BMDO RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 4 - Demonstration and Validation

PE NUMBER AND TITLE: 0603861C THAAD System - DEM/VAL

PROJECT: 2260

COST (*In Thousands*)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2260 Theater High Altitude Area Defense (THAAD)	387260	433922	527871	3519	0	0	0	0	0	1352572

Note: FY00 THAAD EMD and Dem/Val controls do not match OSD/OMB funding controls due to a requested transfer of THAAD EMD ($493,738) to THAAD Dem/Val not being processed prior to the funding controls database lock. These exhibits reflect the correct allocation of funds and the database realignment will be addressed at the Congressional level prior to funding appropriation.

A. Mission Description and Budget Item Justification

The Theater High Altitude Area Defense (THAAD) System is being designed to negate theater ballistic missiles (TBM) at long ranges and high altitudes. Its long-range intercept capability will make possible the protection of broad areas, dispersed assets, and population centers against TBM attacks. The THAAD System includes missiles, Palletized Loading System (PLS) launchers, Battle Management/Command, Control, Communications, Intelligence (BM/C3I) units, THAAD Radars, and support equipment. The THAAD Radar (formerly known as Ground Based Radar) provides threat early warning, threat type classification, interceptor fire control, external sensor cueing, and launch and impact point estimates for the THAAD System. The THAAD Radar is based on state-of-the-art, solid-state, X-band radar technology. THAAD will be interoperable with both existing and future air defense systems. This netted and distributed BM/C3I architecture will provide robust protection against the TBM threat spectrum. THAAD is pursuing integration of THAAD BM/C3I with the Project Manager (PM), Air and Missile Defense Command and Control Systems (AMDCCS) to take advantage of previous Army developments that can be incorporated into the THAAD program.

The Demonstration/Validation (Dem/Val) program will develop the requirements for the objective THAAD system and demonstrate the capabilities of the system in a series of 13 flight tests. The Dem/Val development continues to incorporate the User Operational Evaluation System (UOES) program which is focused on obtaining early soldier involvement in the design of the objective system. As a part of this program, 2 THAAD radars, 4 launchers, and 2 BM/C4I units have been acquired. This hardware has been delivered and is being employed to support the Dem/Val flight test program and soldier training. The Dem/Val contract option for acquisition of UOES missiles will not exercised and has been replaced with a Risk Reduction/contingency (RR/c) program. The RR/c program is focused on reducing risk in the development of the objective system missile and making needed design improvements for testability, reliability, and producibility. Twenty RR/c missiles will be acquired to support ground testing and RR/c flight testing planned in early EMD. The THAAD system design will be developed in and tested in the Engineering and Manufacturing Development (EMD) phase leading to low rate initial production and subsequent fielding in FY07.

During FY95 - FY99 the Dem/Val flight test program is being conducted at White Sands Missile Range (WSMR), New Mexico. The flight test schedule consists of flight and system tests which began on April 21, 1995 with a successful first flight of the THAAD missile. To date, eight flight tests have been conducted with the ninth flight planned for 2Q99. The targets for the flight test program are being developed under the Tactical Missile Defense Targets contract (Project 3354).

