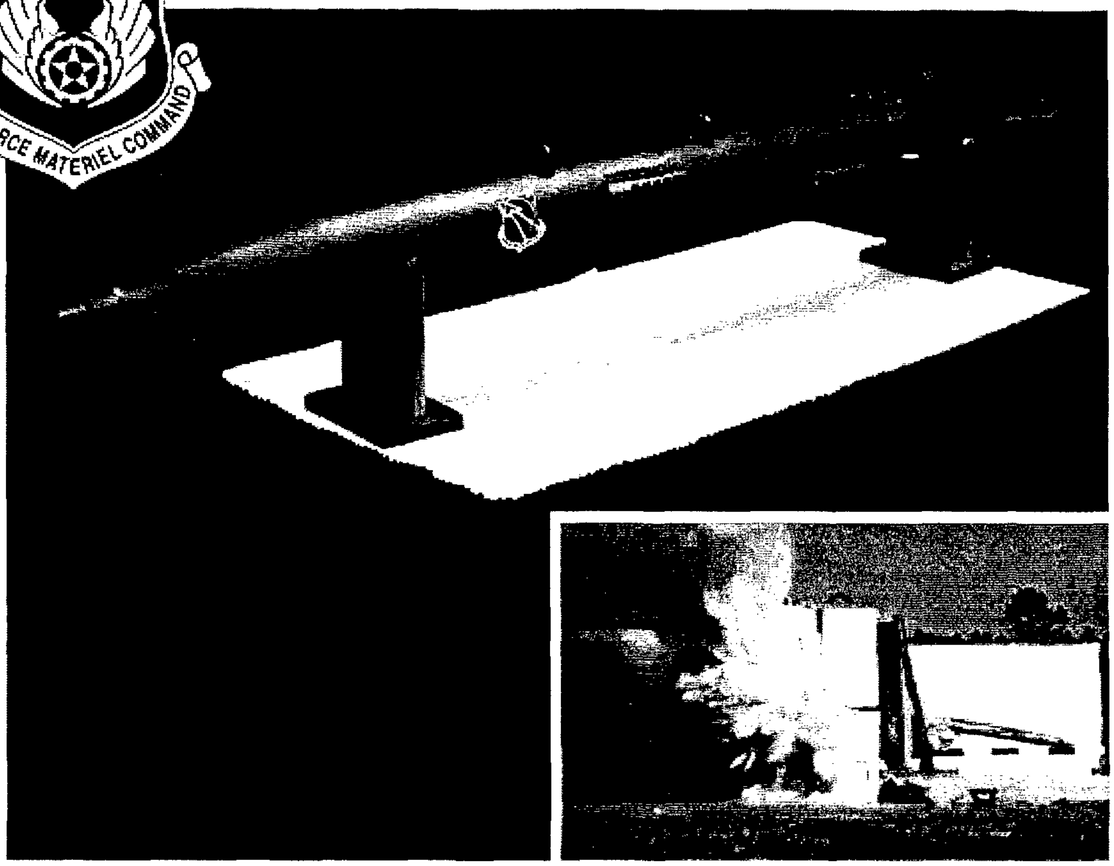
FY97
CONVENTIONAL ARMAMENT TECHNOLOGY AREA PLAN



HEADQUARTERS AIR FORCE MATERIEL COMMAND

DIRECTORATE of SCIENCE & TECHNOLOGY

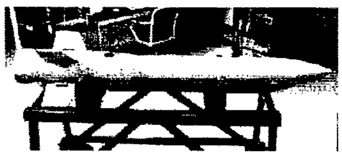
WRIGHT-PATTERSON AFB OH

CONTENTS

CONVENTIONAL ARMAMENT

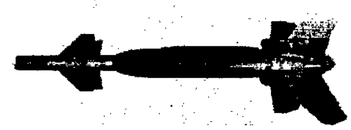
INTEGRATING CONCEPTS

GROUND FIXED CONCEPTS



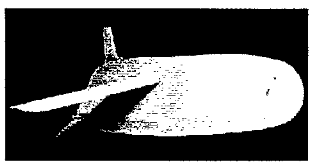
SMALL SMART BOMB

SMART HARD TARGET MUNITION



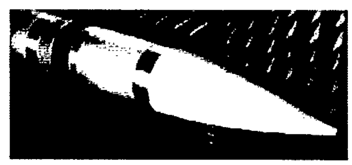
SMART SOFT TARGET MUNITION

GROUND MOBILE CONCEPTS



ANTI-MATERIEL MUNITION

AIR-TO-AIR CONCEPTS



DUAL RANGE MISSILE

VISIONS AND OPPORTUNITIES

With resources shrinking, both in terms of funding and manpower, the Air Force must perform a complicated balancing act in order to satisfy its current and future weapon system needs. Today, weapon systems must be developed and maintained at lower costs, be robust to future threats, and be incrementally modernized through planned upgrades. The Armament Directorate is committed to providing the research and development efforts necessary to meet the conventional weaponry needs of the Air Force while maintaining this balance.

Our vision is to pursue the development of precision guided conventional weapons that are versatile, affordable, autonomous, and provide greater lethality in all-weather conditions. These weapons will enable our forces to target and surgically strike a wide variety of military targets while reducing the risk to civilian populations and minimizing environmental damage. We envision conventional weapons that will be able to defeat targets that were once only defeated by the use of nuclear weapons.

The Armament Directorate and its associated technology thrust leaders are using the idea of "Integrating Concepts" as the organizing principle to focus its technical planning activities. The five Integrating Concepts used at the present time are depicted in the above graphic: one focuses on mobile surface targets (the Antimateriel Munition); one focuses on airborne targets (the Dual Range Missile); and the remaining three focus on fixed surface targets (Small Smart Bomb, Smart Hard Target Munition, Smart Soft Target Munition). To promote efficient integrated planning, the concepts are managed by an interdisciplinary Integrated Product Team (IPT). Each concept facilitates a system-based approach rather than a series of independent component or technology based approaches. The Integrating Concept IPT (ICIPT) will establish long-term visions, operational performance goals, and technology subgoals within the context of their particular munition system and its mission application. Ultimately, the various technology programs described in this Technology Area Plan were selected because their successful execution will provide technology options for the long-term visions of these Integrating Concepts.

Technology innovation is encouraged in this planning cycle. Senior planners are promoting revolutionary thinking to achieve paradigm shifting solutions to operational deficiencies. AFMC/ST has earmarked funds to be dedicated to those promising ideas which emerge from the Air Force Scientific Advisory Board's New World Vistas or other far thinking efforts such as Air Force 2025. The visions and performance attributes of the five Integrating Concepts will be the guiding force in selecting those programs to fund. Second, the corporate Air Force has shown an accelerated interest in Unmanned Aerial Vehicles (UAVs). Two of the munition Integrating Concepts (the Small Smart Bomb and Antimateriel Munition) will enable small UAVs to embody a lethal mission. Component technologies presently being driven by the need for compact, inexpensive munitions can be applied in innovative ways to facilitate compact, high endurance, highly capable UAVs. Some technology examples are the Conformal Array Antenna, AntiJam GPS, Laser Radar Imaging, and Multi-Munition Transceivers.

It will be the goal of the individual thrusts to use the visions of the ICIPTs, the revolutionary ideas of the New World Vistas, and the far thinking ideas of the AF 2025 and make them reality. They will furnish the necessary technical knowledge and facilities to turn the seekers, sensors, fuzes, and ordnance research into hardware that the warfighter can use to meet the future air-to-surface and air-to-air conventional weapon needs of the Air Force.

The development of highly effective and affordable conventional armament technologies for the Air Force is our vision. By working together with the system program offices and Air Force Test ranges located at Eglin AFB, the munition technology development, system acquisition, and testing that is critical to the Air Force will be developed and maintained to meet our current and future munition needs.

This plan has been reviewed by all Air Force laboratory commanders/directors and reflects integrated Air Force technology planning. I request Air Force Acquisition Executive approval of the plan.

