision to pursue MMIII, the first MIRVed (multiple independently targetable reentry vehicle) ICBM. This new version of the missile modified everything from the top of stage two up. A new, more powerful stage three was developed along with a liquid post boost stage called the Propulsion System Rocket Engine (PSRE), which uses monomethyl hydrazine and nitrogen tetroxide. The PSRE has a main or axial engine

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Targeting (Continued from Page 4)



Minuteman PSRE and RS

and ten attitude control engines (4 roll, 4-pitch and 2 yaw engines) and a new MGS. A new wafer or body section was required in order to connect a reentry system (RS) that was large enough to hold the RVs, which at the time was the Mk12 RV, which was being developed concurrently.

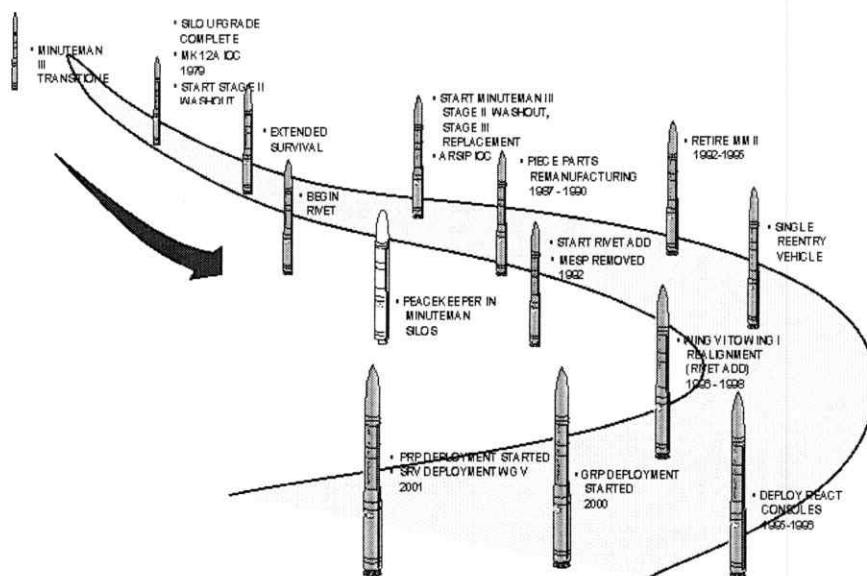
In April 1970, the first MMIII was delivered to the 91SMW at Minot. MMIII also ushered in a command and control upgrade called command data buffer. With this upgrade, and the MMIII upgraded flight computer, the D37D (still using the spinning disk for memory) targeting teams no longer had to dispatch to the LF to change a missile's target. The launch crews could perform this task remotely, through the use of the Remote Data Change Target (RDCT) command. The D37D could store four target sets (up to 12 individual targets for systems equipped with three RVs) in its memory. Initially, the autocollimator was still used as a primary azimuth

reference, but this to quickly fell by the wayside, as enough confidence was built in the GCA's ability to identify true north, thus ending the need for autocollimator alignment and RMADs in MMIII. The B System was also modified to allow the MMIII to be fielded at the 321SMW and the 564SMS. Eventually, the same ground equipment and command and control system upgrade that resulted in the demise of dedicated combat targeting teams found its way into the Minuteman II weapon system with the advent of the Improved Launch Control System (ILCS). The next major upgrade for the command and control system was the Rapid Execution and Combat Targeting (REACT).

Today, MM evolution continues with the fielding of the NS50 MGS through the Guidance Replacement Program, the booster is getting a workover through the Propulsion Replacement Program, and the PSRE is going through the PSRE Life Extension Program. The weapon system has also been modified to carry the Mk21 RV which was originally developed for Peacekeeper, and is being deployed in the Safety Enhanced Reentry Vehicle Program, replacing the Mk12 equipped systems in the fleet of 500 Minuteman missiles, still on alert at Wing I, Malmstrom; Wing III, Minot; and Wing V, Warren.

References:

- A Brief History of Minuteman Guidance and Control, March 1995, by Dr. Bob Nease and Mr. Dan Hendrickson, The Boeing Company*
- ICBM General Familiarization Briefing, by Dan Zemke, Northrop Grumman Mission Systems*



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ICBM Strike Planning - by LtCol Andrew S. Kovich, MbrNo A1140, Commander, 90th Maintenance Operations Squadron, FE Warren AFB, WY

The original purpose of this article was to educate the AFSPC community on the Intercontinental Ballistic Missile (ICBM) strike planning process, and it has been adapted to be part of the AAFM targeting series. The article discusses the "big picture" of the ICBM strike planning process as part of the nuclear planning process. Next, a description of specific people, processes and products involved in the ICBM strike planning process provides detailed procedures required to place bombs on target, on time.

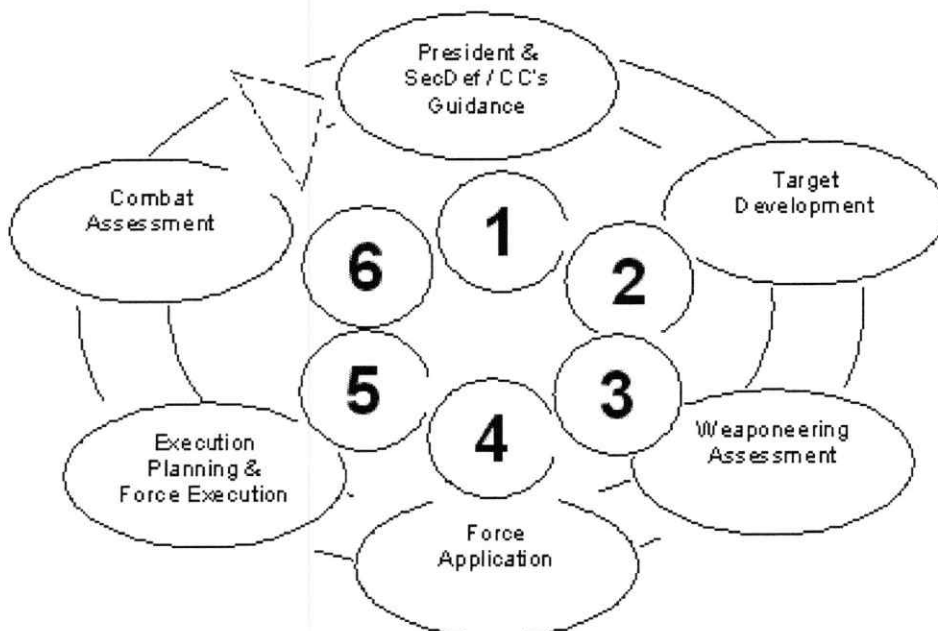
Nuclear Planning Process. The Nuclear Planning Process is a six step process beginning with "guidance and priorities issued by the President, Secretary of Defense, and Chairman of the Joint Chiefs of Staff and culminates with the final step of combat assessment."¹ The six phases of the process include: 1) President, Secretary of Defense and Commander's guidance outlining objectives and intent to initiate the planning cycle; 2) Target development, validation, nomination, and prioritization focuses on adversary centers of gravity for attack; 3) Capabilities analysis results in a weaponeering assessment describing expected results to include target sets and consequences of execution; 4) Commander's decision and force assignment matches specific weapon