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The THAAD Program continued Dem/Val hardware and software design, development and delivery in support of integration and acceptance testing for flight testing at WSMR. The THAAD Dem/Val radar was delivered to WSMR in July 1995, and has participated in flights 3 through 6. The Dem/Val Radar performed in the shadow mode to the test range radar and was the primary sensor on flight 6. Once UOES Radar #1 became available, the Dem/Val Radar was delivered to the national missile defense program for use in their test program. UOES Radar #1 was delivered to WSMR in May 1996, and completed range integration and test in September 1996. It performed nominally in the first Radar System Test in October 1996 and was used for flight testing in flights #7 and #8. UOES Radar #1 will be used for the remainder of the Dem/Val flight tests. The UOES Radar #2 went through range integration and test from September to November 1996, and was used in the second Radar System Test in March 1997. It is currently being used for requirements verification and to check out the block upgrade software to be used on flights #10 - #13. The first flight which was a non-intercept flight was successfully conducted at WSMR on April 21, 1995, proving the THAAD missile propulsion system booster/kill vehicle separation, seeker shroud cover deployment, seeker data, uplink/downlink communications from the Radar Interface Unit (RIU) to the missile, and pre-planned command destruct. The second flight was conducted on July 31, 1995, as a planned non-intercept, guidance and control test. The missile successfully performed the THAAD Energy Management Steering (TEMS) maneuver which resulted in nominal velocities and accelerations. The kill vehicle successfully maneuvered in response to planned In-Flight Target Updates (IFTUs). The third flight was a non-intercept fly-by test against a Storm target on October 13, 1995. The missile collected critical seeker data and the BM/C3I generated the fire control solution and sent the launch command to the interim launcher. During Flight 4, on December 13, 1995, much success was demonstrated even though a planned intercept was not accomplished. The flight test demonstrated seeker close-loop track, kill vehicle homing guidance, and THAAD Radar generation of uplink messages. Detailed analysis of the failed intercept verified that a software error in avionics processing caused the missile to perform an errant maneuver during flyout that consumed fuel required for interceptor divert and control for end game. Flight 5 was conducted March 22, 1996. The flight test successfully demonstrated the first launch from the tactical Palletized Loading System launcher. However, during kill vehicle/booster separation, a power interrupt to the integrated avionics processor caused the missile computer to reset to a prelaunch condition, which predestined the missile on a ballistic flight path and prevented target intercept. During flights 4, 5, and 6, the THAAD Radar successfully tracked both the THAAD interceptor and the target. During flights 4 and 6, it properly maintained track on the interceptor and seeker shrouds during shroud separation. All radar mission events, times, and durations, went as predicted in pre-mission analysis. Flight 6 was conducted July 15, 1996. The THAAD missile did not intercept the target due to the seeker not providing the proper imagery to the onboard computer. Analysis and testing determined the most likely cause of failure was dewar contamination. Although an intercept was not achieved, critical data was obtained on how the seeker viewed the target. Flight 7 conducted March 6, 1997, failed to achieve an intercept due to the inability to provide in-flight course correction from the missile Divert and Attitude Control Systems (DACS). Post flight analysis concluded that the THAAD radar, launcher, and BM/C3I segments performed nominally, and that the failure mode resided in the missile kill vehicle in the electronics connection between the kill vehicle battery and the Divert and Attitude Control System. Flight 8 conducted May 12, 1998 failed to achieve an intercept due to an electrical short in the thrust vector control in the booster. Post flight analysis indicated that the THAAD radar, launcher, and the BM/C3I segments performed nominally.

FY 1998 Accomplishments:

- 244668 Major Contracts: Conducted pre-EMD risk mitigation activity and continued system flight test program and support.
- 64731 Support Contracts: Continued software independent verification and validation. Continued nuclear environment survivability analysis. Continued hit assessment, discrimination, and guidance, navigation and control algorithm development. Continued hit to kill lethality analysis. Continued integration and support to THAAD flight testing.

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•	48503	Government Furnished Equipment (GFE)/Other: Continued integration and testing of Joint Tactical Information Distribution System (JTIDS) radios, launch support, BM/C3I, weapon system deck model, and simulation efforts. Continued system threat vulnerability assessment. Maintained integrated logistics and product assurance efforts. Provided system engineering support to THAAD flight tests to validate test results with predicted performance simulations. Continued pursuing integration of THAAD BM/C3I with PM, AMDCCS to take advantage of previous Army developments of force operations software.
•	17317	In-house support: Maintained government salaries and benefits, travel, training, etc.
•	8279	Targets: Continued development and delivery of targets to support THAAD flight tests and THAAD Radar system tests. Maintained infrastructure to support TMD targets.
•	2258	Lethality Analysis: Continued lethality simulation code validation.
•	1504	Operational Test and Evaluation (OT&E): Conducted independent assessment of the THAAD System.
Total	387260	