SIGNED

RICHARD W. DAVIS
Colonel, USAF
Commander Wright Laboratory

SIGNED

RICHARD R. PAUL
Major General, USAF
Technology Executive Officer

CONVENTIONAL ARMAMENT TECHNOLOGY AREA PLAN

INTRODUCTION

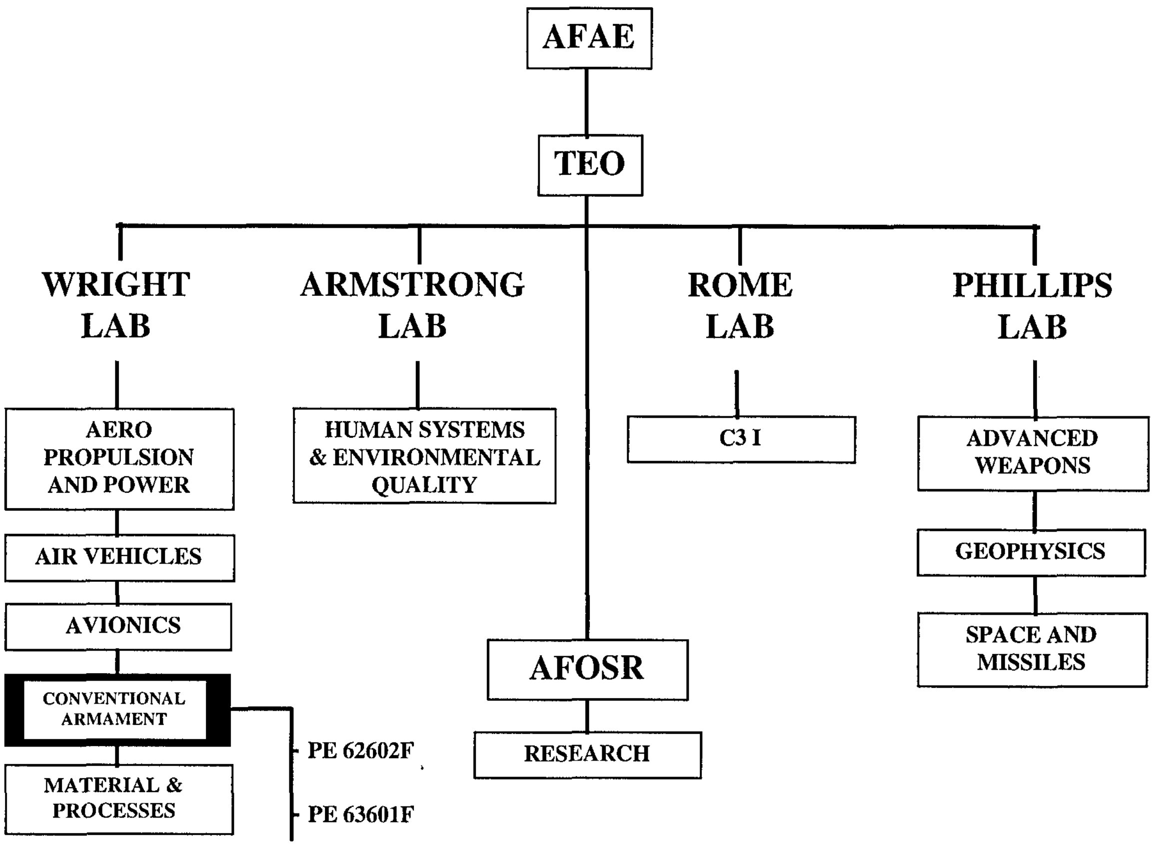


FIGURE 1. AIR FORCE SCIENCE AND TECHNOLOGY PROGRAM STRUCTURE

Background

The Air Force Materiel Command organization for Science and Technology (S&T) is depicted in Figure 1. Within this structure, Conventional Armament S&T is carried out by the Armament Directorate at Eglin Air Force Base (AFB), FL. We have two Program Elements (PEs) as shown. The primary role of the Armament Directorate is to perform research and development to transition conventional armament technologies that meet our customers' needs. Figure 2 illustrates the FY97 Conventional Armament investment compared to the overall Air Force S&T budget. Conventional Armament is approximately five percent of the S&T budget.

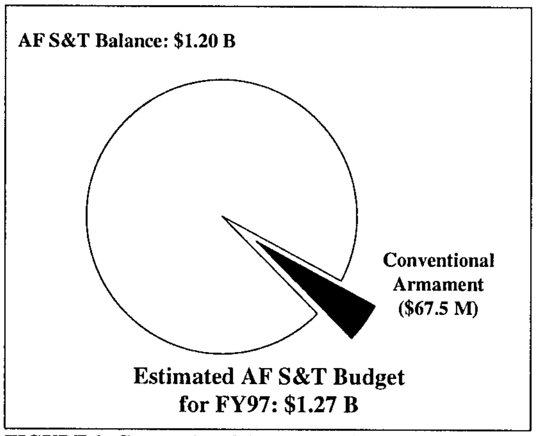


FIGURE 2. Conventional Armament S&T Budget vs. Air Force S&T Budget

The fundamental technology areas or major thrusts for Conventional Armament are shown in Table 1.

Table 1. Major Technology Thrusts
1. Advanced Guidance
2. Ordnance

These thrusts encompass a broad spectrum of technologies that form the basis for enabling new/innovative concepts for air-launched weapons. **To relate User's Needs to conventional armament technology, the thrust descriptions begin with an abbreviated listing of combat user needs extracted from Mission Area Plans and other requirements documents. These needs are expanded and highlighted in boldfaced type in the "Goals" section along with the technologies being pursued to solve the needs.** The thrust descriptions conclude with accomplishments from last year, program changes, and milestones for the future. Figure 3 is the apportionment of AF Science and Technology (S&T) conventional armament funding for the two major thrusts.

The Advanced Guidance Thrust develops the terminal seekers and guidance & navigation technology that provide the precision in a precision guided weapon. Accomplishments during the past year include advancements in conformal antenna design and application, the initiation of a flight demonstration program for Synthetic Aperture Radar (SAR) seekers, and significant cost reduction in inertial measurement units.

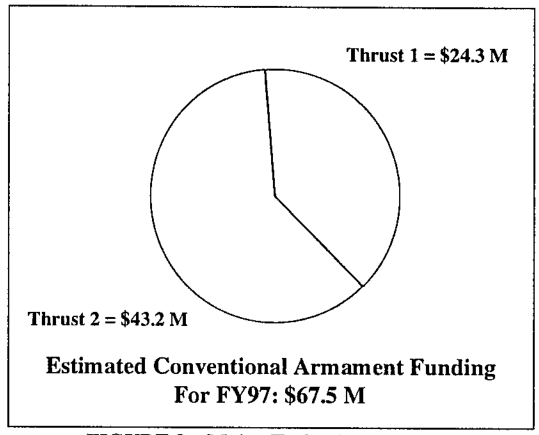


FIGURE 3. Major Technology Thrusts

The Ordnance Thrust is responsible for the development of explosives, warheads, fuzes, weapon airframe controls, and carriage and release equipment, and receives the largest share of the Conventional Armament S&T budget. Major accomplishments during the past year include the completion of the development of a hard target smart fuze, the development of a dense explosive for penetrating weapons, and the demonstration of a 1000-lb penetrator warhead for the Joint Advanced Strike Aircraft and F-22. Technology assessments are conducted in all of these thrusts to provide program managers insight into critical design issues and to ensure the technologies are focused to satisfy the user's requirements. All funding figures reflect the FY97 President's Budget Request, and the programs described in this plan are subject to change based upon possible Congressional action.

Relationship to Other Technology Programs

Our thrusts are coordinated with the other 12 technology areas of Air Force S&T. Special attention is placed on maintaining a close relationship with areas that are vital to armament development such as materials, avionics, air vehicles, and aeropropulsion and power. This awareness ensures our thrusts can benefit from work performed in these areas.

To keep abreast of technologies, we participate in joint programs, data exchanges, and technical interfacing with other Air Force organizations, services, government agencies, National Laboratories, industry, and foreign countries. We maintain an interface and support programs carried out by these organizations so that we can leverage their technical expertise and fill our technical gaps. We also maintain a working relationship with aircraft System Program Offices (SPOs) to provide them with technologies for new weapons, missile launchers, and bomb release units for advanced aircraft. Together we work to support each other so that the SPO and our technology needs are met.

We leverage our technologies with the commercial sector where possible. Where there is limited commercial interest such as in the explosives, warheads, and fuzes area, we conduct more in-house research and expend more resources than private industry to advance this technology.

The Armament Directorate has implemented a broad based technology transfer program. Outreach to industry, patenting, marketing, and cooperative efforts are all a part of the directorate program. We are actively involved with industry through Cooperative Research and Development Agreements to promote the commercialization of Subminiature Telemetry, High Speed Imaging, and layered ceramic materials for gun barrel applications. The Armament Directorate is an active member of the Gulf Coast Alliance for Technology Transfer for the purpose of assessing and commercializing our technologies and is also an active member of the Federal Laboratory Consortium for technology transfer.

The Directorate has several International Exchange Agreements with foreign countries around the world. The primary emphasis is in the ordnance area. A number of joint tests were completed last year, and more are scheduled for the coming year.

Changes from Last Year

A major change from last year is the incorporation of the Instrumentation Technology Thrust into the Ordnance Thrust. As a result of this consolidation activity, the technologies inside the Instrumentation Technology Thrust will now be reported under the Ordnance Thrust.

USER NEEDS

The focus of this thrust is on the development of terminal seeker, sensor, and guidance and navigation technologies for weapons that can go anywhere, anytime, accurately, affordably, and autonomously. User needs have been extracted from the Air Combat Command (ACC) Mission Area Plans for Counter Air, Strategic Attack/Interdiction, Close Air Support/ Interdiction, Theater Missile Defense, and Electronic Combat.

AIR-TO-SURFACE

Smart Hard and Soft Target Munitions
Small Smart Bomb

- Autonomous target identification and tracking in weather with affordable, countermeasure resistant seekers
- Real-time targeting and damage assessment
- Steep dive angle target acquisition and tracking for penetrating munitions
- Reduced mission planning requirements
- Minimal collateral damage
- Intelligent Antijam Global Position System /Inertial Navigation System (GPS/INS) guidance

AntiMateriel Munitions

- Autonomous target identification and tracking in weather with affordable, countermeasure resistant seeker
- Real-time targeting
- Identification of friend or foe

AIR-TO-AIR

Dual Range Missile

- Increased electronic countermeasure (ECM) resistance and broader target set
- Identification of friend or foe
- Capability against cruise missiles
- Improved guidance laws/autopilots for enhanced accuracy and faster intercept
- Low cost, small, and accurate Inertial Measurement Units (IMUs)
- High off-boresight lock-on and track capability with affordable seekers

See Figure 4 for major Thrust efforts.