systems to targets; 5) Mission planning and force execution consists of the tasking order, unit preparation and presidential authorization to execute; and, 6) Combat assessment determines whether military objectives have been achieved."² This six-step process is similar to other planning processes such as the Joint Air Tasking Cycle (JATC), used to produce the Joint air Tasking Order (JATO), and is the basis for ICBM Strike Planning.

The nuclear planning process is useful for missile personnel to understand because it is not unlike the JATC or the ICBM Strike Planning Process and thus provides a solid base from which to relate to other USAF operations. Now that a baseline understanding of nuclear planning has been established in general, a more detailed review of the ICBM Strike Planning process follows. It should be noted that the strike planning process for ICBMs uses a similar methodology to the JATC and the Joint Space Tasking Order (JSTO) process as well.⁴

ICBM Strike Planning Process. The ICBM Strike Planning Process also uses a six step process and consists of guidance, target selection/desired ground zero (DGZ) construction; allocation, application, timing/deconfliction; Joint Plan Interim Change (JPIC) production/distribution; mission plans; and, assessment, wargaming/analysis. Like all planning processes, the ICBM process begins with guidance from senior leaders.

Step 1 – Guidance. Step 1 of the process is the policy developed to guide the employment of nuclear



Nuclear Planning Process³

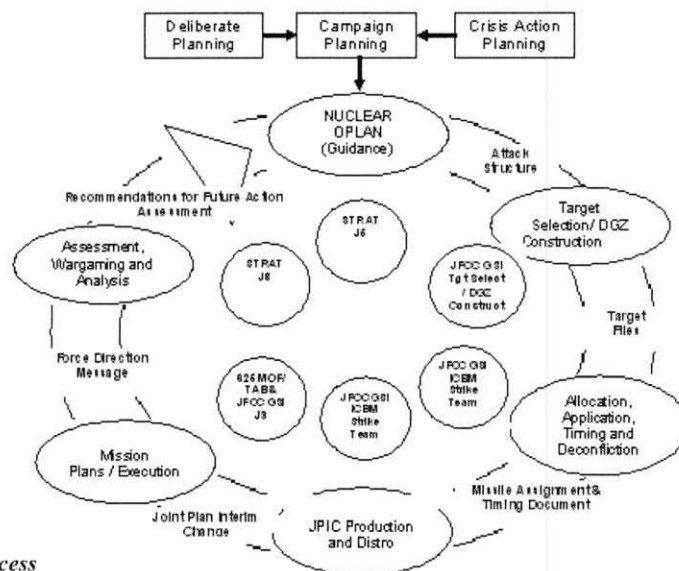
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weapons. Nuclear guidance begins with the president and is refined by each lower echelon ultimately ending with the Commander, US Strategic Command (CDR USSTRATCOM) guidance to OPLAN planners. Nuclear guidance at the presidential level is codified in a presidential directive. The presidential directive is issued by the president, incorporates the advice of the National Security Council, and provides the broad policy objectives for US nuclear forces. Upon receipt of these Presidential Directives, the Defense Department focuses the guidance into military employment objectives. The Secretary of Defense produces the Policy Guidance for the Employment of Nuclear Weapons (NUWEP) which provides objectives, targeting philosophy and constraints. This guidance is in turn refined by the Chairman of the Joint Chiefs of Staff (CJCS) in the form of the Joint Strategic Capabilities Plan nuclear supplement (JSCP-N). The JSCP-N provides nuclear warplan direction to USSTRATCOM for OPLAN development. Finally, the nuclear OPLAN is the result of the planning efforts of the USSTRATCOM Plans and Policy Directorate (J5) and the USSTRATCOM Joint Functional Component Command, Global Strike and Integration, Plans and Integration Directorate (JFCC GSI/J5) and is directly supported by the six nuclear task forces assigned to USSTRATCOM.⁵ Task Force 214 (20AF) is the task force with direct control over ICBMs. All actions taken by strike planners are in direct support of this plan. Once specific OPLAN objectives are codified, intelligence personnel and targeting experts begin the process of

analyzing enemy centers of gravity for attack.

Step 2 – Target Selection/Desired Ground Zero (DGZ) Construction. The JFCC GSI Target Selection Division and the DGZ Construction Branch in the JFCC GSI Plans division are the key players involved in step two. The nuclear OPLAN directs a specific attack structure be designed to prosecute numerous conflict scenarios. Step 2 of the planning process is related to target selection and DGZ construction. Target selection is the process by which USSTRATCOM planners distill the list of hundreds of thousands of world-wide targets identified by the intelligence community into a more manageable list of prioritized installations to be planned against to fulfill OPLAN requirements.⁶ Enemy centers of gravity that may be likely targets for nuclear strikes include “military forces, military bases of operation, infrastructure supporting those forces; C2 systems and nodes, and WMD storage facilities, delivery systems and deployment sites.”⁷ Once the target list is compiled, aim points are identified for every type of weapon in the nuclear arsenal. In the nuclear targeting business, these aim points are known as DGZs.⁸ DGZs are “planned locations on, above, or below the earth’s surface, where a weapon is to be detonated to achieve the optimum/allowable result.”⁹ The goal of this step in the process is to build DGZs that will allow the designated weapon to achieve a desired level of damage expectancy (DE). DE is determined by multiplying the probability of damage (PD) and the probability of arrival (PA) for a given weapon system. PD is determined by calculating the weapon yield, accuracy (CEP), height of burst (HOB),



ICBM Strike Planning Process

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target characteristics (VNTK) and desired level of damage.¹⁰ PA is calculated by multiplying pre-launch survivability (PLS), weapon system reliability (WSR) and probability to penetrate (PTP).¹¹ WSR and PLS are planning factors provided to USSTRATCOM by the Commander, AFSPC as required by the JSCP-N.