FY 1999 Planned Program:

•	302591	Major Contracts: Continue system flight test program and support. Begin RR/C missile design and development work. Conduct Missile Requirement Review and System Software Review. Continue pre-EMD risk mitigation activities, conduct Radar Prelimary Design Review, and prepare for the MSII DAB.
•	47949	Support Contracts: Continue software independent verification and validation. Continue nuclear environment survivability analysis. Continue hit assessment, discrimination, and guidance, navigation and control algorithm development. Continue hit to kill lethality analysis. Continue integration and support THAAD flight testing.
•	47762	Government Furnished Equipment (GFE)/Other: Continue integration and testing of Joint Tactical Information Distribution System (JTIDS) radios, launch support, BM/C3I, weapon system deck model, and simulation efforts. Continue system threat vulnerability assessment. Maintain integrated logistics and product assurance efforts. Provide system engineering support to THAAD flight tests to validate test results with predicted performance simulations. Continue pursuing integration of THAAD BM/C3I with PM, AMDCCS to take advantage of previous Army developments of force operations software.
•	6	Undistributed Reductions.
•	19127	In-house support: Maintain government salaries and benefits, travel, training, etc.
•	9937	Targets: Continue development and delivery of targets to support THAAD flight tests and THAAD Radar system tests. Maintain infrastructure to support TMD targets.
•	5198	Lethality Analysis: Continue lethality simulation code validation.
•	1352	Operational Test and Evaluation (OT&E): Conduct independent assessment of the THAAD System.

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Total 433922

FY 2000 Planned Program:

- 389224 Major Contracts: Complete system flight test program and support. Initiate procurement, fabrication, and integration of RR/c missiles. Complete pre-EMD risk mitigation activities; conduct missile and BM/C3I PDRs; and finalize preparations for the MSII DAB.
- 62976 Support Contracts: Continue software independent verification and validation. Continue nuclear environment survivability analysis. Continue hit assessment, discrimination, and guidance, navigation and control algorithm development. Continue hit to kill lethality analysis. Continue integration and support THAAD flight testing.
- 38600 Government Furnished Equipment (GFE)/Other: Continue integration and testing of Joint Tactical Information Distribution System (JTIDS) radios, launch support, BM/C3I, weapon system deck model, and simulation efforts. Continue system threat vulnerability assessment. Maintain integrated logistics and product assurance efforts. Provide system engineering support to THAAD flight tests to validate test results with predicted performance simulations. Continue pursuing integration of THAAD BM/C3I with PM, AMDCCS to take advantage of previous Army developments of force operations software.
- 21400 In-house support: Maintain government salaries and benefits, travel, training, etc.
- 7264 Targets: Continue development and delivery of targets to support THAAD flight tests and THAAD Radar system tests. Maintain infrastructure to support TMD targets.
- 7086 Lethality Analysis: Continue lethality simulation code validation.
- 1321 Operational Test and Evaluation (OT&E): Continue independent assessment of the THAAD System.

Total 527871

FY 2001 Planned Program:

- 3519 Complete Dem/Val phase flight test data reduction and analysis.

B. Program Change Summary	FY 1998	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 1999 PB)	390785	497752	37000	5400
Congressional Adjustments		-52500		
Appropriated Value		445252		
Adjustments to Appropriated Value				

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a. Congressional Reductions (FFRDC, Inflation, etc)		-8648		
b. OSD Reductions		-2682		
c. Emergency Supplemental				
Adjustments to Budget Years Since FY 1999 PB				
Current Budget Submit (FY 2000 / 2001 PB)	387260	433922	527871	3519

Change Summary Explanation for FY98 Below Threshold Reprogramming:

(-1,200) FY98: Funds were reprogrammed for PAC 3 Spare Target Hardware.
(- 508) FY98: Funds were adjusted between FY99 President's Budget and the FY00 President's Budget
(-1,817) FY98: Funds were reprogrammed.
(-3,525) FY98 Total

Change Summary Explanation for FY00 Adjustment to Budget: Due to program schedule slip, EMD dollars transferred to Dem/Val (+493,738) along with some reductions/recissions (-2,867).