GOALS

AIR-TO-SURFACE

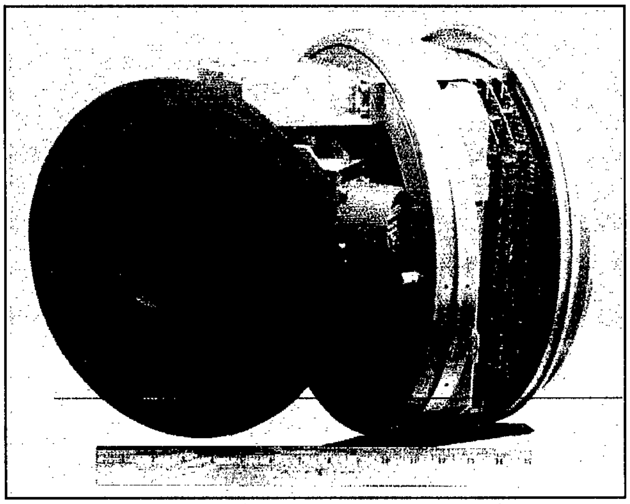


FIGURE 5. Synthetic Aperture Radar Seeker

The air-to-surface laser guided weapons currently in the inventory require designation of the target by laser. A successful mission requires not only the designator remain in the target area until weapon impact, but also the weather to be good enough to allow visual acquisition by both weapon and designator. Desert Storm highlighted this weather limitation and the need for precision guidance (minimum collateral damage). **These considerations have led to the requirement for autonomous, all-weather, countermeasure resistant, precision seekers for our weapons.**

- A near-term goal is to demonstrate a Synthetic Aperture Radar (SAR) seeker (Figure 5) capable of guiding a conventional direct attack weapon to a fixed high value target within 3 meters in adverse weather and at a cost of less than $40K per unit in quantities of 5000.

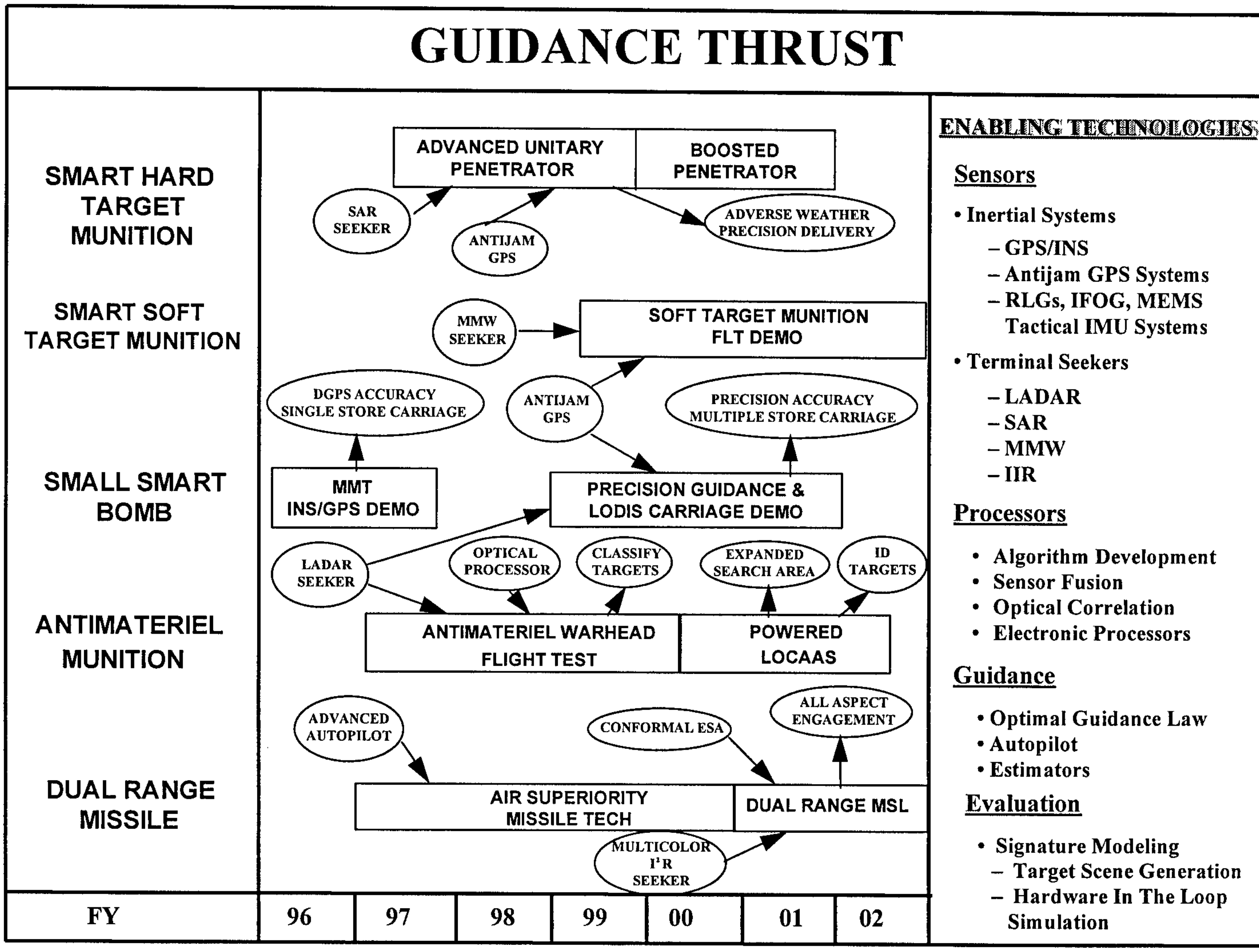


Figure 4. Thrust 1 Advanced Guidance

Real-time targeting offers mission flexibility in a rapidly changing battlefield. It allows an update in the coordinates of a mobile target as well as the opportunity to change to an alternate high value target.

Several techniques are being investigated to address this capability, to include using data from either on-board or off-board sensors. In addition, the seeker may use inputs from multiple types of sensors operating in different parts of the electromagnetic spectrum.

- A mid-term goal is to demonstrate real-time targeting for a SAR seeker using either on-board or off-board sensor information.

- Develop and demonstrate solid-state laser radar (ladar) sensor and algorithms for precision guided munitions. The Advanced Solid State Ladar (DASSL) program will develop the ladar seeker for use in the Miniaturized Munition Technology Demonstration (MMTD) Program.

- Develop and demonstrate jam-resistant, all-weather, day/night, forward-looking, wide field-of-regard, high resolution, millimeter wave, radiometric imaging sensor.

- Investigate emerging technologies in millimeter wave (MMW), LADAR, and passive infrared (IR) that add new signature detection capabilities to current seekers by the exploitation of polarization diversity and various spectral sensitivities for the different frequency regimes.

Acquiring and attacking fixed hard targets presents some unique problems. In order to employ penetrating weapons optimally, the seeker must be able to acquire the target in a steep dive angle and remain locked on until target impact. **Also, detecting damage following an attack is difficult, especially for buried or covered targets such as command control bunkers and aircraft shelters.**

- Develop seekers capable of all-weather, autonomous acquisition, and precision tracking of fixed hard targets at steep dive angles.
- Develop and demonstrate methods to obtain real time battle damage assessment for fixed hard targets.

Traditionally, mission planning for a strike against fixed high value targets with stand-off weapons can take up to several days. This timeline begins from receipt of targeting material through reference template generation to validation. Because of this, the number of sorties flown and targets attacked in a given time period is limited.

- Develop algorithms and tools for weapons which will assist in reducing mission planning times from days to minutes to increase sortie generation.

Mobile targets such as tanks, trucks, relocatable missile launchers, or radar sites have special seeker requirements for both stand-off and direct attack deliveries. To meet the user's need for defeating this broad spectrum of targets, an affordable laser radar seeker has been coupled with a multimode warhead in a maneuvering, antimateriel submunition. The seeker provides highly accurate guidance and enough information to determine which warhead mode should be used to maximize lethality on the target.

- Develop an improved, low cost seeker which combines autonomous target identification and tracking of mobile targets in weather with increased area coverage.

Distinguishing friend from foe when forces are in close contact is required for all-weather environments. To accomplish this task, the seeker must have precise angular and range resolution together with the capability to process at extremely high data rates.

- A mid-term goal is to exploit the technologies of high resolution laser radar, optical processing, and image algebra to develop new seekers. These seekers will have high speed, compact, parallel processors capable of processing high resolution images in less than 10 milliseconds and algorithms which will find and identify targets in an adverse weather, clutter/ countermeasured environment, using high resolution, solid-state, laser radar sensors.

GPS/INS guided munitions are currently being developed for direct attack and stand-off applications. GPS/INS guidance provides a low cost, highly accurate, day/night, all weather guidance system for tactical weapons. GPS/INS

weapon guidance, whether used alone or with a terminal seeker for precision accuracy, is the way of the future. The intensity of jamming encountered by a weapon is more severe than that encountered by an aircraft because of the weapon's proximity to collocated jammers at the target which could render the weapon GPS receiver useless, thus severely degrading weapon terminal accuracy.

- The goal is a low cost, small, intelligent GPS/INS weapon guidance system for weapon options which will be resistant to jamming by postulated threats.

- This thrust contains the only program within DoD that addresses the antijam GPS technology for tactical weapons. This technology supports the Joint Direct Attack Munition (JDAM) and future tactical weapons.

Low cost, highly reliable, miniature IMUs are essential for air-to-air and air-to-surface weapon options, and for GPS/INS guidance systems. The next generation of IMUs will be based on innovative micromachining technologies that lend themselves to the low cost manufacturing techniques associated with chip design and fabrication.

- Our goal is to develop, demonstrate, and mature a new generation of IMUs which are highly reliable, one-fourth the cost, and one-third the size of current systems. They will also have dual use potential for commercial sensing devices.

- To further the goal of identifying affordable concepts and components and reducing the life cycle cost of seekers, we are developing in-house research test-beds. These include MMW Reflectivity Measurement System (MRMS), Research and Seeker Emulation Radar (RASER), the Laser Radar Brassboard, and the Advanced Guidance Research Facility (AGRF).

AIR-TO-AIR

Efforts relating to medium range missiles are primarily concentrated on technologies to improve the AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM). These include lower cost components, increased electronic countermeasure resistance against a broader target spectrum, and identification of friend or foe.

- Develop a multimode seeker with enhanced processor hardware and algorithms to improve the target identification capability and end game accuracy.

- Provide enhanced performance against post-2000 advanced electronic countermeasures and low observable threats.

- Provide acquisition and shoot-down capability of cruise missiles.

There are current investigations underway to improve the performance of seekers for short range air-to-air missiles. The Armament Directorate is assisting in a number of technology areas to address these specific problems with emphasis on reduction of component costs.

- Develop and demonstrate a low cost seeker with an electronic, steerable, conformal array antenna to provide rapid scanning of large fields-of-regard.

In addition to the target oriented goals listed above, there are goals for support technologies which apply across the board to all target types, for both air-to-air and air-to-surface. These include developing research test-beds, modeling, and simulation tools which reduce development and life cycle testing while providing specific seeker performance information as well as overall reliability, maintainability, and supportability data.

- The goal is to develop advanced guided munition simulation and simulator technologies and techniques in order to provide reliable and affordable assessments early in the seeker development process. Advancements in simulator scene projectors, scene generation computer codes and hardware, flight motion simulators, and real-time computer hardware will significantly increase the fidelity and utility of ground test facilities and reduce the magnitude of expensive flight test programs.

Missile effectiveness can be significantly increased by applying new target state estimation techniques, new guidance laws, and robust autopilot designs to optimize missile trajectories for faster intercept and increased terminal accuracy.

- The goal is a fully integrated guidance and control system which is capable of providing higher single-shot-kill-probabilities for missiles such as AMRAAM. An additional goal is the development of an innovative guidance law to replace the time honored, but limited, "proportional navigation" which was invented in 1948.

- This technology is also applicable to the air-to-surface area.

MAJOR ACCOMPLISHMENTS

- Completed a system requirements flowdown of the Hammerhead program's performance objectives into a functional allocation of SAR seeker and free flight weapon specifications. Began detailed SAR seeker and weapon design modifications. Obtained GBU-15 flight vehicles for future integration with the GPS/INS guidance package and SAR seeker. Obtained GPS/INS guidance package components for preliminary testing. Began procurement of long-lead hardware items to support future SAR seeker fabrication.

- Completed the development of a six-degree-of-freedom-simulation for a SAR-guided GBU-15 weapon to support analysis activities under the Hammerhead program.

- Completed a Test Execution Plan and a draft Method of Test document for initial test planning associated with the Hammerhead program. Established a free flight weapon integration facility and technical support through the 46th Test Wing. Conducted preliminary weapon-to-aircraft compatibility analysis and coordination with the Air Force Seek Eagle Office.

- Completed development and demonstration of the Passive Adjunct Seeker Antenna for AMRAAM. Also completed design/development of Active Conformal Antenna under a Phase II Small Business Innovation Research (SBIR). Participated in adapting our conformal designs to meet antenna requirements for HARM Program Office (PMA-242) and the Advanced Anti-Radiation Guided Missile (AARGM) Program Office.

- Established a consortum between the Armament Directorate and a group of companies to conduct the Parallel Algebraic Logic (PAL) processor program. Under the PAL program the implementation of high speed hardware and high level image algebra software has allowed real time integration and processing of multiple sensor data for target identification. The PAL processor was provided to the Shands Research Hospital for use in a variety of medical applications.

- Downselected to one contractor on the Optical Processor Enhanced LADAR (OPEL) program to fabricate and captive flight test a light-speed optical correlator coupled with a solid state laser radar for target identification in clutter.

- Fabricated and demonstrated large format (512 x 512 pixels) staring imaging IR Multiple Quantum Well (MQW) focal plan arrays which will provide detection of long wave IR not presently possible today.

- Completed a state-of-the-art mobile test-bed called the MMW Analysis of Passive Signatures (MAPS).

- Demonstrated a 512 x 512 radiative element resistor array with a complete drive electronics suite for hardware in the loop simulations. This is the first time a 512 x 512 projection device has ever been driven at the speed (120 Hz) and resolution (14 bits) necessary for high fidelity testing of imaging infrared sensors.

- Delivered a 512 x 512 radiative element resistor array to the 46th Test Wing Guided Weapon Evaluation Facility for installation into their IR hardware-in-the-loop suite.

- Improved the target scene modeling capability of Irma under the Data Analysis and Modeling (DAAM) program. This resulted in the release of Irma 4.0 which has the unique capability to model correlated active and passive imagery in the infrared and millimeter wave wavebands and the development of a user friendly graphical user interface. The DAAM program was completed in FY96 and has been superseded by Multi Sensor Modeling and Analysis (MSMA). MSMA is comprised of three efforts: Modular Algorithm Concepts and Evaluation Tool (MACET), continued Irma refinement and validation, and Solid State LADAR Algorithm Development and Evaluation (SSLADE).

• Developed and exercised statistical and unconventional algorithm development approaches under the MACET environment. The MACET development Version 1.2 for passive IR, LADAR, and MMW channels was completed.

• Developed nonproprietary, government-owned, autonomous target acquisition (ATA) algorithms for solid state laser radar seekers. Greater than 90 percent probability of target classification of mobile targets was demonstrated with the algorithm developed under this in-house, contractor-supported SSLADE effort.

• Provided ten weeks testing in Kinetic Kill Vehicle Hardware-in-the-Loop Simulation (KHILS) facility for the Defense Nuclear Agency on nuclear effects and theater missile defense-type interceptor nuclear mitigation algorithms. Testing uncovered a failure mode due to nuclear effects that was never found with pure digital simulation. A mitigation technique was demonstrated.

• Successfully transitioned the Tri-Service Inertial Measurement Unit (IMU) into the Joint Direct Attack Munition (JDAM). The Fiber Optic Gyro (FOG) IMU program was completed, resulting in a functioning FOGIMU that can fully replace the Tri-Service IMU, with a cost savings of 25 percent per unit without sacrificing performance.

• The Tactical High Antijam GPS Guidance (THAGG) program was completed. THAGG, for the first time, demonstrated rapid direct P(Y)-code GPS satellite acquisition in a heavy jamming environment. Once acquired, THAGG tracks satellites in a multiple jammer environment in excess of 80 dB Jam-to-Signal ratios (J/S).

• Continued Advanced Guidance Law development with the investigation of the nonlinear controls. Tremendous theoretical strides have been made that can lead directly to improved autopilot and estimation algorithms. A method for directly accounting for actuator saturation has been investigated and shows promise.

• Completed anechoic chamber testing of antijam GPS receiver hardware.

• Completed hardware-in-the-loop testing of antimateriel submunition in preparation for flight tests.

• Completed baseline INS/GPS guided munition simulation with full satellite constellation over oblate rotating earth.

CHANGES FROM LAST YEAR

There were no major changes in this Thrust.

MILESTONES

AIR-TO-SURFACE

• MMW Analysis of Passive Signatures (MAPS) test-bed delivered in FY96. Begin data collection and phenomenology investigations to verify analytical models and form baseline for mission specific designs of passive MMW seekers.

• Conduct RASER determinations of exploitable MMW phenomenology for the improvement of smart munition guidance systems in FY96.

• Initiate a program to develop a laser radar brassboard to evaluate new low cost components and algorithms which will provide the next generation, high resolution seekers in FY96.

• Explore active and passive real beam MMW imaging technologies in FY96 and FY97 for application to a covert air-to-surface seeker.

• Contract for Advanced GPS Inertial Navigation Technology (AGINT) program was awarded in FY96. The program will produce a low cost, small, intelligent antijam GPS capability. The preliminary schedule has a breadboard delivered in FY98, a brassboard in FY99, and program completion by FY99.

• Complete development of closed-loop INS/GPS guided munition simulation to include capability to evaluate antijam technology response to all known jammer threats. Support antijam technology flight test program in FY97.

- A wideband passive MMW radiometer array will be delivered in FY97. This will provide a baseline for a cative flight test-worthy design

- Complete study for performance and affordability of advanced IR bolometric sensor in FY97.

- Predict, measure, and validate multidiscriminant IR and LADAR data in FY97.

- Target and background scene sequences will be generated for closed-loop testing of an infrared seeker and will be used to help demonstrate a high fidelity infrared scene projector in FY97.

- The OPEL contractor will assemble the LADAR seeker optical processor and conduct component and system laboratory testing in FY97. Tower tests, consisting of high speed processing of a large data base, will be conducted in FY97. Identification friend/foe (IFF) will be demonstrated under static but high clutter conditions in FY98.

- Demonstrate optical pulse injection for active LADAR scene projection in FY97. Integrate real-time simulation capability along with this projection capability for closed-loop LADAR hardware-in-the-loop testing by FY98.

- In FY97, the contractor will complete the demonstration of the 368 giga-operations per second (GOP) PAL I processor, and the assembly and test of the tera-op PAL II Mesh Connected Computer (MCC) and I/O chip(s) which will be designed, manufactured, and tested in accordance with standard commercial practices. The integrated circuit will be simulated using computer aided engineering tools to verify its design, performance, power requirements, and power dissipation. Prototype MCC and I/O chips and data sheet(s) describing the MCC chips will be completed in FY98. Packaging of the PAL II processor will be completed in FY99.

- In FY97, the MSMA program will increase the speed of operation, and increase the type of target signatures it generates. The Irma model will be upgraded to support the development of multimode air-to-air/air-to-surface munitions and be validated against measured imagery taken in laboratory and real world environments for real-time data analysis and algorithm development in FY98. After successful development of the top level functions and system validation, MACET will be interfaced to a real-time hardware system for demonstration purposes in FY99. SSLADE will develop critical mobile and fixed, high value, target acquisition, and classifier algorithms in FY99.

- Complete flight testing of an INS/GPS jam resistant receiver integrated within flight test vehicle in FY98.

- Deliver LADAR brassboard sensor from DASSL for use with the Small Smart Bomb program in FY98.

- Captive flight testing of the SAR weapon for the Hammerhead program will begin in FY98, followed by free flight demonstrations in FY99.

- Continue development of an even smaller and cheaper replacement for the FOGIMU. A Breadboard will be delivered in FY98, a brassboard in FY99, and completely tested in FY99.

- Demonstrate real time targeting for a SAR seeker using either on-board or off-board sensor information in FY01.

- Complete flight testing of precision guided small smart bomb with integrated seeker and GPS/INS guidance in FY01.

AIR-TO-AIR

- In FY96 apply signature modeling capability from the Irma program and the codes from the Composite, High Altitude, Maneuvering, Post-Boost Vehicle Program to air-to-air scene generation and analysis.

- Integrate conformal antenna design for the next-generation air superiority missile with high speed munition processor in FY97 and captive flight test the seeker in FY98.

- Autopilot development for agile, dual range missiles is expected to improve missile lethality by incorporating advances in automatic controls. Contract is expected to be awarded in FY97, Flight Control System design and simulation development 3Q98, hardware-in-the-loop simulation in FY99, and flight tested in FY00.

- Begin developing and testing affordable, passive, electro-optical/infrared seekers which are sensitive to longwave infrared, multicolor, and polarization signatures to provide improved air-to-air terminal seekers in FY98.

- Begin Multimode Conformal Array Seeker Program using CAST antennas for RF portion in FY98.

USER NEEDS

The focus of this Thrust is to provide affordable, high probability of kill, conventional weapons to the Air Force inventory. The user needs presented below are extracted from Operational Requirements Documents, munitions TPIPT study efforts, the ACC Mission Area Plans for Aerospace Control, Strategic Attack/Interdiction, Close Air Support/Interdiction, Theater Missile Defense, Electronic Combat, and the Air Force Special Operations Command (AFSOC) Weapons System's Roadmap, 2nd Edition.

AIR-TO-SURFACE

Smart Hard Target Munition

- Increased aircraft loadouts through reduced warhead size and compressed carriage
- Smart fuzing to optimize warhead burst point
- Increased mission kill capability and payload flexibility
- Neutralize biological and chemical targets
- Unitary heavy metal penetrating warheads
- Antijam GPS capability

Smart Soft Target Munition

- Insensitive explosives to reduce safety hazard
- Improved height-of-burst determination
- Jam resistant proximity sensor
- Enhanced kill mechanisms for increasing effectiveness of smaller weapons

Small Smart Bomb

- Increased aircraft loadouts through reduced warhead size and compressed carriage
- Smart fuzing to optimize warhead burst point
- Increased mission kill capability and payload
- Force multiplier munitions flexibility

Antimateriel Munition

- Multimode warhead effective against a broad spectrum of materiel targets
- Insensitive explosive for submunitions
- Reduced cost per kill and increased kills per aircraft sortie

AIR-TO-AIR

Dual Range Missile

- Improved warhead burst point control
- Enhanced lethality warheads
- Fuzing for low observable threats
- Guidance integrated fuzing
- Increased maneuverability, performance, and aircraft loadouts

See Figure 6 for major Thrust efforts.

GOALS

AIR-TO-SURFACE

Figure 7. Penetration Test on Hardened Aircraft Shelter

For Smart Hard Target Munition options, we develop ordnance capable of penetrating complex hard targets such as heavily hardened command and control bunkers, aircraft shelters (Figure 7), runways, and concrete buildings. We also develop smart fuzing technology with layer counting, depth of burial, void sensing, and programmable time delay capabilities. To improve weapon accuracy and performance, we use low cost inertial guidance and optimized impact conditions through trajectory shaping and the use of reaction control systems so that the weapon and weapon velocity are orthogonal to the target plane at impact for better penetration.

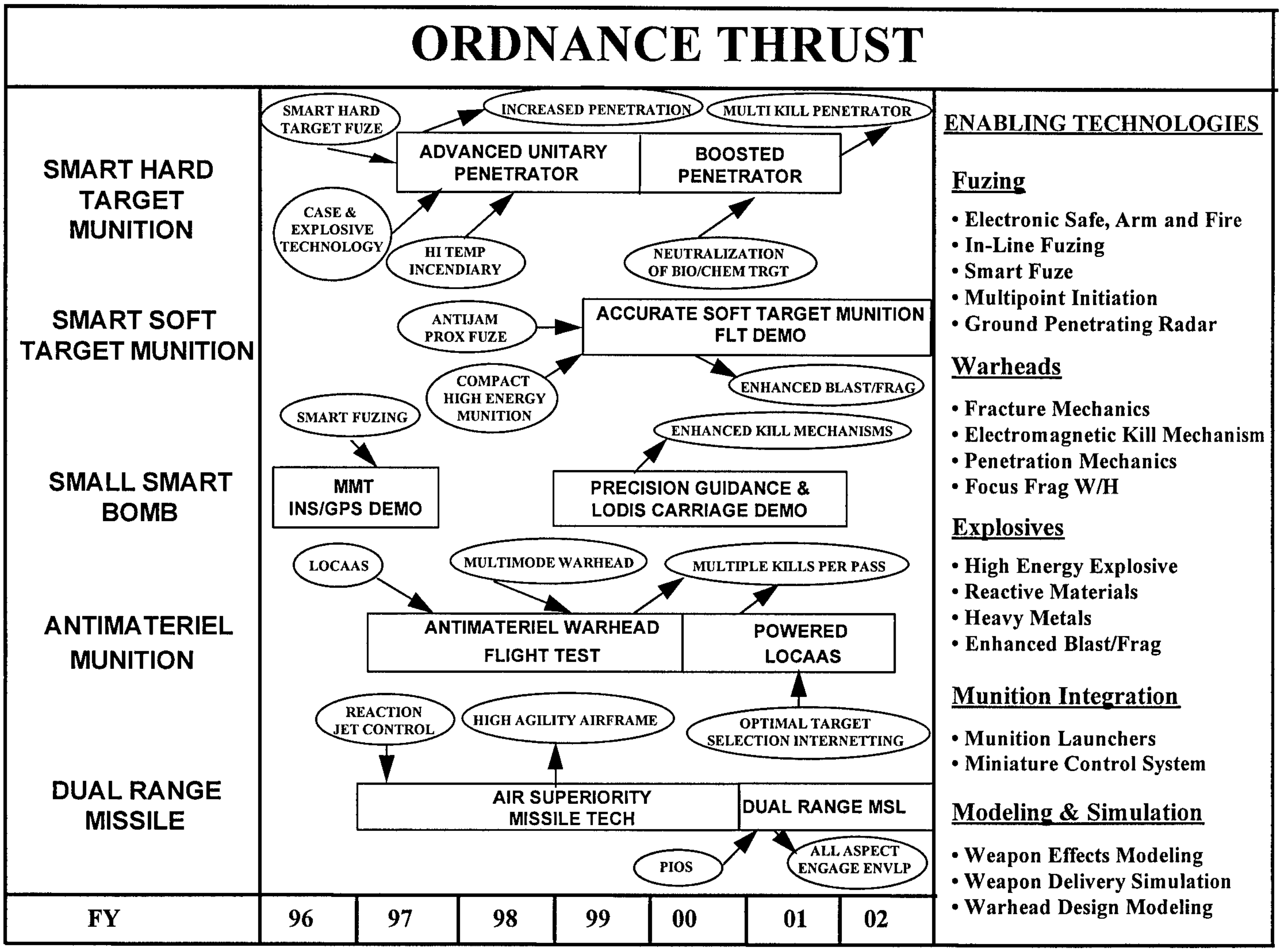


Figure 6. Thrust No. 2 Ordnance

Warhead case and hard target fuzing technologies are emphasized to reduce cost, improve productivity, and increase reliability of penetrator munitions.

For a given impact velocity, the penetration capability decreases with the decreasing size and weight of the penetrator. However, the number of weapons that a platform can carry increases with the decrease in penetrator weight. Extensive trade studies based upon cost and effectiveness indicate that a two-pronged approach is best: a high payoff, deep penetration capability and an increased force multiplier capability (carriage of more weapons).

- Develop velocity augmented warhead technology which can accelerate warheads for deep penetration, but at sizes and weights which can be carried on a variety of attack aircraft. The ordnance package would be an option for a replacement for the gravity drop BLU-109 warhead presently planned for JDAM.

- Develop options for heavy metal penetrating warheads. The payoff would be improved penetration over the present steel case designs (more weight per cross section) for both gravity and velocity augmented concepts.

Operational effectiveness is degraded when using fixed time delay fuzing because accurate intelligence data on the design and construction of all hard targets is lacking. A layer counting fuze with a void sensing capability only requires general construction data about a target to be optimally effective.

- Develop a smart fuze with void sensing and layer counting capability to provide accurate warhead burst point control for complex hard targets. The fuze will count floor layers and detonate the warhead in a predetermined void (room).

- Develop ground penetrating radar fuzes for interrogating buried targets prior to weapon impact. This interrogation will allow the selection of an optimum penetration depth in real-time. This will in turn increase the weapons effectiveness; therefore lowering the number of sorties and minimizing the overall cost to the warfighter.

•

Current and developmental air-to-surface weapons are typically right circular cylinders with large aerosurfaces and control fins that steer the weapon to the target. These weapons require large areas/volumes for aircraft carriage and have large incarriage drag and signature. This type of control system provides limited maneuverability for optimum penetrator impact conditions. Reaction jet control technology coupled with an on-board inertial measurement unit and improved guidance laws reduce attack angles, thus optimizing the impact angle which significantly improves the weapon performance and effectiveness.

- Develop weapons which can be carried conformally or internally with minimum stowage volume. Implement control systems with minimum span aerosurfaces or reaction jet controls which provide additional reductions to weapon size. Resulting systems will be compatible with external carriage on current aircraft and internal carriage on future advanced fighter aircraft.

- Develop detailed six-degree-of-freedom simulations to predict/optimize flyout and terminal performance of munitions with advanced aerodynamic control technology and conformal shapes.

Penetrator design requires a thick walled warhead case for increasing penetration and ensuring warhead survivability during the penetration event. This thick wall requirement results in low volumes for explosive fills; which, in turn, drives a requirement for higher energy density explosives and new target defeat mechanisms. These advanced target defeat mechanisms can be used individually or combined to provide the effectiveness needed. Target defeat technologies are being developed to defeat large hardened targets such as command, control, and communication facilities and biological and chemical weapon facilities.

- Develop revolutionary explosive fills for penetrator warheads. High density fills with enhanced energy density will provide increased warhead penetration while providing enhanced lethality. This technology would increase the effectiveness of the smaller warhead options for JDAM product improvement.

- Develop electromagnetic energy weapon payloads which provide wide area mission kills against targets that rely upon computers, communication, and power systems. Methods for effectively coupling energy from the weapon into the target will be investigated.

- Develop warhead payloads for defeating/ neutralizing weapons of mass destruction. Investigation of explosives, catalysts, and high temperature incendiaries as effective kill mechanisms will be accomplished.

- Develop innovative kill mechanisms that will neutralize or deny access to biological and chemical agents in hardened storage or production facilities.

- Develop the Modular Effectiveness/Vulnerability Assessment (MEVA) modeling and simulation methodology to perform effectiveness analyses of conceptual munitions employed against hardened targets. MEVA payoffs include optimized component technologies, robust system designs, and reduced experimentation requirements.

Battle damage assessment for hard buried targets is very difficult. Visual inspection of the target area usually provides little, if any, information on the weapon's effectiveness against the target. **Providing real-time data to airborne assets would maximize sortie effectiveness.**

- Develop miniature weapon borne sensor packages for penetrating warheads that will enable the transmission of battle damage information from inside the buried target.

Smart Soft Target Munitions (general purpose bombs) use proximity sensors to increase blast and fragmentation effects on soft targets. These sensors are expensive, bulky, and susceptible to electronic countermeasures (ECM) and jamming. Because they currently perform only the sensing function, the present bombs are required to carry a supporting initiation fuze which adds to the associated build-up costs of the bomb.

- Develop and demonstrate solid-state electronics and an ECM hardened proximity sensor for product improvement for the Joint Programmable Fuze.

- Develop monolithic microwave integrated circuits (MMIC) and wideband radar technology while lowering the cost and improving the reliability and supportability of proximity sensors.

- Incorporate all sensing and fuzing functions into a single soft target smart fuze.

- Develop digital signal processing to reduce sensor susceptibility to ECM jamming.

Aircraft costs are directly related to aircraft weight, thus a continuing emphasis is reduction in size and weight of the total weapon system (aircraft, suspension and release equipment, and armament). Kill mechanisms for delivering more energy on the target or more effectively coupling energy into the target are being explored. These technologies provide the opportunity to reduce the weapon size and weight while maintaining the effectiveness currently available in larger munitions. Smaller, highly effective weapons result in reduced aircraft stowage volumes/areas and thus reduced aircraft size, weight, and costs.

- Develop and demonstrate innovative warhead, initiation, and explosive technologies for enhancing the effectiveness of 1000-lb class general purpose bombs so that their effectiveness is equivalent to the MK-84 2000-lb general purpose bomb.

- Develop carriage and release technology to reduce supportability costs through advanced energy sources which replace pyrotechnic devices. This technology will allow increases in flexibility of weapon loadouts, accommodating a wide range of weapon types.

- Develop innovative kill mechanisms which couple explosive and electrical energies to enhance the destructive power delivered to the target. Investigate capabilities obtainable from simultaneously applying multiple kill phenomenology to targets.

- Develop analysis and simulation capability for predicting the effects of novel kill mechanisms employed against a range of fixed soft targets including military headquarters buildings and high-value industrial sites.

- Perform comprehensive effectiveness trade studies for a wide range of aircraft and targets to determine goals for munition size/loadout and kill performance.

The most widely used form of airborne and ground test data is photography obtained with high speed film cameras. Computer processed metric analysis of high speed film is a standard data gathering technique. Film test data suffer many shortcomings, not the least of which is that film processing takes days and data quality is not known until that time. Weapon test programs are impeded by film processing delays. Film processing chemicals are also an environmental hazard and present severe operational restrictions.

- Develop high resolution, high speed electronic imaging systems which can replace high speed film camera systems and provide test data in real time. Both airborne and ground applications are being pursued. Payoff will be "film quality" image data that will be available to test and project personnel during the actual conduct of the test. Data quality will be immediately known and scarce test resources can be optimized in real time. Operational uses such as reconnaissance and strike battle damage assessment are immediate spin-offs of this technology. Elimination of wet-chemical film processing completely solves the associated environmental problems and improves field deployability.

- Develop ultra-high speed, 1 million frames per second electronic imaging technology for measuring short duration transient phenomenon. The combination of pulsed laser illumination with this technology will offer completely new capabilities for studying warhead initiation and detonation physics.

Future fighters, such as the Advanced Tactical Fighter and the Joint Strike Fighter, demand that the weapon payload size and weight be reduced. The Small Smart Bomb (SSB) family of weapons will provide weapons which combine precision guidance with enhanced burst point control and enhanced energy explosive fills to defeat targets currently requiring much larger warheads. These technologies will reduce weapon cost while increasing aircraft loadouts and reducing sortie requirements.

- Develop inertial aided small bomb technologies for hard targets which would provide multiple carriage per aircraft station and defeat multiple targets on a single sortie. Technologies required are low cost inertial guidance and second generation Smart Fuzing (autonomous decision making rather than preprogrammed).

- Develop smart fuzing technology for 250-lb class weapons. Effective fuzing against thin layered structures as well as hardened targets consisting of up to 6 feet of reinforced concrete is required.

- Develop miniature munitions which integrate advanced ordnance technologies developed under the Smart Hard Target Munition and Smart Soft Target Munition areas to provide a family of weapons with increased loadouts and sortie effectiveness. For the first generation of small munitions, develop a 250-lb warhead capable of penetrating 6 feet of concrete and defeating 85 percent of the BLU-109 target set. This first demonstration will utilize a GPS/INS guidance system. Demonstrate an integrated terminal seeker version of the miniature munition with precision guidance and technologies for enhancing warhead effectiveness against soft targets.

- Utilize MEVA simulation methodology to conduct a multivariate trade study of the Small Smart Bomb point design, optimizing guidance, penetration, fuzing, and blast/fragment lethality requirements.

- Evaluate SSB concept terminal flyout performance and effectiveness via detailed simulation and analysis to include investigation of such issues as seeker and GPS trade-offs and guidance law operation.

- Develop simulation models to represent the SSB and associated technologies.

The effectiveness of advanced munitions is, in large measure, dependent upon warhead design, where the development trend is toward much smaller explosive fills, coupled with multimode, aimable operation. Improved warhead effects instrumentation must be available to support development of new warhead designs. Current warhead effects instrumentation is too costly and does not have sufficient bandwidth to support intra-warhead data acquisition. Warhead fragment pattern analysis is difficult, with the primary data source, high speed X-ray, providing only orthogonal views of the event. Present explosive temperature measurement techniques are inaccurate.

• Develop low cost, wideband blast instrumentation to support weapons research activities. This includes the development of both sensors and their support equipment.

• Develop real-time holographic warhead fragment pattern characterization that will ultimately yield increased warhead lethality through improved understanding of the warhead fragmentation process.

• Develop spectrographic methods to accurately measure explosives reaction temperatures. Accurate temperature data is required to validate and improve warhead computer models which are used to develop new munition concepts.

Real-time telemetry from developmental weapons is essential for ascertaining whether the system and subsystems function properly under realistic flight conditions. Current telemetry systems are too large to allow instrumentation of smaller munitions and submunitions. Even where size is not prohibitive, high telemetry system costs limits instrumented tests to only a few items.

• Develop weapon effectiveness telemetry by combining subminiature telemetry and smart fuze technologies. Payoff will be indication of proper weapon positioning and fuze function.

Strategic attack, interdiction, and close air support will continue to be primary missions for advanced tactical aircraft. Targets include enemy air defenses, tactical ballistic missile sites, and the whole range of ground mobile targets such as those included in a motorized rifle battalion. To meet the user's need for defeating a broad spectrum of antimateriel targets, the multimode warhead with enhanced lethality will be developed and integrated with the Antimateriel Munition. The large number of targets and limited aircraft carriage capability require a cluster munition approach to defeat dispersed ground targets.

Until recently, different warheads had to be fielded to get the optimum lethality for each different class of target. Armament Directorate in-house development has demonstrated the feasibility of a single warhead being initiated in any one of the three modes (long penetrating rod, explosively formed aerostable penetrator, or fragmentation). This technology breakthrough enables one submunition to be lethal against the wide spectrum of materiel targets.

Concurrently with the multimode warhead, the Advanced Guidance Thrust has developed an affordable diode pumped laser radar seeker which can classify, in real time, targets such as tanks, trucks, relocatable missile launchers, or radar sites. This seeker and a maneuvering submunition airframe have matured in the Low Cost Autonomous Attack Submunition (LOCAAS) program. The Antimateriel Munition of the future is envisioned as a second generation smart submunition that will combine autonomous target classification with significantly increased area coverage with a selectable multimode warhead. Detailed cost projections verified by independent government cost analysis indicate these submunitions could be built in large quantities for under $20K each. Joint service use of these effective munitions against ground, mobile targets requires them to be carried safely on Navy ships with Navy insensitive munition requirements.

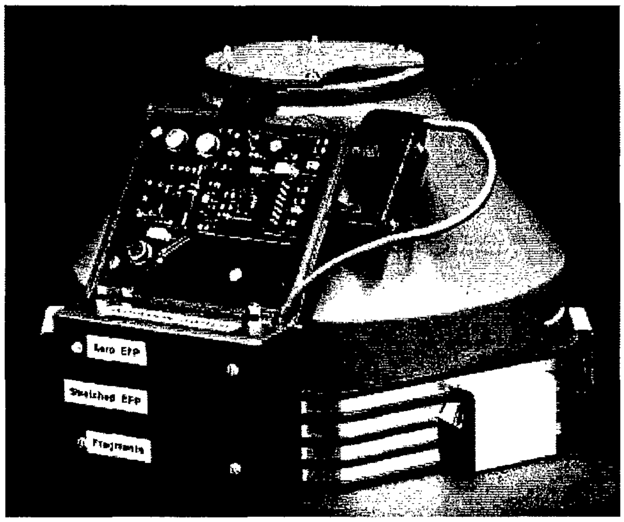


Figure 8. Antimateriel Submunition Warhead (8.5 inch diameter, 6 inches high)

• Continue advancement of multimode warhead technology which can be selectively fired as a penetrating jet, aerostable slug, or multiple fragments. This will provide technology options for next generation antimateriel submunitions. The Antimateriel Submunition Warhead is shown in Figure 8.

Current antimateriel submunitions are limited in their area coverage and search patterns. They also have limited lethality against the broad spectrum of

antimateriel targets which includes armored vehicles, trucks, and missile sites.

- Develop high density carriage and dispensing technology to allow large increase in aircraft loadout of antimateriel submunitions.

- Continue development of low cost antimateriel submunitions which provide significantly lower cost per kills than existing submunitions.

- Develop technologies for incorporating multiple kill methods into a single antimateriel submunition thus providing improved cost per kill. Potential mechanisms include conventional, explosively projected fragments and projectiles, conductivity of high energy currents, and transmission of high powered electromagnetic pulses.

- Analytically assess the effectiveness of current multimode warhead design against varied target sets. The results will highlight design requirements for next generation antimateriel submunitions employing multiple kill mechanisms.

- Refine LOCAAS flyout simulation for improved performance prediction to optimize warhead standoff parameters and munition software which determines warhead burst position.

In order to maximize the number of kills per sortie, multiple kills of the same target must be avoided. Multiple autonomous munitions must have a method of coordinating an attack.

- Develop telemetry technology which will enable effective networking of multiple submunitions to maximize the number of kills per sortie.

AIR-TO-AIR

Enhancement of air-to-air ordnance package performance requires that the target detection device and warhead burst point calculations use all information available to the missile. Effective coupling of the warhead energy onto the target requires improvements in directing the kill mechanism so that as much of the kill mechanism as possible interacts with the target. Data from the missile seeker can be used to project the encounter geometry and velocity. Further enhancement of the burst point control algorithms requires that the volume viewed by the target detection device be expanded to cover as much of missile forward hemisphere as possible. Reductions in target signatures require that the fuze be capable of detecting low observable targets.

- Develop guidance integrated fuzing systems which accurately predict the relative target encounter conditions using all available data from the seeker and guidance systems.

- Develop an imaging seeker/fuze sensor which covers the forward hemisphere and provides missile/target encounter geometry refinement and a preferred target aimpoint for enhancing warhead burst point calculations and improving warhead effectiveness.

- Develop mass focusing warheads which direct the fragment and blast patterns so that the majority of the warhead energy is coupled into the target.

- Develop fuze sensors which have greater detection ranges against low observable targets in weather.

Improvements in enemy aircraft technology and the proliferation of advanced aircraft have resulted in nations possessing fighter aircraft nearly equal to our own. The weapons suite for these aircraft is in some areas (e.g., aerodynamics) superior to our current systems. Technologies such as reaction jets will eliminate the need for missile fins, providing compressed missile carriage which will double missile loadouts for a given carriage volume. This technology should be developed with the goal of supporting future product improvements to the AIM-9 Sidewinder and AIM-120 AMRAAM systems. Additionally, the munition control system technologies of the thrust are also applicable to the air-to-surface weapon systems.

- Develop technologies for increasing missile maneuverability and high off-boresight launch capabilities. These technologies will provide increased first shot opportunities and minimize the time required for missile launch and destruction of the enemy aircraft.

- Develop advanced, low cost, supportable, munition control system technologies which provide decreased missile flight times, high off-boresight, and high angle-of-attack launch capabilities.

- Develop evaluation methods for dual range missile concept terminal flyout performance and effectiveness via simulation and analysis to include investigation of such concepts as guidance integrated fuzing, advanced fuze sensors, and advanced guidance and control technologies.

MAJOR ACCOMPLISHMENTS

AIR-TO-SURFACE

- Completed Nonnuclear Munition Safety Board qualification of Hard Target Smart Fuze with void sensing capability for hard target weapons. Accomplished GBU-27 and GBU-28 Hard Target Smart Fuze flight tests against hardened underground targets and procured 40 units for testing and deployment in contingency operations.

- Completed large scale aerosol tests of agent defeat kill mechanism for neutralizing biological weapons.

- Completed design and test of hard target smart fuze for the miniature munition technology demonstration.

- Demonstrated penetration of 4 feet of concrete with miniature munition technology demonstrator.

- Accomplished full scale testing of advanced high density penetrator explosive fills for penetrator warheads.

- Completed vulnerability and lethality test with small warhead package for miniature munition technology demonstration.

- Continued scale tests of agent defeat neutralization payloads against chemical weapon agents.

- Completed integration of warhead and fireset for multimode antimateriel warhead brassboard.

- Completed wind tunnel testing for Miniature Munition Technology demonstration.

- Completed lethality assessment of Small Smart Bomb point design against in-theater targets including hardened aircraft bunkers and surface-to-air missile sites.

- Completed preliminary internal dispersion methodology for assessing defeat of weapons of mass destruction facilities.

- Accomplished full scale tunnel vulnerability experiments in conjunction with other DoD services and international allies.

- Developed methodology for assessment of conceptual munition effectiveness against extremely hardened tunnel facilities.

- Completed LOCAAS simulation development to reflect the current technology configuration; validated the simulation against actual flight tests.

- Completed development of a baseline MMT six-degree-of-freedom (6-DOF) simulation.

- Developed 512 X 512 pixel, 1000 frame per second charge coupled device (CCD) electronic imager. It will be transitioned to a joint Navy/Air Force Airborne Separation Video EMD program for use as the video sensor in the airborne video camera.

AIR-TO-AIR

- Completed testing of jet reaction control device for air-to-air missiles.

- Completed development of a baseline Dual Range Air-to-Air Missile six-degree-of-freedom (6-DOF) simulation.

- Produced ballistic holograms up to 18 inches in diameter using in-house laboratory facility. Conducted successful initial experimentation to develop remote holographic camera for use in warhead arena testing.
- Transitioned Noncooperative Vector Scoring technology to ASC/VXA. Program office selected this technology for the Air Force Interim Vector Scorer EMD program. Over 400 units will be built and used for flight operations over the next 3 years.

- Developed spectro-radiometer instrument to simultaneously measure spatial and spectral infrared target signatures. Transitioned technology to AFDTC and AEDC.

CHANGES FROM LAST YEAR

Received funding for heavy walled penetrator design, development, and testing from the OSD Counter Proliferation Initiative program managed by the Defense Nuclear Agency. A portion of the Armament Directorate work in the agent defeat area is being funded by the OSD and feeds an FY98 technology demonstration for the defeat of biological and chemical targets.

Starting in FY97 the Instrumentation Technology Thrust (Thrust 3 in FY96 TAP) has been deleted. Instrumentation Technology research has been incorporated into the Ordnance Thrust.

MILESTONES

AIR-TO-SURFACE

- Complete flight test demonstration of a 2000-lb advanced unitary penetrator warhead which provides greater than twice current warhead penetration capability in FY97.

- Complete parametric assessment of 2000-lb advanced unitary penetrator against hardened target set to optimize kill effectiveness while maximizing penetration requirements in FY97.

- Flight test the Battle Damage Assessment Telemeter in FY97.

- Demonstrate explosive recycling technologies which provide low cost recycling of military weapon explosives with environmentally safe end products in FY97.
- Complete development of a lethality/vulnerability methodology for assessing the defeat of the ground-fixed soft target spectrum. Validate methodology through full scale testing in FY97.

- Deliver final version of 1000 and 12,000 frame per second High Speed Charge Coupled Device Imagers to support Ultra-high Speed Multiframe Electronic Camera development in FY97.

- Demonstrate 250-lb force multiplier warhead compatibility with multiple weapon carriage on a single aircraft station in FY97.

- Complete simulation studies to investigate seeker and GPS trade-offs in FY97.

- Demonstrate initial Energetic Material Pyrometry instrument design through in-house experiments in FY97.

- Demonstrate lethality of the multimode warhead against ground mobile and relocatable targets in FY97.

- Demonstrate Submunition Video Sensor in Antimateriel Munition flight test vehicle in FY97.

- Flight test Multiple Munition Telemetry Demodulator and transition to AFDTC in FY97.

- Develop technology for a 2250-lb munition with velocity augmentation and physical compatibility with the F-16, F-15, F-117, F-18, and B-1 by FY97-FY01.

- Demonstrate 2250-lb and 1000-lb warhead technology compatibility with inertial and precision guidance and develop flight control algorithms to ensure small angle-of-attack at impact in FY98.

- Complete ground test of advanced weapon carriage and release equipment for application to JAST and other aircraft in FY98.

- Demonstrate brassboard ground penetrating radar system for hard target penetrator fuzing in FY99.

- Complete development and sled track demonstration of 1000-lb class tungsten alloy case penetrator warhead. Penetration goal is three times the penetration of current system in FY99.

- Integrate the full capability to model enhanced energetics into the MEVA methodology for high confidence assessments of the defeat of the hard targets spectrum in FY99.

- Demonstrate countermeasure resistance proximity fuze for general purpose bombs. Demonstrate improved altitude resolution and high resolution height of burst capability in FY99.

- Demonstrate, through full scale tests, technologies for enhancing lethality of 1000-lb class general purpose bomb. Synergistic integration of warhead design and explosive enhancements will provide performance equivalent to 2000-lb general purpose bomb in FY99.

- Analytically assess the enhanced lethality of the 1000-lb advanced general purpose munition employing optimized kill mechanisms. Parametrically assess performance versus 2000-lb munition across entire soft target spectrum in FY99.

- Perform component integration and live fire flight testing of an all-up antimateriel submunition effective against all mobile ground targets in FY99.

- Configure detailed simulation to represent flight test vehicle and reduce test risk through preflight analysis in FY00.

- Flight demonstrate Multi-Munition Transceiver Techniques in FY00.

- Demonstrate Multi-Frame Holocamera through Warhead Arena experiments in FY01.

- Flight demonstrate high density packaging and dispense technologies for carriage and release of antimateriel submunitions in FY01.

- Completed development of a baseline Dual Range Air-to-Air Missile six-degree-of-freedom (6-DOF) simulation capable of performing concept trade-off studies to include flyout and effectiveness evaluation.

AIR-TO-AIR

- Complete simulation studies to investigate optimal concept formulation in FY97.

- Complete development of flight control software for highly maneuverable, missile incorporating, hybrid reaction jet/aerodynamic flight controls in FY98.

- Complete testing of imaging target detection device and electronic safe, arm, and fire device in FY00.

- Complete flight testing of reaction jet control system for missile agility and performance improved for short and medium range in FY00.

- Complete flight testing of air superiority missile technology providing short and medium range capability in FY01.

GLOSSARY

A/C	Aircraft
ACC	Air Combat Command
ADV	Advanced
AFAE	Air Force Acquisition Executive
AFB	Air Force Base
AFDTC	Air Force Development Test Center
AFOSR	Air Force Office of Scientific Research
AFSOC	Air Force Special Operations Command
AGM	Air-to-Ground Missile
AGRF	Advanced Guidance Research Facility
AIM	Air Intercept Missile
AMRAAM	Advanced Medium Range Air-to-Air Missile
ARPA	Advanced Research Project Office
A-S	Air-to-Surface
BLU	Bomb Live Unit
BMDO	Ballistic Missile Defense Organization
CCD	Charge Coupled Device
CEP	Circular Error Probable
DoD	Department of Defense
DEMO	Demonstration
DEV	Development
E-O	Electro-optical
ECM	Electronic Countermeasure
EMD	Engineering Manufacturing Development
FY	Fiscal Year
GBU	Guided Bomb Unit
GPS	Global Positioning System
HIPRA	High Speed Digital Processor Architecture
IMU	Inertial Measurement Unit
IR	Infrared
IRMA	Infrared Modeling and Analysis
IPT	Integrated Product Team
JAST	Joint Advanced Strike Technology
JDAM	Joint Direct Attack Munition
JSOW	Joint Standoff Weapon
LADAR	Laser Radar
lb	pound
LOCAAS	Low Cost Anti-Materiel Submunition
MACET	Modular Algorithm Concept Evaluation Tool
MAP	Mission Area Plan
MMIC	Monolithic Microwave Integrated Circuits
mm	Millimeter
MMW	Millimeter Wave
MRMS	MMW Reflectivity Measurement System
MSMA	Multi Sensor Modeling & Analysis
MUN	Munition
NASP	National Aerospace Plane
NAV	Navigation
OSD	Office Secretary of Defense
PE	Program Element
P^3I; P3I	Preplanned Product Improvement
PIP	Product Improvement Program
RASER	Research and Seeker Emulation Radar
RF	Radio Frequency
S&T	Science and Technology
SADARM	Search and Destroy Armor Munition
SAR	Synthetic Aperture Radar
SCUD	Short Range Ballistic Missile
SEEK EAGLE	Aircraft/Weapon Certification Program
SFW	Sensor Fuzed Weapon
STAG	Smart Tactical Autonomous Guidance
SPO	System Program Office
SUBMIN	Subminiature
SUBMUN	Submunition
TAP	Technology Area Plan
TDP Data	Time Space-Position-Informaiton Processor
TIPP	Test Instrument Planning and Programming
TEO	Techology Executive Officer
TM	Telemetry

TPIPT	Technology Planning Integrated Product Team
TSPI	Time-Space-Position-Information
UAV	Unmaned Air Vehicle
WPN	Weapon

Technology Master Process Overview

Part of the Air Force Materiel Command's (AFMC) mission deals with maintaining technological superiority for the United States Air Force by:

- Discovering and developing leading edge technologies
- Transitioning mature technologies to system developers and maintainers
- Inserting fully developed technologies into our weapon systems and supporting infrastructure, and
- Transferring dual-use technologies to improve economic competitiveness

To ensure this mission is effectively accomplished in a disciplined, structured manner, AFMC has implemented the **Technology Master Process** (TMP). The TMP is AFMC's vehicle for planning and executing an end-to-end technology program on an annual basis.

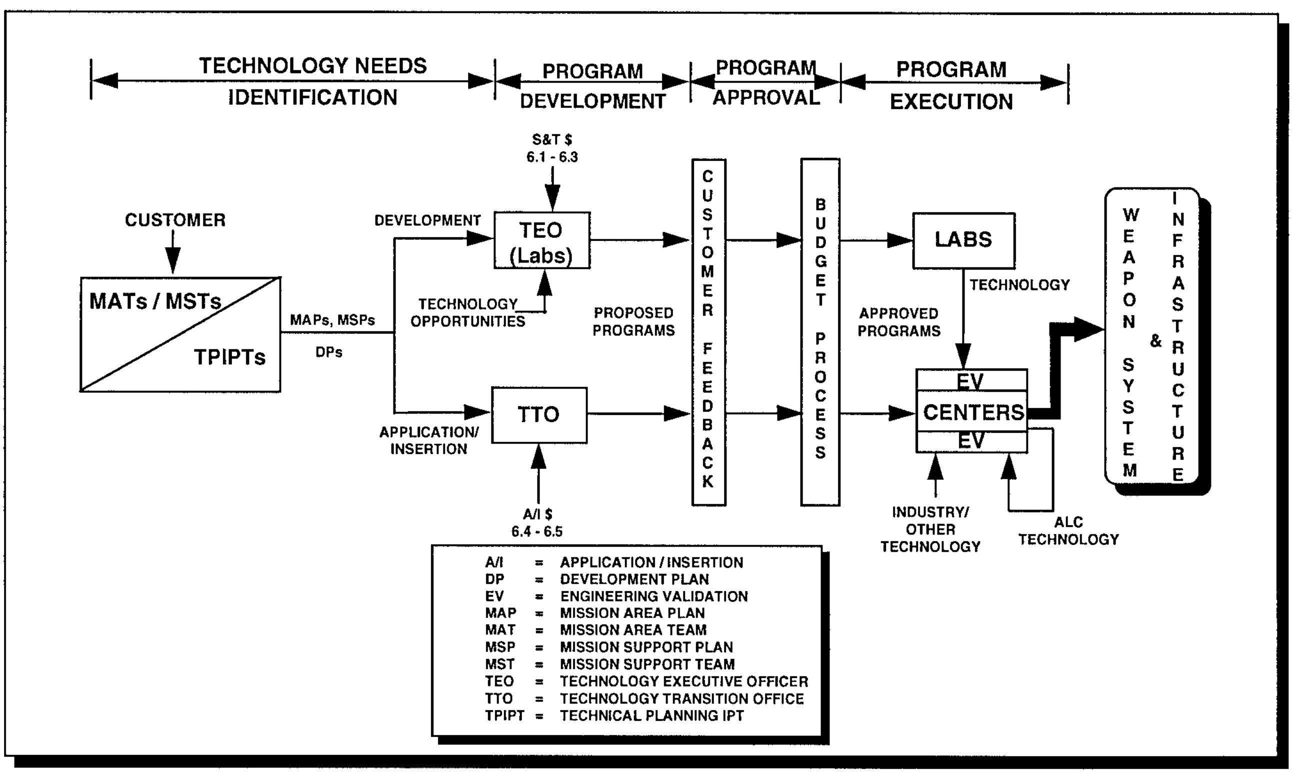


Figure 1 - Technology Master Process

The TMP has four distinct phases, as shown in Figure 1:

- Phase 1, **Technology Needs Identification** -- Collects customer-provided and customer-prioritized technology needs associated with both weapon systems, product groups and supporting infrastructure; then identify them by the need to develop new technology or apply/insert emerging or existing technology. These needs are derived in a strategies-to-task framework via the user-driven Modernization Planning Process.

- Phase 2, **Program Development** -- Formulates a portfolio of dollar constrained projects to meet customer-identified needs from Phase 1. The Technology Executive Officer (TEO), with the laboratories, develops a set of projects for those needs requiring development of new technology, while the Technology Transition Office (TTO) orchestrates the development of a project portfolio for those needs which can be met by the application/insertion of emerging or existing technology.

- Phase 3, **Program Approval** -- Reviews the proposed project portfolio with the customer and obtains approval for the portfolio through the budgeting process. The output of Phase 3 is the authorizations and appropriations required, by the laboratories and application/insertion programs, to execute their technology projects

- Phase 4, **Program Execution** -- Executes the approved S&T program and technology application/insertion program within the constraints of the Congressional budget and budget direction from higher headquarters. The products of Phase 4 are validated technologies that satisfy customer weapon system and infrastructure deficiencies.

Additional Information

Additional information on the Technology Master Process is available from HQ AFMC/STR, DSN 787-6777/8764, (513)257-6777/8764.

INDEX