AFSPC A3 Nuclear Operations Branch (AFSPC/A3NN) develops planning factors from information in the Weapon System Effectiveness Report (WSER) produced by the 526ICBMSW and approved by the Chief, Nuclear and Helicopter Operations Division (AFSPC/A3N).¹³ The OPLAN outlines the required DE for specific target sets based on objectives. Depending on attack objectives, the strengths and weaknesses of a weapon system are assessed to determine the best weapon for a given mission. The product produced at step 2 is the individual target files which equate to the JPITL in the JATC. ICBM planners then begin the process of allocating and then applying weapons to targets in order to meet OPLAN objectives.

Step 3 Weapon Allocation/Application/ Timing and Deconfliction.¹⁴ Allocation is the process by which the best weapon is selected for a target. "Each system has advantages and disadvantages...such as range, weapon yields, lead time, accuracy, recallability, and vulnerability to enemy defense systems."¹⁵ USSTRATCOM planners receive inputs from their service components on the number of assets available for nuclear tasking. For ICBMs, AFSPC provides USSTRATCOM with the Forces Available document that communicates the number of boosters and reentry vehicles (sorties/weapons) that will be available for planning. In turn, USSTRATCOM balances all other service inputs to determine their needs for a given weapon system. The result of this determination is distributed to all nuclear forces in the Force Commit document that outlines USSTRATCOM requirements for a given system and directs compliance with the USSTRATCOM Priority Maintenance Letter (PML) and the OPLAN.¹⁶

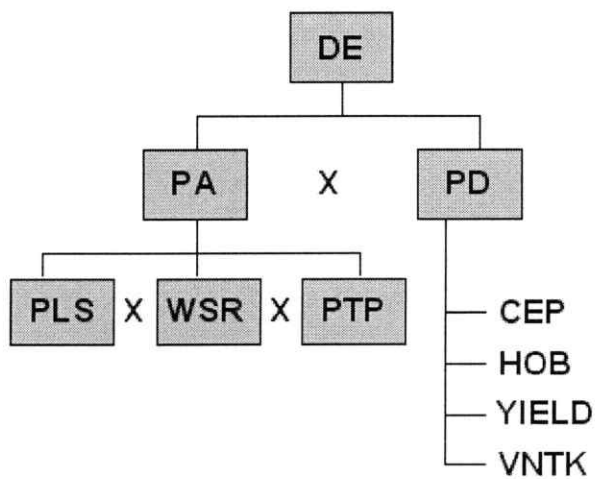
Ensuring the nuclear force is capable of meeting the objectives of a diverse attack structure is the goal of the ICBM Strike Team planner in USSTRATCOM's JFCC GSI. Maintaining the viability of the attack structure begins with sortie availability requirements. Based upon these requirements, the ICBM strike planner balances intelligence generated targeting requirements with missile unit sortie maintenance schedules. As a result, the planning process at USSTRATCOM can be initiated by a number of different factors. Intel updates

on target sets can drive a change but most often the sortie modification schedule necessitates the need to retarget a sortie off of a high priority target to a lower priority target while the maintenance modification occurs.

Weapon systems require periodic maintenance to assure full mission capable (FMC) status of the platform. In addition, modifications to extend the service life or to improve reliability, accuracy, or timeliness of launch, are accomplished continuously through a weapon system's life cycle. As a result, modifications sometimes require the missile to be removed from strategic alert to accomplish required retrofit. Maintenance modification requests are submitted in the form of a Joint Plan Interim Change (JPIC) request letter.

The JPIC request originates in the unit Maintenance Operations Flight (MXOO) Plans and Scheduling Section and is then passed to the unit Weapons and Tactics Flight (OSK) Plans Section for review. Following OSK review, the request is submitted to 20 AF who provides a second review before sending to the ICBM Strike Team (JFCC GSI/J541) in the "Air Room" at USSTRATCOM. At this point, planners begin to determine how they will cover the target set allocated them based on current sortie availability.

ICBM Strike Team planners utilize the Missile Graphic Planning System (MGPS) to plan ICBM strikes. Once the planner determines where the sortie is required to be targeted to meet national guidance, the MGPS software allows the planner to assign individual weapons on specific sorties to a specific DGZ. MGPS then provides the capability to "fly out" the sortie to determine range and reentry vehicle footprint ability. A sortie's footprint is



Damage Expectancy¹²

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defined as the weapon's physical ability to fall within an ellipse on the ground given factors such as re-entry angle, distance to target, and speed. Essentially, planners apply and reapply weapons as necessary to account for all required targets and cover planned sortie maintenance. Planners then time the targeted sorties against all other existing missions in the overall OPLAN attack (ICBMs, SLBMs and aircraft weapons). This portion of the process is essential to integrate specific attack options and to prevent fratricide of friendly weapons. Once the missions are successfully timed, planners perform an internal quality check (QC) to ensure sortie capabilities are optimized and are planned according to guidance. An example of planning guidance is the requirement to use an alert weapon or a survivable weapon for a particular target. Additionally, requirements for a specified level of damage or for collateral damage constraints could be identified. Once the Strike Team has performed a QC on their target package, the targeting is submitted to another Air Room agency to perform a second QC check to ensure all required OPLAN targets are covered and in compliance with guidance. The product delivered at this step of the process is the Missile Assignment and Timing (MAT) document. The MAT is similar to the MAAP and contains every ICBM's assignment in the war plan.

Step 4 – JPIC Production and Dissemination.

The ICBM Strike Team produces JPICs for each sortie/mission being targeted or requiring a targeting change. A JPIC is the only authority to change the alert category or targeting of an ICBM. JPICs include information related to sortie configuration, attack structure, target locations and time-on-target requirements. Two planners verify all JPICs, and one final QC planner reviews JPICs to ensure this data is correct before delivery to 20 AF's 625th Missile Operations Flight Trajectory Analysis Branch (625MOF/TABM) for mission planning and transmission to the field.

Step 5 – Mission Plans and Execution. The 625MOF/TABM performs the final verification of targeting information by matching the targeting received from the Air Room with the JPIC request originally submitted to the ICBM Strike Team by 20AF/A3NK. Next, 625MOF/TABM uses actual missile guidance set gyroscopic data to "fly" the targeting data provided by the strike team since MGPS only uses a facsimile of the minuteman operational targeting program. When 625MOF/TABM has "good flies" and all targets are within parameters, TABM releases the targeting data via a Force Direction Message (FDM) directly to launch control

centers (LCC) for use by missile combat crews on alert. The Rapid Execution and Combat Targeting (REACT) weapon system provides missile combat crews the ability to rapidly retarget sorties by providing an interface between the Strategic Automated Command and Control System (SACCS) and the weapon system computer. Instead of manually inputting all target and execution plan information into the weapon system computer, the crew simply transfers the information contained in the FDM from the Higher Authority Communication (HAC) side of the REACT console to the Weapon System Control Element (WSCE). This capability eliminates the laborious process of typing sortie configuration data (PRP, GRP, number of RVs, RV type), RV reentry angles/spacing, target latitude/longitudes, attack option assignments, delay times, and country codes into the weapon system by hand. The Remote Data Change Targeting (RDCT) procedure is then accomplished to provide the sortie with the authorized targeting data. The same targeting data sent to missile combat crews is also transmitted by the ICBM strike team to unit OSK planners in JPIC formats.

USSTRATCOM's JFCC GSI Global Operations Directorate (J3) is responsible for command, control and execution of nuclear forces. Day-to-day, the current operations section is responsible for monitoring the daily viability of the war plan. Specifically, they track sortie alert status and how off-alert sorties degrade execution options. The JFCC GSI's Global Operations Center (GOC) is responsible for global situational awareness and is the mechanism for exercising operational command and control of the Nation's global strategic forces. The GOC's Emergency Action (EA) Team is responsible for transmitting directives to the alert force. "Based on Presidential orders, the GOC will execute global strike missions or send emergency action messages to the strategic nuclear forces."¹⁷

Step 6 – Assessment, Wargaming and Analysis. Step 6 is performed by the USSTRATCOM Capability and Resource Integration Directorate (J8) and ensures that "target effects are consistent with either the strategic or the theater campaign objectives. Combat assessment is composed of three interrelated components: battle damage assessment, munitions effectiveness assessment, and reattack recommendation."¹⁸ In conventional planning, a mission is executed and then evaluated for effectiveness so guidance can be changed to improve the planning process. Combat assessments following a nuclear strike are equally important. During this assessment, intelligence data is collected on the

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enemy to determine if the desired effects of the attack were achieved. "If possible, combat assessment will be required to include estimates of environmental impact, including radiological contamination of soils, water, and air, as well as contamination carried from the target."¹⁹

In peacetime, the assessment process for nuclear planning is ongoing to ensure viability of the OPLAN for execution. This assessment occurs during simulations and wargames. For nuclear forces, a rigorous process using analysis tools is used to assess attack effectiveness at a given time. Enemy air defenses are just one example of the type of threats evaluated during a simulated execution of the war plan. Computer modeling is used to "determine if the required target effects are being achieved...consistent with the JFC's campaign objectives."²⁰ Now that we understand the process used by USSTRATCOM, let's drill down to the unit level for a description of the day-to-day process.

Day-to-Day Planning. The Plans and Scheduling Section in the Maintenance Group (MXG) precipitates the primary need for day-to-day sortie retargeting. The large number of Minuteman III non-aligned modification programs currently being implemented by AFSPC necessitates extremely close coordination between the maintenance Plans and Scheduling Section and the OSK Plans Section in the Operations Group (OG). In order to provide USSTRATCOM with the most capable/reliable assets, modification programs, rather than off-alert sorties, have become the priority for wing maintenance efforts. The primary modifications impacting sortie availability include: the Guidance Replacement Program (GRP) to replace portions of the missile guidance system to increase the reliability and maintainability of the weapon system; the Propulsion Replacement Program (PRP) to replace the propellant in the first three stages and some hardware components; the Propulsion System Rocket Engine (PSRE) to replace components of the post-boost vehicle and modernize support equipment; and, the Safety Enhanced Reentry Vehicle (SERV) to replace some of the older Minuteman reentry vehicles with newer, safer, and more reliable warheads. Additionally, government mandated Reentry System Limited Life Component (LLC) changes and other reentry system configuration changes based on Moscow Treaty are recurring maintenance requirements.²¹ Balancing all of the sustainment and modernization programs with other mandated requirements demands meticulous planning on the part of every player in the planning process.

The following is a typical scenario for how the planning process is initiated by a needed sortie modification in the field. A sortie at FE Warren requires a missile remove and emplace to upgrade the sortie to a PRP/GRP/SERV configuration. Notionally, it takes 14 days to perform this maintenance action - a day to teardown (remove reentry system and post-boost control system), a day to pull the missile, approximately 10 days to perform maintenance required without a missile/warhead present, a day to emplace the missile downstage and a day to buildup (install reentry system and post-boost control system) the sortie.²² For this action to take place, maintenance scheduling determines the total number of days required to be utilized and requests relief from priority assignments. However, this determination is complicated by uncontrollable events such as weather, road closures, personnel availability, security requirements or the inability to get necessary parts or equipment. Once all these factors have been accounted for, OSK forwards the request to 20AF who in turn sends the request to USSTRATCOM. Typically, these scheduled actions occur 45 days prior to the needed targeting. The ICBM Strike Team then begins building a monthly targeting package for the entire ICBM fleet (all unit requests included).

So, why is understanding this process and each unit or individual's role important to ICBM professionals? Because educating our airmen on the whole system, rather than just their individual pieces, is a necessary step to ensuring the ICBM team can continue to meet emerging threats with the most reliable nuclear weapon platform while undergoing historic levels of retrofit and modernization. All in all, these actions fulfill the AFSPC vision by being the "acknowledged experts and leaders in fielding, launching, and employing space power for the 21st century."²³ Learning the ICBM system will in turn lead to airmen capable of understanding other USAF processes or systems in use throughout any combatant command they find themselves in the future.

Notes

¹ Draft Joint Pub 3-12 Joint Doctrine for Nuclear Operations, Final Coordination 15 Mar 2005, pxi

² Ibid, pxi

³ Ibid, pII-4

⁴ In the STO process the joint space operations plan (JSOP) and space operations directive (SOD) are produced by the Strategy Division and equates to the JAOP and the AOD. The Combat Plans Division Target Effects Team is responsible for Target Development and the production of the Target Recommendation List (TRL). The Joint Space Effects Team performs deconfliction and produces the Joint Master Space Plan (JMSP). The JSTO

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Targeting (Continued from Page 10)

Production Team produces and disseminates the Joint Space Tasking Order (equivalent to the ATO). The Combat Operations Division is responsible for executing the current JSTO and receiving unit reports. The Strategy Division conducts combat assessment and produces the Combined Assessment Report. 5 Nuclear task forces include: Aerial Refueling/Tankers (TF294), Airborne Communications (TF124), Ballistic Missile Submarines (TF134 and TF144), Strategic Bomber and Reconnaissance (TF204), Land-based Intercontinental Ballistic Missiles (TF214)

6 Nuclear OPLAN targets are selected from thousands in the Modernized Integrated Database (MIDB) and form the National Target Base (NTB) from which options are generated.

7 Draft JP3-12, pII-5

8 A DGZ is similar to either a Desired Mean Point of Impact (DMPI) or a Desired Point of Impact (DPI) in conventional targeting. The DoD Dictionary of Military Terms as updated March 2007 provides the following definitions of DMPI, DPI, and aimpoint: DMPI—"A precise point, associated with a target, and assigned as the center for impact of multiple weapons or area munitions to achieve the intended objective and level of destruction. May be defined descriptively, by grid reference, or by geolocation." DPI—"A precise point, associated with a target, and assigned as the impact point for a single unitary weapon to achieve the intended objective and level of destruction. May be defined descriptively, by grid preferences, or geolocation." Aimpoint—"A precise point associated with a target and assigned for a specific weapon impact to achieve the intended objective and level of destruction. May be defined descriptively (e.g., vent in center of roof), by grid reference, or geolocation." Definitions available on-line at: <http://www.dtic.mil/doctrine/jel/doddict/>

9 AFTTP 3-1.ICBM Tactical Employment Minuteman III ICBM, 19 March 2007, p5-6

10 A target's vulnerability to nuclear weapon effects is characterized by a VNTK classification. The vulnerability number or VN portion of the classification refers to the target's vulnerability to blast damage. The "T" in the classification refers to either target sensitivity to overpressure (P) or dynamic pressure (Q). The "K" factor of the VNTK classification refers to a target's response to a 20 kiloton blast.

11 PTP: A calculated probability of arrival at the target, considering only the effects of enemy defenses along the route. WSR: The probability of a scheduled weapon arriving in the target area and detonating as planned excluding the effects of enemy action. PLS: The probability that a delivery and/or launch vehicle will survive an enemy attack under an established condition of warning.

12 AFTTP 3-1.ICBM, p5-12

13 WSR information is determined by using Olympic Play weapon system testing, Force Development Evaluations (FDE), and Simulated Electronic Launch (SEL) results.

14 "Weapons available for nuclear planning include: gravity bombs deliverable by dual-capable aircraft (DCA) and long-range bombers; the Tomahawk Land Attack Missile/Nuclear (TLAM/N) deliverable by submarines; cruise missiles deliverable by long-range bombers; submarine-launched ballistic missiles (SLBM); and intercontinental ballistic missiles (ICBM). These platforms provide

CDR USSTRATCOM with a wide range of options." (Joint Pub 3-12.1 Joint Doctrine for Theater Nuclear Operations, 9 February 1996, pI-3)

15 Joint Pub 3-12.1, pvi 16 "The PML is a letter that identifies specific missiles assigned to high priority targets which must receive priority in maintenance scheduling." (AFTTP 3-21.2 Munitions and Missile Maintenance, 30 December 2005, p7-3)

17 Taken from USSTRATCOM Fact Sheet. Available on-line at: http://www.stratcom.mil/fact_sheets/fact_goc.html

18 Draft JP3-12, pII-5

19 JP3-12.1, pIV-6

20 Ibid, pIII-6

21 "On May 24 [2002], President George W. Bush and President Vladimir Putin signed the Moscow Treaty on Strategic Offensive Reductions. Under this Treaty, the United States and Russia will reduce their strategic nuclear warheads to a level of 1700-2200 by December 31, 2012, a level nearly two-thirds below current levels." Source: Department of State Fact Sheet available on-line at: <http://www.state.gov/t/ac/trt/18016.htm#14>

22 The post-boost control system (PBCS) consists of the propulsion system rocket engine (PSRE) and the missile guidance set (MGS). Examples of maintenance performed when a missile/warhead are not present include: silo modifications or periodic maintenance to accomplish write-ups that cannot be performed with explosives present and include but are not limited to the environmental control system modification, drain line modification, fast rising B-plug installation, and Rivet Mile tasks.

23 AFSPC Fact Sheet, available on-line at: <http://www.afspc.af.mil/library/factsheets/factsheet.asp?id=3649>

More Early Days - by MSgt (Ret) James Denman, MbrNo A1082, Angola, IN

I have a couple of more experiences to share with our readers evolving around the early target and alignment of Minuteman 1 and 2. One of the most notable situations we experienced was Good Friday 1964. I was stationed at Whiteman at the time -my T&A team was dispatched out in the field to do a start up. It was night and we were one of 2 or 3 Air Force teams in the complex that night as well as a couple of Boeing teams, all doing RMAVs as a part of the start up procedures. We had set up our equipment and I was topside operating the theodolite and my officer was on the second level operating the theodolite down there. The procedure always required us to read the azimuth number in the theodolite and also to give a reading of the bubble level on top of the unipod (for the topside station) and the operator in the second level did the same thing as he measured the mirror or the compound angles. This was done for each reading. The third man on the team would record the numbers and do the math. All three of us used a headset for communication with each other. I had given a reading

(Continued on page 12)

Targeting - (Continued from Page 11)

and waited on the Lt to give his. I heard the azimuth reading and nothing else, so I asked him for the bubble reading, and his reply was as soon as it stops moving, I did not believe him so I said "hard night at the club sir?" He replied that the bubble was going from one side to the other. I looked at my own bubble and indeed he was right, mine was doing the same. He came topside and we got on the radio in the van and contacted the other teams in the field and sure enough all were experiencing the same thing, including the Boeing folks. The next contact was Job Control - they told us "We just had a major earthquake in Alaska". We were seeing the effects of that anomaly in central Missouri. As you might guess there was a huge amount of concern as to the accuracy of our targets, so the next several weeks we retested a lot of the alignments and the geodetic survey people reevaluated the monuments in the field - no major problems found.

In Minuteman I we had a big targeting console inside a van to read the targeting tapes into the G&C. It also was the control we used to start the G&C and calibrate it. We lowered a heavy cable down the hatch and connect it to the side of the distribution panel. In itself this was not a big deal - it became a problem was backing out of the site. The B-Plug took a long time to lower or raise and after a long shift everyone was anxious to get back home or to the next job. The trick was to start the B-Plug up and stop it with enough space for the two people down stairs to squeeze through, cutting backout time in half. One day, the inevitable happened - someone was not watching the plug and it cut the cable in half. There was a huge response from the wing and an investigation. It was determined that procedure was not followed and discipline followed. Everyone learned their lesson, correct? Nope - 2 or 3 weeks later it happened again. Only this time it was not a line crew it was the QC team. When Force Mod was accomplished we no longer used the targeting van as that huge targeting console was replaced by a couple of boxes, one with a tape reader to read the targets into the G&C that hooked directly into the coupler rack.

During the latter time before Force Mod we were hit by a 3901SMES at Whiteman. I knew all of the members of the team and did not take the evaluation with a great deal of stress, although our section chief warned us about not being to complacent. We were on site and everything was going just great. I was the topside BMAT and was operating the targeting console. I had only had one small mishap - the cover over the tape on the tape reader came off - I recovered from that nicely.

I kept watching the weather and before we finished it began to sprinkle. My first thought was we will probably beat the rain, but on second thought we were doing good and maybe we would get written up for not putting up the environmental tent over the access hatch. So I went to the hatch and got my team chief's attention. He said to start assembling the tent. I looked back down at him and mouthed the words so the evaluator could not hear me "I don't know how", so he came up to help. I attempted to assist but it was obvious that I never had done that task. I really expected the worst. However, at critique the evaluation crew chief said our crew did an outstanding job, but possibly Sgt Denman might want to practice tent set-up.

Sewage Lagoons - Why?

Recently, a new member asked a question we hadn't heard before - why does a Minuteman LCF/MAF have a sewage lagoon instead of a septic tank with leech fields? We got a few replies after our June e-mail update, but we aren't sure if the answer is really one of these. If you know, tell us.

Felix Boston said he suspected that leech fields were decided against because of the shallow ground water at most missile bases.

Pete Minck said from his time working on the SAC ICBM Facility Staff, the lagoons were used as the preferred course of action due to the original, late 50s Minuteman Ops Concept. The original concept had three ops crews, security forces, cooks and a facility manager at the LCF for a 3 day tour, plus overnight maintenance teams. A septic tank with or without a leech field, would have had to include a periodic empty of the tank. At the time the LCFs were even more remote than they are today. The tank would have had to be large, maybe 15 times bigger than a residential tank. The tanks would have needed to be emptied almost every 3 to 4 days.

Walt Greene suggested that when he served in AC&W squadrons, the sewage lagoons were back up water. They weren't often used for drinking but said, "Yes, we drank it when necessary, but most often it was used to water the grounds."

We did call the lagoons the "Officers Swimming Pools" at one time - but the last idea of backup water was not one that was common knowledge. If you have some insight into this question, we would be glad to hear it. While Pete Minck and Felix Boston both gave good reasons, there may have been another that resulted in the decision to use lagoons.

The Non-essential Bus

by MCCC, 579SMS Crew S-055

The Non-essential bus
Turns off 11 water pumps.
Seven ventilation fans,
Fail to turn their blade-like hands.
Nine more units it will stop.
Plus all 6 stub-up's on the top.
Condenser water stops its flow,
Diesels heat up fast, you know.
Hot water pumps will never go,
And the sump may overflow.
The air wash spray pumps will not run,
And the demineralized pump is done.
Utility water pressure drops,
And the fire fog system stops.
Supply Fan Number 21,

In the dust collector, fails to run.
Supply Fan Number 22,
For lower silo, is now through.
EF-30, main exhaust,
And the cooling tower fan is lost.
EF-40 and 41 On the LP, fail to run.
Fan coil unit SF-4 zero,
Stops like a coward, not a hero.
Instrument air compressors, two,
And WCU five one are through.
Three vacuum pumps now fail to run,
And the facility elevator's done.
Silo lights make it like night,
Power receptacles will not bite.
The dirty lube oil and defueling pumps

Are out, as are the six stub-ups.
P-thirty two does not come on,
Because the system's wired wrong.
To start it up, do one of these,
Activate the blast detector, if you please.
The blast closures test close pushbutton choose,
Or P-32 manual start you'd use.
On Red-Heat Sites I'm sure you'll find,
It starts when pressure drops in the lines.
I'm really not a poet,
And this rhyme doth surely show it.
But if you read until you know it,
Your test results will always show it.

UFOs and ICBMs - Revisited - by

Robert Hastings, MbrNo A2096, Albuquerque, NM

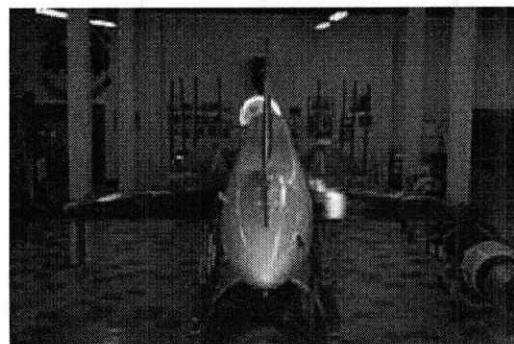
I wrote an article for the September 2002 issue about my research of UFO sightings at ICBM sites. I have interviewed over 60 personnel who were involved in such incidents while stationed at various SAC bases during the Cold War era. After my first article, 35 AAFM members contacted me and described their personal UFO experiences, or those reported by other individuals in their squadrons. A number of the ICBM-related UFO incidents are mentioned in declassified USAF and NORAD documents.

Intriguingly, it appears that military personnel at the Soviets' nuclear weapons-related sites also reported observing UFOs. To further my research, I am seeking additional information from former/retired USAF personnel who were involved in, or may have heard about, an incident involving UFOs and ICBMs. I am interested in any UFO sighting, at any base, during any given time-frame, especially from individuals who were stationed at FE Warren AFB in 1973 and 1974, and at Ellsworth AFB between 1978 and 1980. The existence of UFOs is of course a controversial topic. While I would prefer that my former/retired USAF sources go on-the-record, I can assure those requesting anonymity of complete confidentiality. My email address is hastings444@att.net and my home address is 6200 Eubank Boulevard NE, Apt. 832, Albuquerque, NM 87111.



Travis Hound Dog

The restored Hound Dog, GAM-77, AGM-28 missile that AAFM's grant helped to restore was unveiled on 27 March at the Travis Air Museum/Jimmy Doolittle Air and Space Museum. AAFM provided \$1,800 in 2005 to the museum for the Hound Dog project.

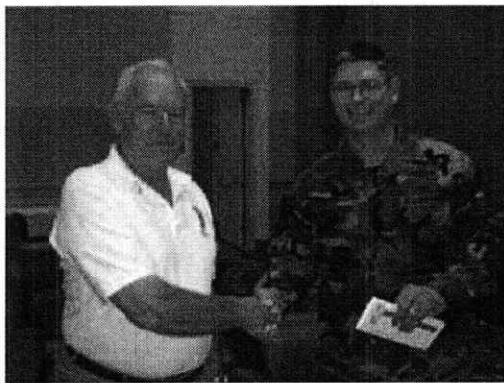


A Word from the Association

Member Dues - Since Kevin Mortensen, our dues notice mailer, is in the middle of a PCS move, I took over the dues notice mailings for a short time. I mailed extra notices to a number of members whose dues had expired in recent months. It worked well - so many of you sent in dues, I collected over \$10,000 in the last two months. Remember that your dues expiration date is above your name on the address label for this newsletter.

Members Moving - Three AAFM members who are senior leaders in the missile and space field, including two of our Active Duty Advisors, are moving soon. LtGen Frank Klotz, currently Vice Commander, AF Space Command, is moving to the Pentagon. MajGen Tom Deppe, Commander, 20AF at Warren, is replacing Klotz. MajGen Roger Burg, currently in the Pentagon, is replacing Deppe as Commander, 20AF.

New Members - AAFM is now in its 15th year - and we continue to grow. I process two or three new members every week - usually people who just heard about us. I recently met the AFSPC Command Chief Master Sergeant, CMSgt Michael Sullivan, at the Strategic Warfare Conference at Keystone, CO, and signed him up. He replaced CMSgt Ron Kriete when Ron retired. The chief is continuing AFSPC's great outstanding airmen recognition program, which we support with funds each year. The Chief was a DC-130 crew chief involved with remotely piloted vehicles early in his career.



Letters to the Association

Address your letters to AAFM, Box 5693, Breckenridge, CO 80424, or send by e-mail to aafm@afmissileers.org. Letters may be edited to fit - content/meaning will not be changed.

72 Hour Alerts - I was amused by the article on 72 hour alerts. From 1962 and 1967 the 455SMW had 72 hour alerts with two man crews. The policy was to organize crews around the AFIT schedule and manning missile sites with the least amount of scheduling problems. Each site was scheduled on an eight day rotation with four crews. Two crews were off duty for four days to attend AFIT classes and have break time. Two crews were scheduled to pull duty at a specific site. The two crews were scheduled to relieve each back to back for four days. The next four days they were off duty to attend AFIT, with the second set of two crews now pulling their alert duty for four days. Where did the 72 hour tours come into play? In North Dakota every winter we had snow storms so crews couldn't be relieved, which meant that they stayed on duty 48 hours. Only problem was that they were the crew scheduled to come on duty next. So the wing, rather than juggle schedules, let the schedule stand, meaning the crew stayed on alert for 72 hours. My crew pulled at least eight 72 hours tours before we graduated from AFIT. *Walt Greene, MbrNo A0512, Edinburg, TX*

Walker Accidents - Reading the December propellant discussions reminded me within the 579SMS three and a half year operational existence, three of its twelve sites were lost. While a technical glitch surfaced in each case, site loss invariably fell to human error. In one instance, a standardization crew commander ordered tripping of the nonessential Bus during a PLX exercise, contrary to the MCCC's strong objection. The cascade of events that followed was ultimately catastrophic. In testimony before Congress, it was suggested to the MCCC that had he refused the order he could have become the Billy Mitchell of the ICBM force. His succinct reply was, "And we all know what happened to General Mitchell." As one familiar with SAC might imagine, during the short

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AAFM is a non-profit, tax-exempt organization under section 501c(3) of the IRS Code. The Newsletter is published quarterly, printed by Allegra Print and Imaging, 1419 Santa Fe Ave, Long Beach, CA 90813, 562-432-2931.

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Letters (Continued from Page 14)

existence of the 579SMS squadron commanders fell like scrub trees. Following the last explosion a new face arrived at Walker, with a management style that lay somewhere between Captain Queeg and Rasputin; he did what had to be done and he did it quickly. In the vernacular, bodies lay everywhere. However, shortly before he arrived, the squadron was ordered to the base theater for a mandatory formation. General Power (CinCSAC) quickly walked down the isle, stepped to the stage and surveyed the assembly standing at attention for what seemed an interminable period. After we were seated he immediately gave his speech, "Gentlemen, if it is in the tech order, do it; if it is not in the tech order, don't do it." As the last word was spoken he left. It was remarkable in its brevity and unforgettably precise. Not long afterward a poem authored by MCCC R-55, The Non-Essential Bus, appeared in crew mail boxes. By the time the poem appeared, the number one standardization crew commander, the "Top Gun", had unceremoniously departed having learned too late the nonessential bus was hardly nonessential. One might imagine the work environment to have been difficult and perhaps it was; there is such a thing as too much attention. The 579SMS could not afford to dwell on the past although lessons learned were crucial; focus was set on Management Control System excellence in maintenance, operations and management - when the order came to stand down, rather than a relief, it was a disappointment. *Joe Conrad, MbrNo A1384, Mt Vernon, NH*

See the Poem "The Non-Essential Bus" page 13

Titan II Site - I am working with a group interested in digging up a Titan II site. An individual owns property which is located on top of what once was Site 533-4 here in Kansas. I was contacted by the property owner to provide some assistance in digging out the access portal area and gaining entry into the control center. We have been able to get the site demolition engineering diagrams from the Little Rock sites to give us some idea of how areas were destroyed/filled in after deactivation of the sites. I am hoping there is a member here in the Wichita, KS area who might be of some assistance in this excavation process or provide some advice. We are also asking if anyone else has heard or seen any of this type of activity at any other former Titan II deactivated sites. *Mike Riemer, MbrNo A1347, Wichita, KS*

Nuclear Weapons Technicians Association - I am president of the NWT. We have some members in

common since many of us served missile units as nuclear technicians. I check out your website often because I worked MMIII and PK for over 10 years and recognize some of the names. We're trying to spread the word about our organization. I would also appreciate it if you would post our reunion dates in your newsletter. We are holding ours in conjunction with the 51MMS in Dayton OH, 4-6 October. Our website is www.usafnukes.com. *SMSgt (Ret) Anne Golembeski, President, NWT*

Hound Dog - Would you consider an article about Airborne Missiles? I was in Hound Dog - GAM-77/AGM-28 - and could put together some recollections about them. I always look forward to the newsletters because they are filled with interesting articles. I wonder though, why

Taps for Missileers

Col (Ret) John Arnold, an AAFM Life member, served in Titan I in the 569SMS and in Minuteman in the 351SMW and 4315CCTS and lived in Montgomery, AL

A1C Eric M. Barnes died June 9 as result of an improvised explosive device attack in Iraq. He was assigned to the 90th Logistics Readiness Squadron at FE Warren

Col (Ret) Thomas G. Bowen, an AAFM life member, served in GLCM as commander at Dugway and as first commander of the 487TMW, and lived in Tucson, AZ

Former Airman Fred Clubb, an AAFM member, served in Atlas in the 567SMS and Minuteman in the 341SMW and Hound Dog and lived in Cincinnati, OH

Maj (Ret) William Fein, an AAFM member, served in the Atlas E in the 549SMS and the 548SMS, and lived in Newhall, CA

Col (Ret) Chandois (Chan) Johnson, who served in Minuteman, lived in Lompoc, CA

TSgt (Ret) Frank Kerr, an AAFM member, served in Titan II in the 390SMW and Hound Dog and lived in Shelton, WA

TSgt (Ret) Gary Lubbe, an AAFM member, served in Thor, Minuteman and space and lived Katy, TX

LtCol (Ret) John Mattioli, served in Minuteman in the 44SMW, 57AD and the 576SMS, and lived in Aliso Viejo, CA.

H. C. "Bud" Meyer, an AAFM member, lived in Frankfort, KY

Col (Ret) Robert K. O'Connor, an AAFM member, served in Minuteman in the 90SMW, 351SMW, 1STRAD, BMO, SAC and AFOTEC and lived in Redlands, CA

CMSgt (Ret) Charles Roegge, an AAFM member, served in Snark in the 702SMW, Atlas in the 556SMS and 550SSMS, Hound Dog and Quail and lived in Castalia, OH.

are the two "new" badges on the cover sheet both Master Badges while the two "old" missileman and launch crew badges are not? Just wondered. *Bill Bates, MbrNo A2471, highlands Ranch, CO*

We welcome articles about Hound Dog or any other missile system. We get gripes because we haven't covered a specific system often enough. There's only one way to solve this problem - you with experience in the "too often ignored" systems need to send us articles. Your editor served in Titan, Minuteman and GLCM - he can't write with any authority on others. Send in your stories and articles now. On the question on the badges on the cover - rather than show all three versions of each, we picked one representation of each badges - missile, missile with ops designator, space and missile and the new space badge.

Job for a Missileer? - Federal agency reviewing classified documents for sanitization and release to the public anticipates a vacancy for an experienced Air Force missileer. Along with a strong missile background, a thorough knowledge of RD/FRD is necessary; Dept. of Energy experience is desirable. Candidate must possess a TS clearance. For additional information, contact Michael Binder at (301) 837-3729, or at coldwar@flash.net.

We get an occasional request like this and make them available to our members

SAC Stripe - I am looking for an adhesive SAC crest with stripe to remake my hardhat from my 321SMW days. I was about the third officer (2Lt) in the wing in 1964 and Col Gil Friederichs, who was my first CO also happened to be my Dad's last CO at FE Warren. *LtCol (Ret) Fausto Molinet, fausto4@comcast.net*

Launch Pin - You mentioned a pin for OT launches in a recent update. Are these pins available anywhere now? *Dave Hinken, MbrNo A1773, Green Valley, AZ dfhinken@yahoo.com*

Let AAFM or Dave know if you have a source

Missileer in Iraq - Still loving life here - I am at FOB Liberty, 15 minutes by Humvee convoy west of the IZ. It is unique - we have Army, Navy, and Air Force personnel all wearing Army Combat Uniform (ACUs). The AF wears the name and rank in blue. We have a major who is a WSO on B-1s at Ellsworth here as an ALO. *Felix Boston, MbrNo A1788, currently serving in Iraq*

Help on Health Issues - I was a Titan II MFT at Vandenberg involved in refurbishing silo exhaust shafts after test launches. We removed and replaced sound attenuation modules in both exhaust shafts and other general work after launches. It was a dirty job and we wore only limited protective gear. I have developed kidney cancer, and the VA hospital has asked me if I knew of any other cases of cancer among those who worked in my specialty. Besides the cancer, I also have vision problems. I would appreciate hearing from any other missileers who might have similar problems that might be related to our work environment. *Jim Olson, MbrNo A2530, Atlanta, GA, jo3263@hotmail.com*

We have had one or two requests like this in the past.

40th Anniversary of the Competition Special Issue *Curtain Raiser - Olympic Arena - Guardian Challenge*

Send us your stories, photos and memories about your experiences in competition. Next issue We will commemorate the 40th anniversary of the first competition, *Curtain Raiser*, with a review of all 40 years from those who participated in the "Comp." Send by e-mail or mail.

Reunions

The "real" 20th Anniversary of 308SMW Deactivation, 12-16 September 2007, Little Rock, AR, contact William Leslie, 937-255-2783, info at www.308smw.com or e-mail william.leslie2@wpafb.af.mil

SAC 2008 - 30 April - 4 May 2008, Dayton, OH, reunion and dedication of the SAC Memorial

51MMS (Vandenberg) - October 2007, Dayton, OH, go to www.51stmms.org for more information

50th Anniversary of the first Atlas Launch - 21 July 2007, 1895 Camino Del Rio So (Mission Valley) San Diego CA, e-mail atlas.reunion@yahoo.com or go to http://members.cox.net/atlas_reunion/

OCS Class 58-A - 11-14 September 2007, Holiday Inn at the AmeriStar, Council Bluffs, IA. Don Aldridge (daldridge@cox.net)

Association of Air Force Missileers - 2008 National Meeting, 9-13 Oct 2008, Hyatt Dulles, Herndon, VA.

Reunion Notices should be to AAFM as early as possible for the newsletter, web page and e-mail updates.