Change Summary Explanation for FY01 Adjustment to Budget: Due to undistributed reductions/recissions (-1,881).

C. Other Program Funding Summary	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	To Compl	Total Cost
Navy Theater Wide – 0603868C	437896	364284	329768	369049					TBD	TBD
THAAD MILCON – 0604861C	0	0	0	0	0	4689	17200	0	0	21,889
THAAD EMD– 0604861C	0	0	83755*	556178	417530	289197	188652	0	0	1,535312
UPPER TIER – 0604218C	0	0	0	0	514318	471852	517902	634550	Cont	Cont
THAAD Procurement – 0208861C						91729	182628	603924	5186000	6064281

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D. Acquisition Strategy: The THAAD Acquisition Strategy approved for the Dem/Val phase specified full and open competition for THAAD system integration, missiles, launchers, and BM/C3I. The TMD Ground Based Radar (GBR) Acquisition Strategy also specified full and open competition for Dem/Val. The Concept Definition phase, completed in 1992, involved three contractor teams and defined concepts and preliminary designs for the THAAD System. The THAAD Dem/Val contract was competitively awarded to Lockheed Missiles and Space Company in September 1992. The Dem/Val program will develop a design for the THAAD System. The THAAD Radar (formerly known as TMD-GBR) Dem/Val contract was competitively awarded to Raytheon Company in September 1992. The Dem/Val phase includes the development and test of one Dem/Val radar and two UOES radars.

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E. Schedule Profile	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Dem/Val Radar Integration and Test	1Q									
System Design Review	3Q									
UOES Radar 1 I&T Complete	4Q									
Radar System Test #1		1Q								
UOES Radar 2 I&T Complete		2Q								
Radar System Test #2			2Q							
Software Specification Review				3Q						
Risk Reduction Award				3Q						
Integrated System Tests Complete					1Q					
Milestone II					3Q					

BMDO RDT&E COST ANALYSIS (R-3)

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I. Product Development	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. LMMS	CPFF/CPAF		1841818	279091		369224		3519		0	2493652	2493652
b. Raytheon	CPIF/AF/FF		561987	23500		20000		0		0	605487	605487
Subtotal Product Development:			2403805	302591		389224		3519			3099139	3099139

Remark:

II. Support Costs	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. SETA	CPAF		138799	25281		28500		0		0	192580	192580
b. Other Spt Cont	Various		268687	22668		34476		0		0	325831	
c. OGAs	MIPR		145075	38070		28600		0		0	211745	
d. Program Mgmt	Various		101581	19127		21400		0		0	142108	
Subtotal Support Costs:			654142	105146		112976					872264	

Remark:

III. Test and Evaluation	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. WSMR	MIPR		73884	9692		10000		0		0	93576	
b. OT&E			8898	1352		1321		0		0	11571	
c. TARGETS			122118	9937		7264		0		0	139319	
d. LETHALITY			13347	5198		7086		0		0	25631	
Subtotal Test and Evaluation:			218247	26179		25671					270097	

Remark:

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IV. Management Services	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY 1999 Cost	FY 1999 Award Date	FY 2000 Cost	FY 2000 Award Date	FY 2001 Cost	FY 2001 Award Date	Cost To Complete	Total Cost	Target Value of Contract
a. Undistributed Reductions		BMDO		6							6	
b.												
c.												
d.												
e.												
f.												
Subtotal Management Services:				6							6	

Remark:

Project Total Cost:			3276194	433922		527871	0	3519			4241506	

Remark: