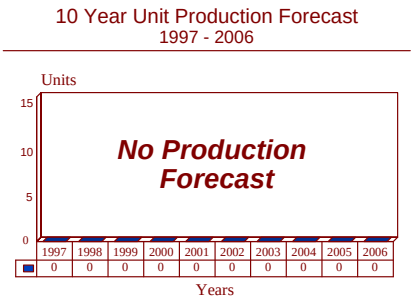
BMD Communications Technology - Archived 11/97

Outlook

- Communications technology support activity
- Program canceled
- Activity distributed among other programs/systems



Orientation

Description. This effort supported the Ballistic Missile Defense (BMD) program (formerly known as Strategic Defense System or SDS prior to May 1993) communications engineering technology requirements.

Sponsor

Ballistic Missile Defense Organization
(formerly Strategic Defense Initiative Organization)
Washington, DC USA

Contractors

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Status. Having reached the demonstration and validation stage, this project was terminated at the end of FY95. Efforts within the project were transferred to related programs for continued development.

Total Produced. Not applicable, as this was a technology support program.

Application. The focus of this project was on developing communications technology to support systems to be deployed after the turn of the century.

Price Range. Not applicable.

Technical Data

Design Features. The BMD emphasis has shifted from focusing on countering the former Soviet threat, to one that counters potential ballistic missile attacks from the increasing number of nations that have such a capability, or are in the process of acquiring such technology (either from other sources or from internal development).

PE #0603217C, Project 1405 - Communications Engineering Technology: This project focused on developing communications technology to support operational requirements for defensive systems. It also developed communications components, both radio frequency (RF) and laser communications, for space-to-space, space-to-ground, and ground-to-space links. Efforts to define requirements for space qualifications and radiation hardness of extremely high-frequency (EHF) components, needed for robust communications, were included.

Variants/Upgrades

This program supported upgrades by providing new technology, but due to its classified nature, very little specific information has been available.

Program Review

Background. Project 1405 Communications Engineering Technology developed the communications technology, devices, and subsystems for several alternative BMD architectures. As such, this effort pursued communications system planning and design, communications protocols, candidate communications network architecture, critical communications technologies and demonstration of survivable dynamic communications networks.

Communication networks have been considered integral to the BMD and are embedded in virtually every aspect of BMD capability. Communications network planning and design for BMD was heavily influenced by the requirement for the most stringent survivability measures. Objectives of the communications research tasks were to define communications network and technology requirements, to develop candidate network architectures to satisfy perceived system requirements, and to test network robustness and technology solutions in simulated threat environments. Research was aimed at providing high confidence for making programmatic decisions necessary to realize future communications networks for ballistic-missile defense.

Hardware requirements were formulated and analyzed in FY84-FY86 for the wide-band and narrow-band links needed to support the inter-netted communications system. Work was pursued on component technology needed to support 60 GHz radio frequency and laser communications links.

A number of contracts were awarded in FY90 for development of: a 40 watt traveling wave tube amplifier (TWTA); an adaptive spatial processor and communications testbed; an adaptive link reconfiguration, communication system simulator, and waveform impact assessment; a Master Oscillator Power amplifier (MOPA) High Power Laser Diode array; and a 60 GHz solid state amplifier. Several other applications were also completed and delivered including: surface-emitting phased array laser with increased power output; an independently tested high power laser diode; liquid crystal beam steerer; the multi-channel optical communication/tracking receiver Proof of Concept system; a high power amplifier evaluator; and a 1000 watt 44 GHz TWT.

FY91 produced significant accomplishments that included: testing 60 GHz power amplifier devices for incorporation into a solid state power amplifier; completing one section of the 60 GHz Phased Array Subarray; and demonstrating the 60 GHz radiation hardened transmitter/receiver pair. The liquid crystal beam steerer/beam spoiler was tested and delivered. The X-Y coupled laser diode array was tested and the first copy of the high power MAG-MOPA diode delivered. Work was begun on the Government RF and laser communication test facilities at Rome Laboratory, Griffiss AFB. The communications system simulator, adaptive link reconfiguration software, and waveform impact evaluation was completed and delivered. Two contracts were also awarded, one for an integrated EHF transceiver

in conjunction with DARPA/Us Army Labcom, and another for an open loop lasercom system, including laser sources, laser receivers, and laser beam formation/control technologies.

Scheduled work for FY92 included: demonstrating the 60 GHz Phase Array Subarray, the radiation hardened 60 GHz transmitter and receiver in rigorous radiation tests, the reliability of 60 GHz power amplifier devices, and completing the 60 GHz synthesizer program; initiating development of the 20/44 GHz Phased Array for GPALS ground station; developing a digitally programmable modem to implement waveforms and interoperate with existing military communications systems; completing the lightweight LIDAR/Communications dual mode laser breadboard and high power broad area MOPA diode; and delivering the liquid crystal lens and open loop lasercom receiver components.

The following was accomplished during FY93: delivery of a 3-Watt 60 GHz Solid State Power Amplifier, integrated EHF transceiver brassboard, and a radiation hardened CCD design rules and Acousto-Optic beam steerer; integration was completed on a radiation hardened 60 GHz transceiver and tested for radiation survivability, along with a demonstration of a 1 watt power and 1 GHz modulation of a MAG-MOPA laser diode; completion of the advanced adaptive networking development, seeker data compression breadboard, design of miniature high data rate telemetry system for KKV testing, programmable digital modem preliminary development module design, code Division Multiple Access (CDMA) Receiver, an 8x6 APD Array, Liquid Crystal Device Prototypes, and an Acousto-Optic Beam Steerer; and initiated work on design of 60 GHz communications flight test package, 60 GHz aperture Program, 20/44 GHz GEP antenna design, and software design to support 20/44 GEP antenna design.

By the end of FY94, scheduled work focused on: completing the second integrated 20/44/60 GHz transceiver breadboard; completion and delivery of the miniaturized telemetry breadboard for high data rate seeker applications; delivery of the programmable digital modem preliminary development module; completion of life testing of 60 GHz MMIC power amplifiers; completion and delivery of a miniature high data rate telemetry system for KKV testing; continuing radiation testing of radiation hardened 60 GHz transceiver; and continuing the Rome Laboratory direct support of contracts.

Project Canceled. This project was terminated at the end of FY95. At that time, all accomplishments and work in progress within this project were transferred to various other programs (unspecified) for continued support on a higher level. FY95 funding, approximately US$0.5 million, was applied to termination costs.

Funding

	US FUNDING							
	FY94		FY95		FY96		FY97	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (BMDO) PE #0603217C Ballistic Missile Defense: Project 1405 Communications Engineering Tech.	-	1.9	-	0.5	-	0(a)	-	0

All US$ are in millions.

Source: FY1994/1995 Biennial RDT&E Descriptive Summary

(a)Project 1405 was terminated at the end of FY95.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Martin Marietta	5.0	May 1993 — CPFF to provide an innovative engineering and technical approach and process for the development of the BMD BM/C^3 and for the overall system engineering and integration of the BMD System (SDIO84-93-C-0020).
Raytheon	5.0	May 1993 — CPFF to provide an innovative engineering and technical approach and process for the development of the BMD BM/C^3 and for the overall system engineering and integration of the BMD System (SDIO84-93-C-0021).
TRW	5.0	May 1993 — CPFF to provide an innovative engineering and technical approach and process for the development of the BMD BM/C^3 and for the overall system engineering and integration of the BMD System (SDIO84-93-C-0022).

Timetable

	FY86	Research, advanced technology and data acquisition program plans set. Baseline performance requirements and candidate configuration defined. Critical technology development and studies initiated
	FY87	Test facilities available for critical evaluation of algorithms and software tools. Testbed program for integrated ground, air, space communication network and components initiated
	FY88	Communications systems model evaluation completed. Integration and test of critical communications subsystems for performance verification.
	FY89	Battle Management/C^3 technology project (Project 4) renamed Command Center/System Operation and Integration Functions (CC/SOIF) Technology (Project 43)
	FY90	Initiated fabrication and test of space-qualified processor hardware. Weapons release and ordnance safety doctrine established.
	FY91	Definitized - fault-tolerant computing architecture; method of generating verifiable software for large systems; BM/C^3 applications algorithms
	FY92	Implemented ATAMM on GVSC architecture
Jul	FY92	Completed LIDAR/Comm Dual Mode Laser Breadboard
	FY93	Implemented ATAMM on SPPD
Jan	FY93	Completed Acousto-Optic Transceiver Breadboard
	FY93	Completed 60 GHz Solid State Amplifier ADM
Jul	FY94	Completed MMIC EHF Transceiver Brassboard. Programmable flexible MODEM PDM Demonstration. Subminiature Telemetry Prototype
	FY95	Terminated project, transferred technology to operations

Worldwide Distribution

This is a **US** program only.

Forecast Rationale

In May 1993, then-Secretary of Defense Les Aspin replaced the Strategic Defense Initiative Organization with the Ballistic Missile Defense Organization to reflect the Clinton Administration's concentration on new dangers in the post-Cold War world. This shift emphasized the new mission of defending against a limited strike from a lone rogue adversary, rather than that of defending the homeland from a massive all-out-attack from the now-defunct Soviet Union.

The new BMDO program places greater emphasis on acquiring an improved theater missile defense as the top priority. Developing a competent communications system to assist in intercepting strategic missiles has become far less demanding than the original requirements for the former Phase 1 Defense program. Additionally, information processing needs will now be less, as there will be fewer friendly and potentially hostile objects to track.

In the original Strategic Defense System (SDS) Phase I scenario, the Command Center (CC) element was to provide positive, survivable, and secure human control over the SDS. It would consist of fixed and mobile units, and a terrestrial communications network with ground entry points for interconnectivity to the space components. The CC would also support coordinated offense-defense operations and interface with other US Government agencies outside the Department of Defense.

The System Operation and Integration Functions (SOIF) element was to include the distributed information processing network required for the automated execution of a "human-selected" battle plan. This function would require both the assured, secure exchange of information between the CC and all SDS elements, and the data processing to identify targets, allocate weapons, execute the defense, and manage the system's resources.

However, with the coming of the Global Protection Against Limited Strike (GPALS) version of the BMD, there appeared to be some significant changes in what comprised CC/SOIF work. It now seems to have been severely reduced in scope with the cancellation of the GPALS effort in FY94, and the refocusing of the BMD concept yet again.

The philosophy behind the United States' strategic defense plans has undergone radical change in the last several years. Ever since the breakup of the Soviet Union, "Star Wars" supporters have been scrambling to keep the program alive in one form or another — BMDO was that result. The decline of the strategic threat has also lowered the prestige of the BMDO. Yet, with many Third World nations acquiring nuclear weapons, some type of strategic defense system is still needed, providing BMDO a lengthened life.

Cost-cutting constraints in effect have taken BMDO in the direction of using existing warning systems (such as BMEWS and PAVE PAWS) and upgrading these systems, while at the same time integrating them with a number of other warning assets. This does not mean the end to future communications technology breakthroughs; rather it is a progression to the next level of development.

Ten-Year Outlook

The forecast chart has been omitted.

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