PROCEEDINGS

BALLISTIC MISSILE DEFENSE ORGANIZATION

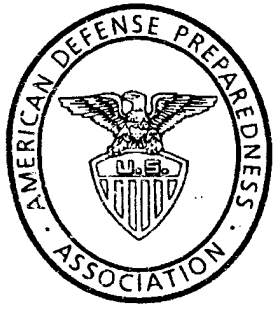
ADVANCE PLANNING BRIEFING FOR INDUSTRY

The Ritz-Carlton, Tysons Corner, VA
March 7-8, 1995
Meeting #576

SPONSORED BY
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BMDOTIC



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Ballistic Missile Threat TMD PEO ABM
Treaty ACTD Contract NMD

[redacted] DEFENSE ORGANIZATION

Advance Planning Briefing for Industry

7-8 March, 1995

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- Potential Impediments to Participation

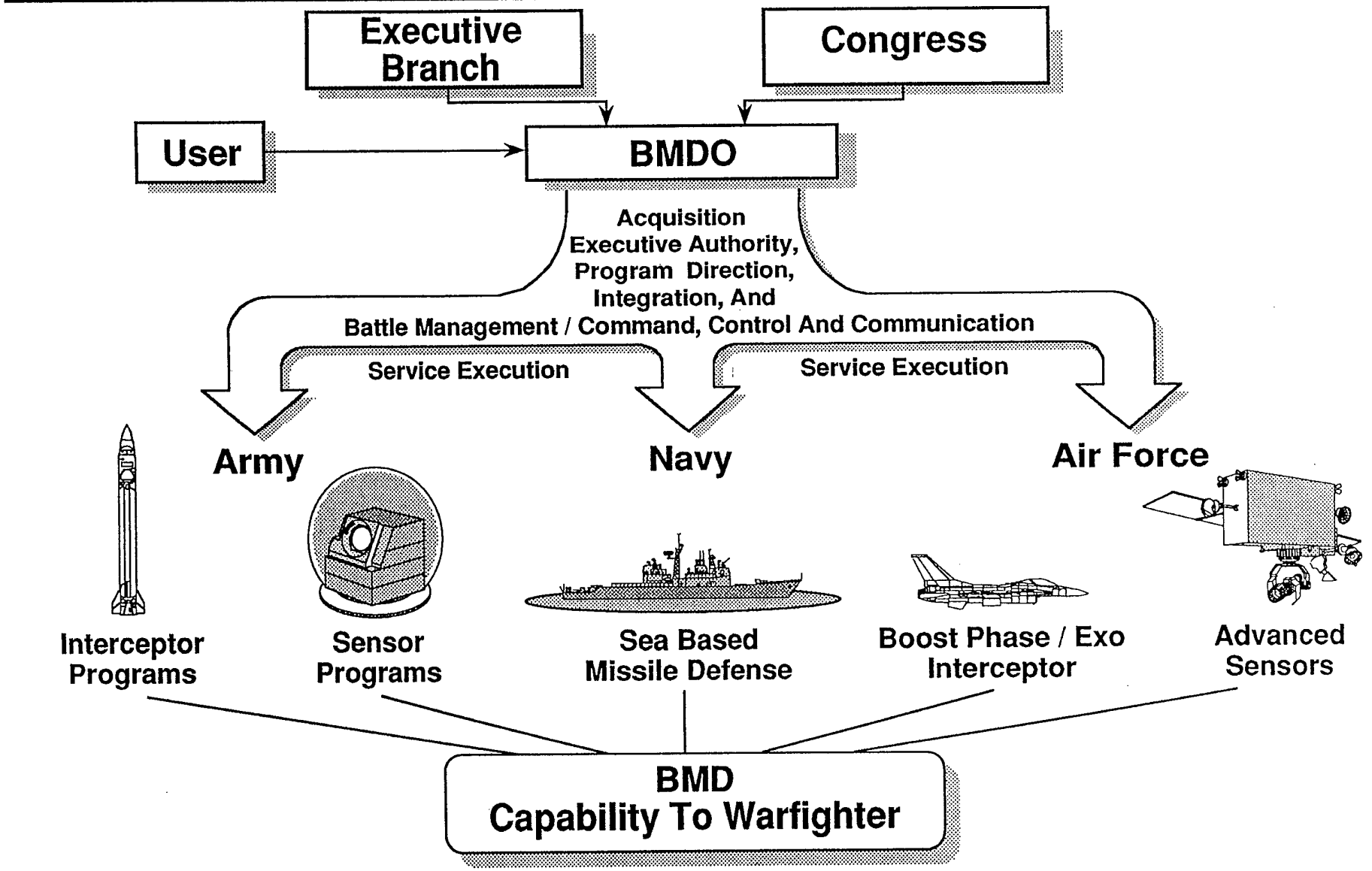
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PROGRAM BRIEFING
FOR
THE ADVANCE PLANNING BRIEFING FOR INDUSTRY

7 MARCH 1995

MR. DOUGLAS KLINE
ARCHITECTURE INTEGRATOR
BALLISTIC MISSILE DEFENSE ORGANIZATION

BMD PROGRAM



mj-39521B / 061394

OUTLINE

- Program Rationale
- Program Guidance
- Theater Missile Defense
- National Missile Defense
- Technology Program
- Summary

BALLISTIC MISSILE DEFENSE KEY COMPONENT OF DoD DEFENSE STRATEGY

SECDEF's New World Dangers	BMDO Contributions
• Regional Aggression	• Protect Forces For Power Projection And Relief Operations • Coalition Flexibility / Stability
• Proliferation	• Support Defense Counterproliferation Initiative • Develop Improved Ballistic Missile Defense
• Dangers To Democracy	• Cooperative R&D • Potential Multilateral Defense
• U.S. Economic Concerns	• Dual Use Technologies • Advanced Technology - Aerospace - Electronics • Commercialization Of Military R&D

PROGRAM RATIONALE

Provide Analytical Foundation And The Underlying Rationale For The BMD Program

"System Of Systems" (Architecture) Perspective

- Characteristics Of Threat
- Scope Of Mission Space
- Synergistic / Complementary Capability
- Analysis Of Architectural Concepts

→ "How Do The Pieces, When Taken Together, Accomplish The BMD Mission ?"

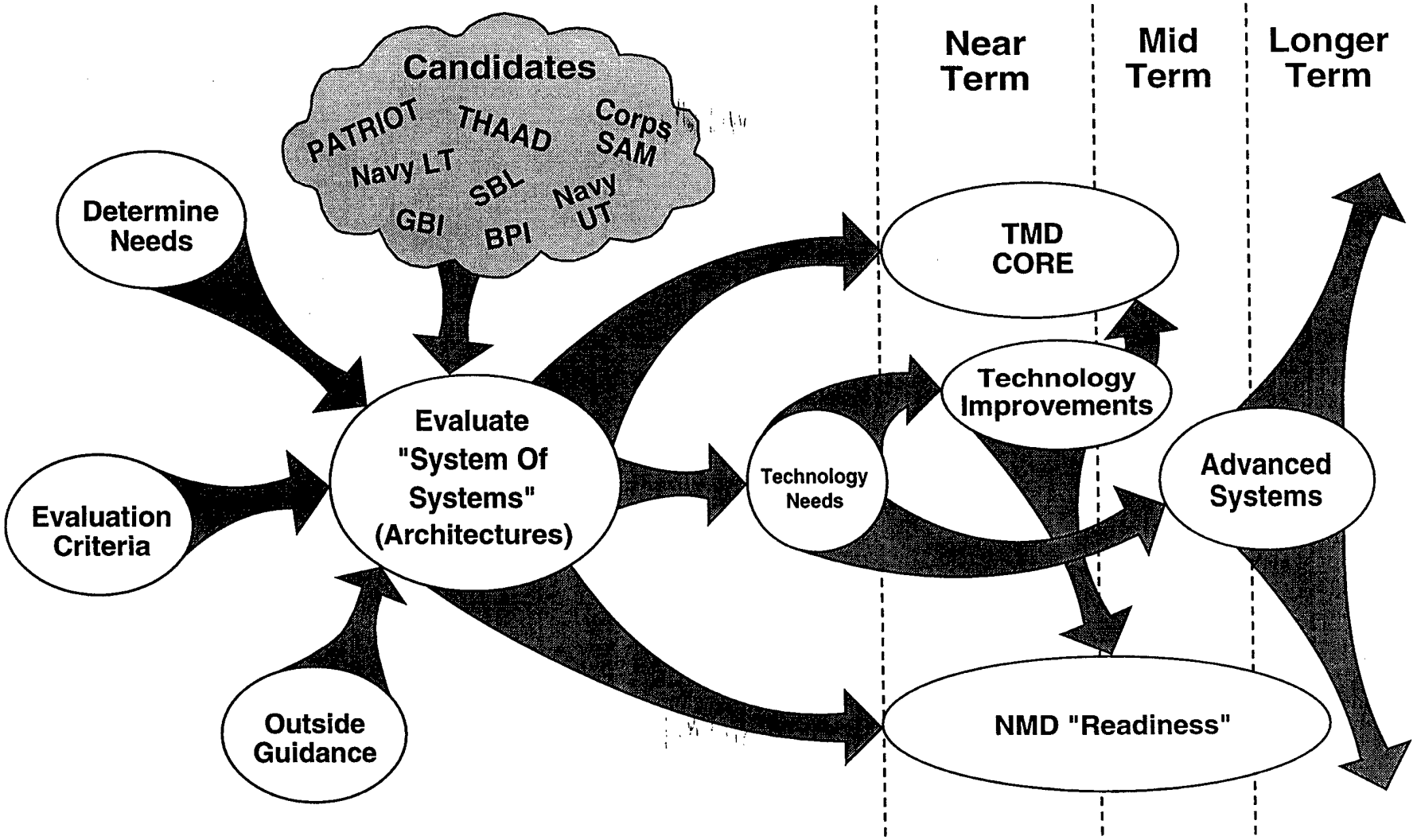
Architectural Measures Of Merit

- Mission / Threat Space Supported
- Robustness Versus Countermeasures
- Timeliness
- Affordability
- Risk

→ "What Contribution Does Each System Make To BMD ?" (Why Was Each Piece Selected ?)

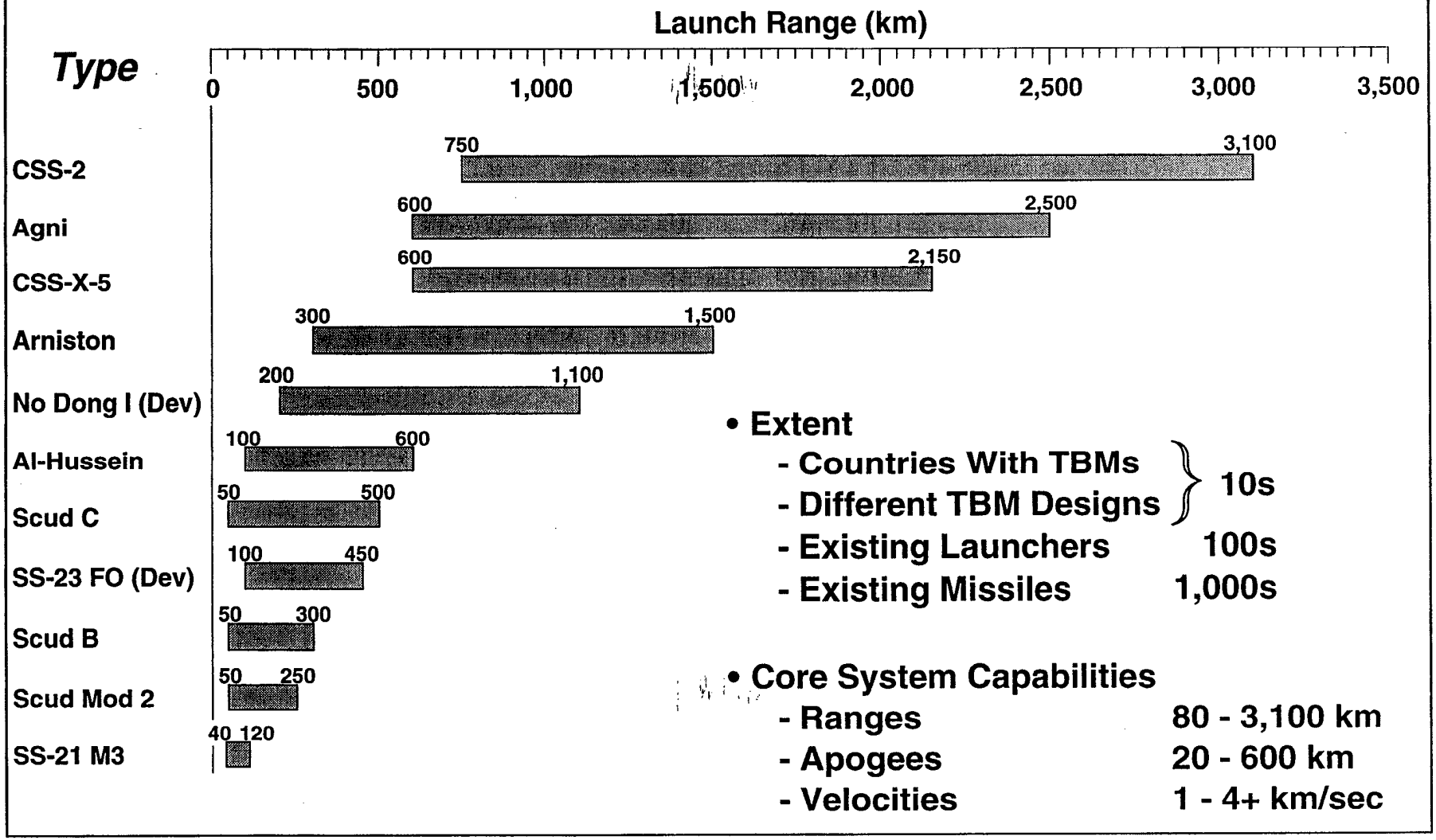
mj-42373A / 101894

HOW THE BMDO PROGRAM WAS DEVELOPED



mj-41576B / 111894

TBM THREAT - REAL AND GROWING



- **Extent**
  - Countries With TBMs } 10s
  - Different TBM Designs } 10s
  - Existing Launchers 100s
  - Existing Missiles 1,000s

- **Core System Capabilities**
  - Ranges 80 - 3,100 km
  - Apogees 20 - 600 km
  - Velocities 1 - 4+ km/sec

mj-34733K / 111894

BALLISTIC MISSILE THREAT TO UNITED STATES

Three General Categories	Current Assessment
• Emerging Attack Capability - From Hostile Third World Country	• "...The Possibility Of A Limited Ballistic Missile Threat From The Third World Sometime In The First Decade Of The Next Century Cannot Be Excluded."
• Accidental Attack - From Former Soviet Union - From China	• "...Considered Unlikely."
• Deliberate Attack - From Former Soviet Union - From China	• "...Would Appear To Be Highly Unlikely."

BUR BMD PROGRAM GUIDANCE (1 SEP 93)

Priority	Program	Focus	Funding* (FY 95-99)
First	TMD →	Acquisition Programs → • Core → Near And Midterm Capabilities • Advanced → Follow-on TMD Acquisition	$12B
Second	NMD →	Technology Readiness Program → • Emphasize Technology Long Poles • Maintain Contingency Options	$3B
Third	Technology / R&S →	Support Acquisition Programs And Provide Tech Base → • Near Term And Advanced Technology • Infrastructure / Personnel	$3B

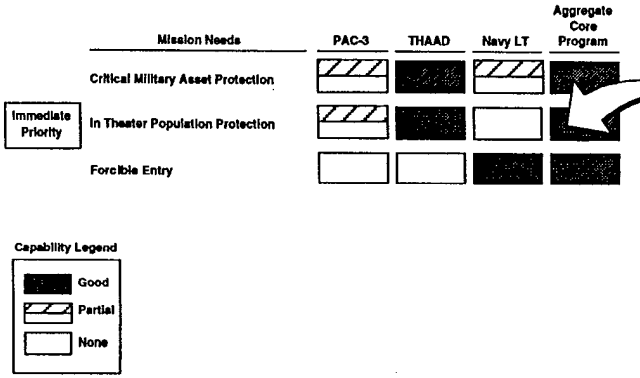
The Administration's Commitment To BMD Is Clear

* Subsequently Decreased $2.9 Billion

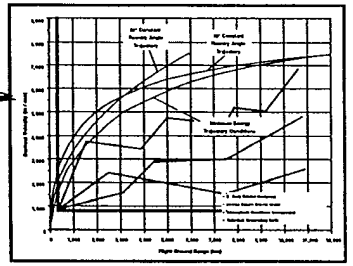
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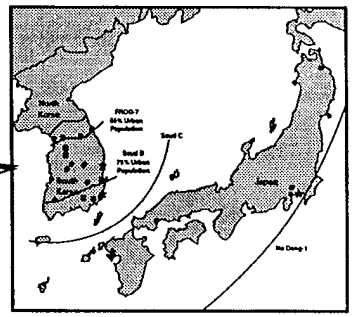
MULTILEVEL ANALYSIS

Strong Analytical Foundation For The BMD Program Has Been Developed At A Very Detailed Level; Example Shown Below



Measures Of Merit	PATRIOT	SM-2 Blk IVA	THAAD	Architecture
Coverage - Local	G	G	G	G
Coverage - Coalition Population				
Leakage				
Battlespace - High				
Battlespace - Low				
Lethality				
Tier Independence	N/A	N/A	N/A	
Time To Deploy				
Theater Insertion Support				
Tactical Mobility				
Survivability - A/C				
Survivability - Front Lines		N/A		
Countermeasures - ERS				
Countermeasures - Maneuvers				
Countermeasure - Decoys / ECM				
Cruise Missile Capability				
Passive Defense Support				
Active Defense Support				
Battlefield Intelligence	?		?	?
Programmatic Robustness				
Life Cycle Costs				
Resources For Transportability				
Manpower / Force Structure				
Time To Develop / Deploy				
Risks - Technical				
Risks - Costs				
Risks - Schedule				





Level 1
Top Level
Aggregate Display

Level 2
Mid Level
Specific Information

Level 3
Lower Level
Data

Detailed Analysis Available On Request

TOP LEVEL ASSESSMENT OF CORE PROGRAM VERSUS TMD MISSION NEEDS

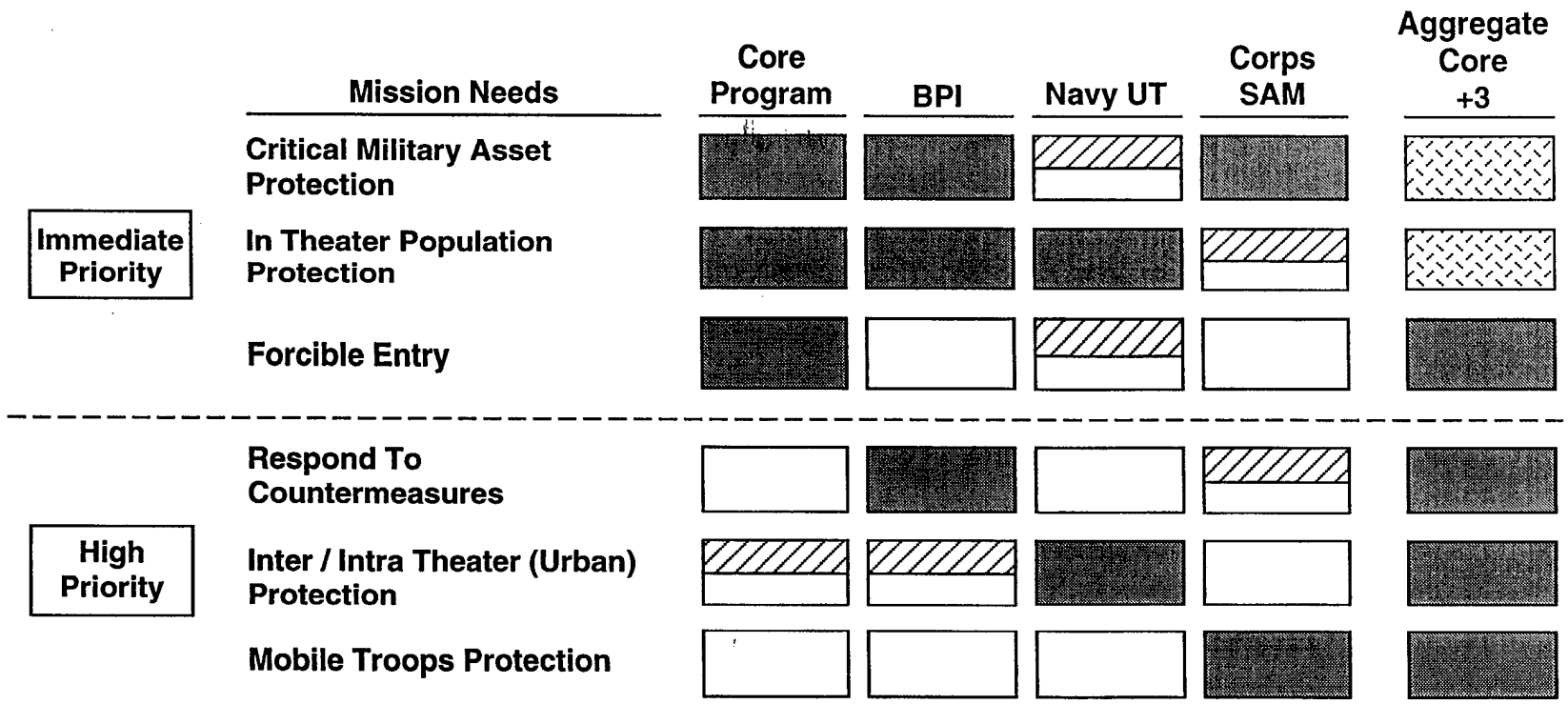
Immediate Threat Addressed By Near Term Core Program

	Mission Needs	PAC-3	THAAD	Navy LT	Aggregate Core Program
Immediate Priority	Critical Military Asset Protection	Partial	Good	Partial	Good
	In Theater Population Protection	Partial	Good	None	Good
	Forcible Entry	None	None	Good	Good

Capability Legend

- Excellent
- Good
- Partial
- None

TOP LEVEL ASSESSMENT TMD ADVANCED CAPABILITIES VERSUS MISSION NEEDS



Capability Legend

- Excellent
- Good
- Partial
- None

Good Defense Provided Against Multifaceted Threat By Advanced Systems

PROGRAM RATIONALE SUMMARY

Architecture Studies Give The Analytical Foundation For The BMDO Program And Are Based On Analyses At A Very Detailed Level

The Resulting BMD Program

- **Progressively Increases Capability Over Time For TMD**
- **Reduces Deployment Time And Provides For Increase In NMD Performance**
- **Responds To National Priorities Now And In The Future**
- **Is Flexible To Accommodate Future Policy / Mission Shifts**

OUTLINE

- Program Rationale
- Program Guidance
- Theater Missile Defense
- National Missile Defense
- Technology Program
- Summary

BALLISTIC MISSILE DEFENSE (BMD) CONGRESS AND THE ADMINISTRATION

Congress

Missile Defense Act (As Amended) And The FY 95 Authorization And Appropriation Bills

Administration

DoD Bottom-Up Review And The FY 95 President's Budget

Emerging Consensus

- Theater Missile Defense - Top Priority
- National Missile Defense - Second Priority; Technology Readiness Program
- Focus Technology To Support Development Programs And Advanced Capabilities
- Work Within Treaty Constraints

Make BMD A Reality

mj-41950 / 101294

OUTLINE

- Program Rationale
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TMD PROGRAM STRATEGY

Acquire And Field Capability

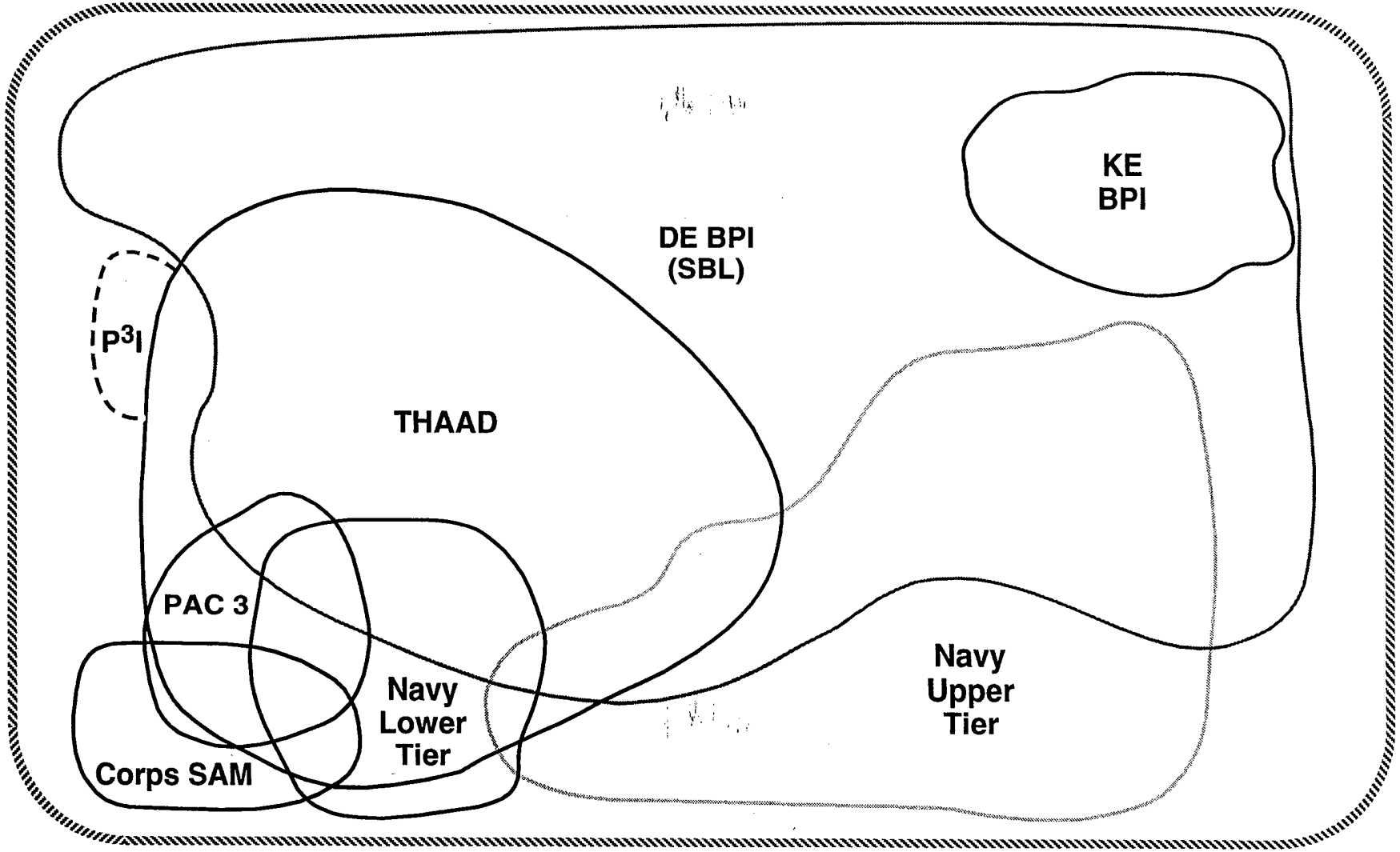
Goal

- **Address Full Spectrum Of Threat Over Time Through**
  - **Multiple Tiers**
  - **Multiple Basing Modes**
  - **Multiple Shot Opportunities**

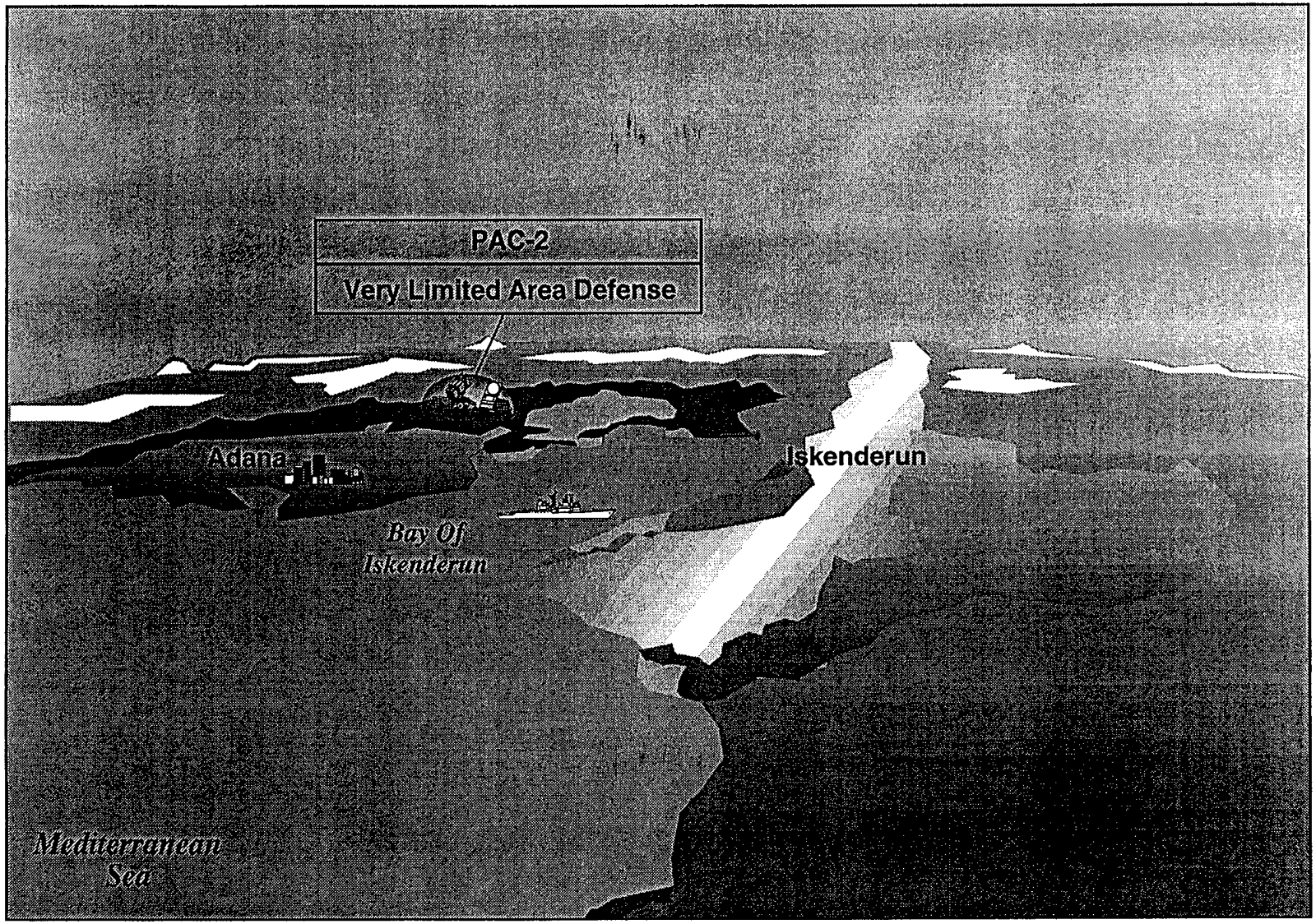
Acquisition Strategy

- **Core Systems**
  - **Rapidly Increase Capability By Upgrading Existing AEGIS And PATRIOT Systems**
  - **Continue Ongoing THAAD Program To Provide Wide Area Defense**
- **Advanced Capability (As Funds Permit)**
  - **Develop MEADS To Protect Maneuver Forces Against Ballistic And Cruise Missiles**
  - **Expand AEGIS To Provide Theater Wide Protection**
  - **Pursue Boost Phase Interceptor System To Add Robustness And To Defeat Countermeasures**

THEATER MISSILE DEFENSE REQUIREMENTS UNIVERSE

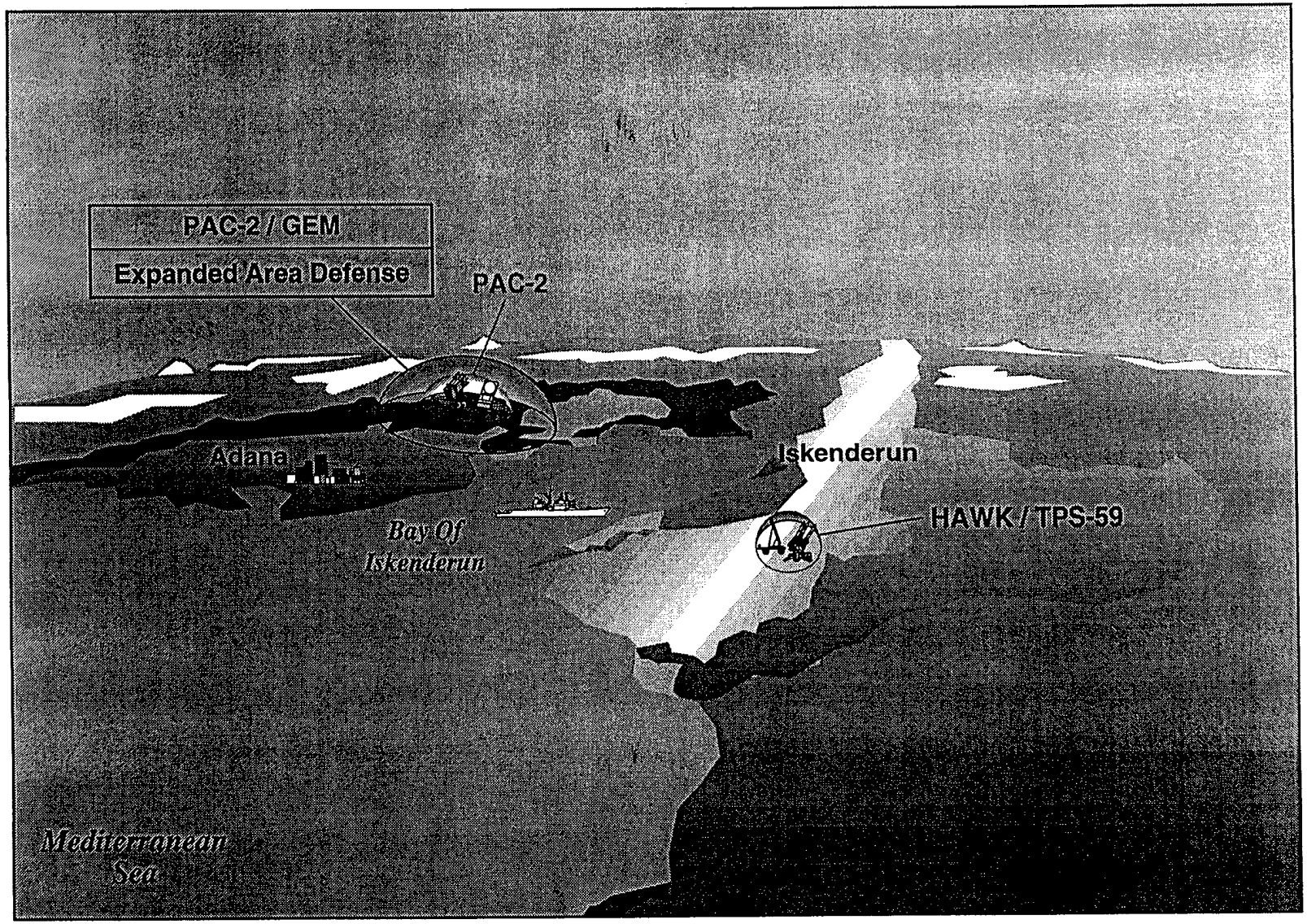


TODAY'S CAPABILITIES
(FY 95)



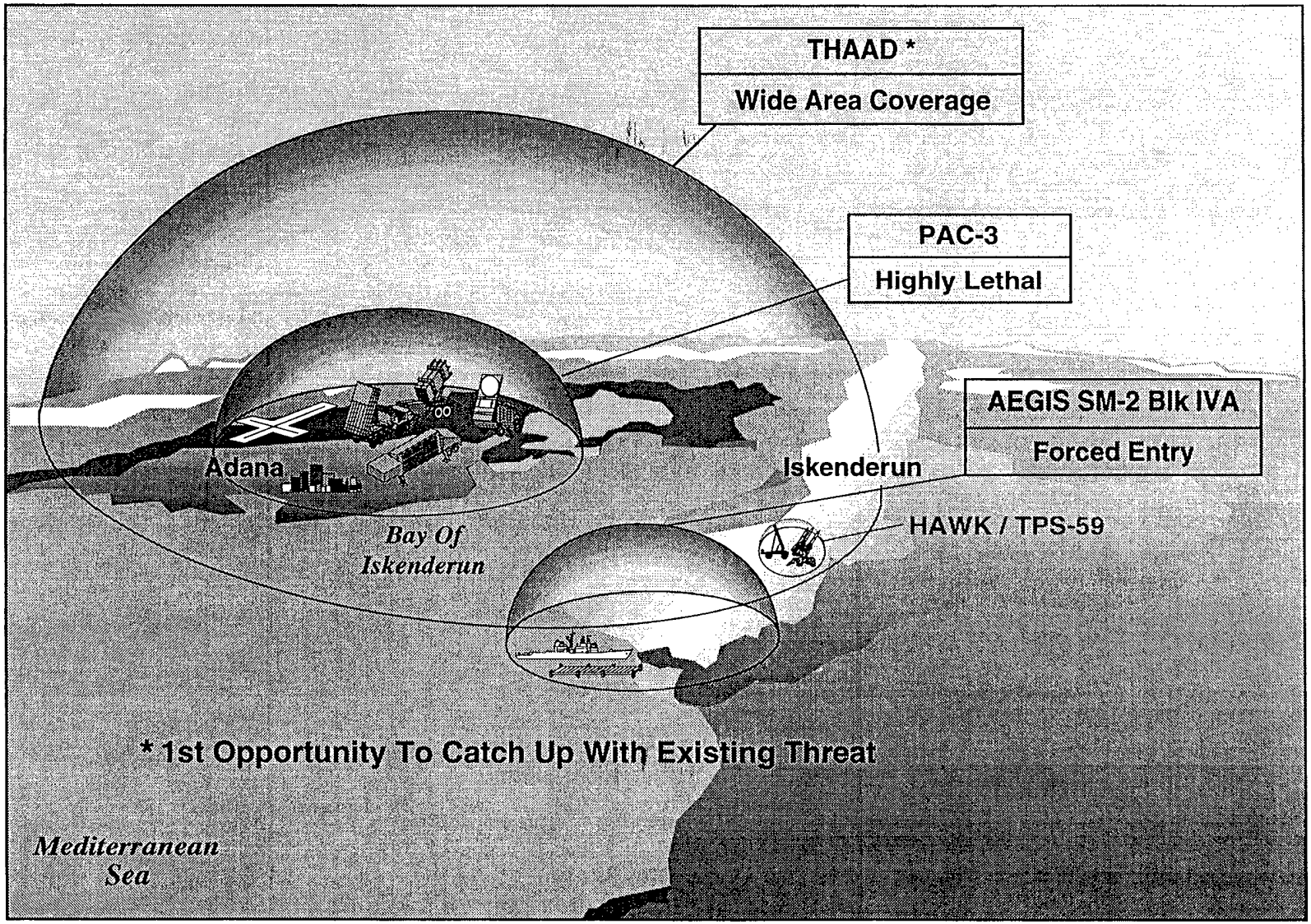
mj-38447SSS / 110394

NEAR TERM CAPABILITIES
(FY 95-97)



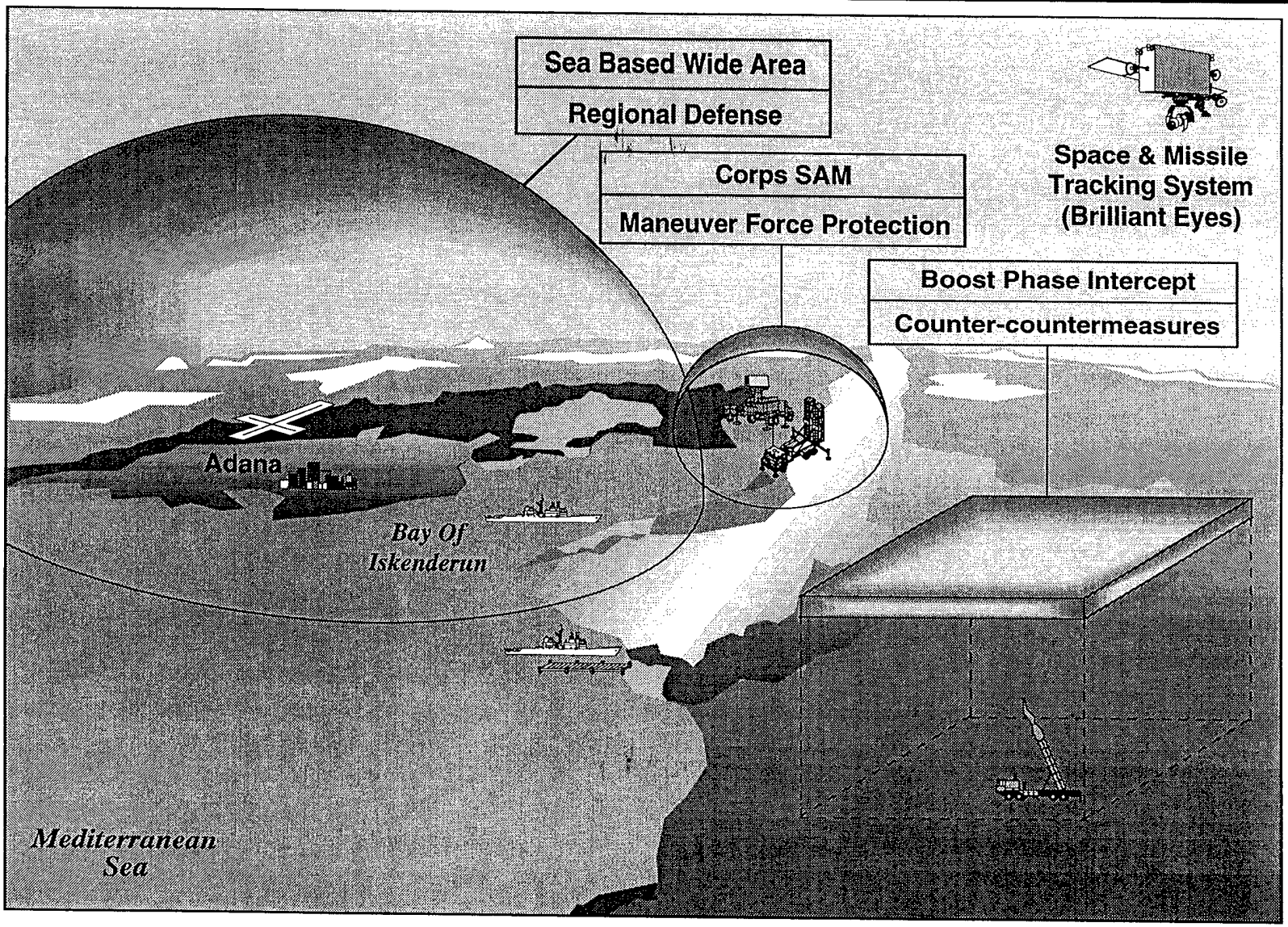
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MIDTERM CAPABILITIES
(FY 97-2002)

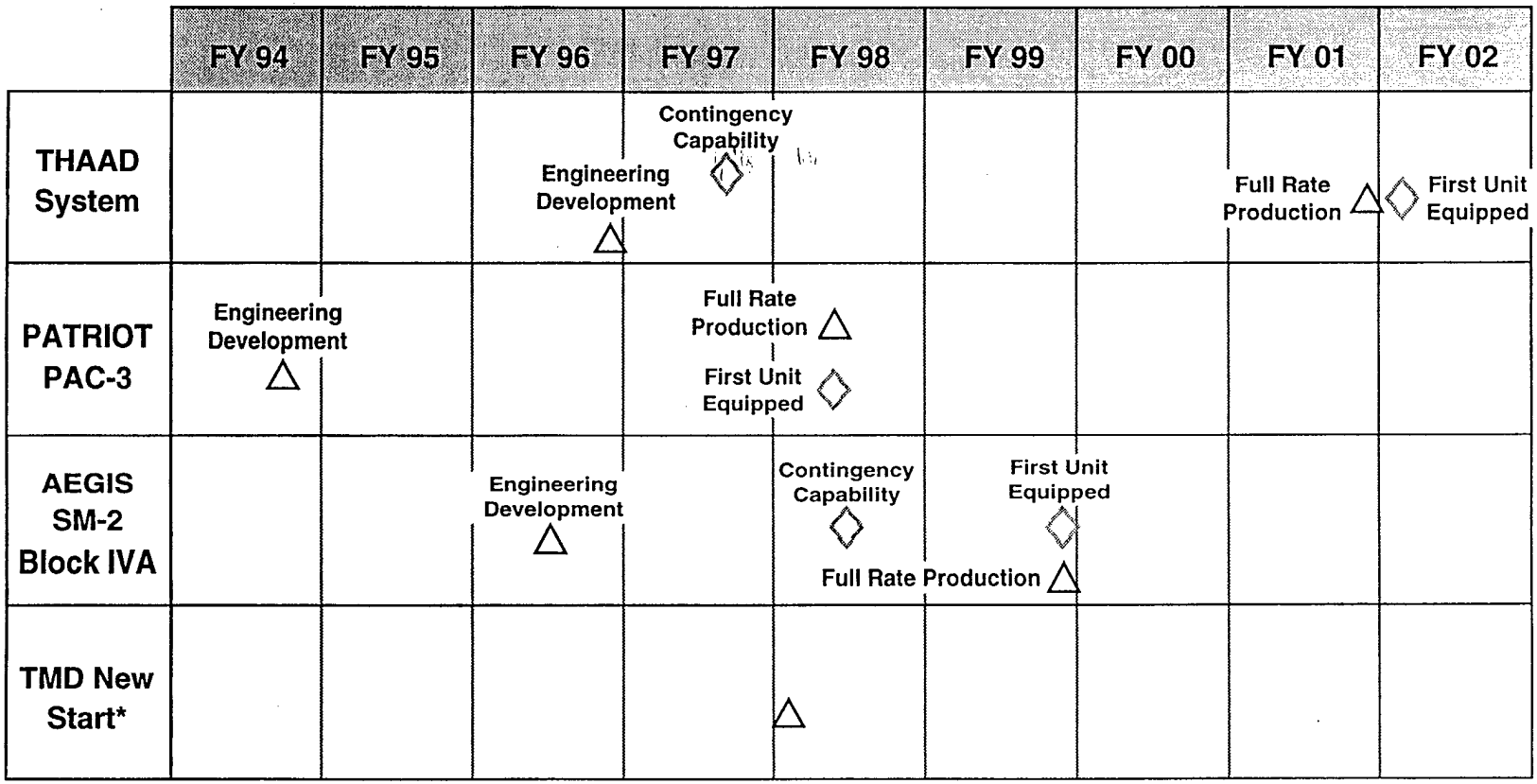


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ADVANCED CONCEPTS
(FY 2002+)



THEATER SCHEDULE



* TMD New Start Candidates
- Corps SAM
- Sea Based Wide Area
- BPI

Orange Yellow Green

Capability

mj-39912C / 101194

INTERNATIONAL PARTICIPATION IN TMD PROGRAMS

Ongoing / Planned Allied Activities

- NATO
  - Examining Numerous Issues, e.g., Proliferation, Emerging Requirements
  - CNAD Established EAD / TMD Ad Hoc Working Group
    - –Reviewing 14 Cooperative Proposals

- United Kingdom
  - Conducting Joint Trials / Experiments
  - Participating In Information Exchange
  - 18 Month BMD Study To Define Requirement

- Germany / France / Italy / U.S.
  - Signed Statement Of Intent On 20 FEB 95 To Cooperate On Medium Extended Air Defense Systems (MEADS)
  - Currently Negotiating MOU For Project Definition - Validation Phase

- Japan
  - No Dong Flight Test Has Heightened Interest In TMD
  - TMD Working Group To Examine Alternatives

- Israel
  - Arrow / ACES Development Ongoing
  - Israeli Test Bed Up And Running
  - Boost Phase Intercept Study To Be Completed In FY 94

OUTLINE

- Program Rationale
- Program Guidance
- Theater Missile Defense
- National Missile Defense
- Technology Program
- Summary

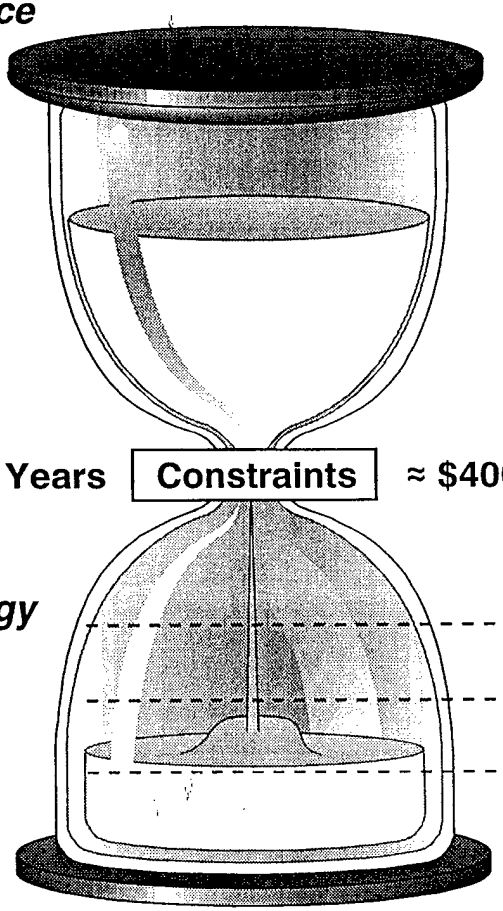
NMD PROGRAM ENVIRONMENT AND STRATEGY

Congressional / Administration Guidance

- Develop A "Contingency" Strategy
- Reduce Deployment "Long Poles" Or Substantially Increase Capability
- Develop Flight Tested Hardware For Limited Defense
- Be Economical

Military Requirements

- Threat Exists And Is Proliferating
- Timing And Character Of Threat Is Uncertain



Be Ready To Deploy In 3-5 Years | Constraints | ≈ $400M / Year

Technology Readiness Program Strategy

- Exploit Past Investments
- Leverage TMD Program
- Invest to Reduce Timelines Or Increase Capability
- Test Capability To Reduce Risk

Objective System

Mid Term Contingency Options

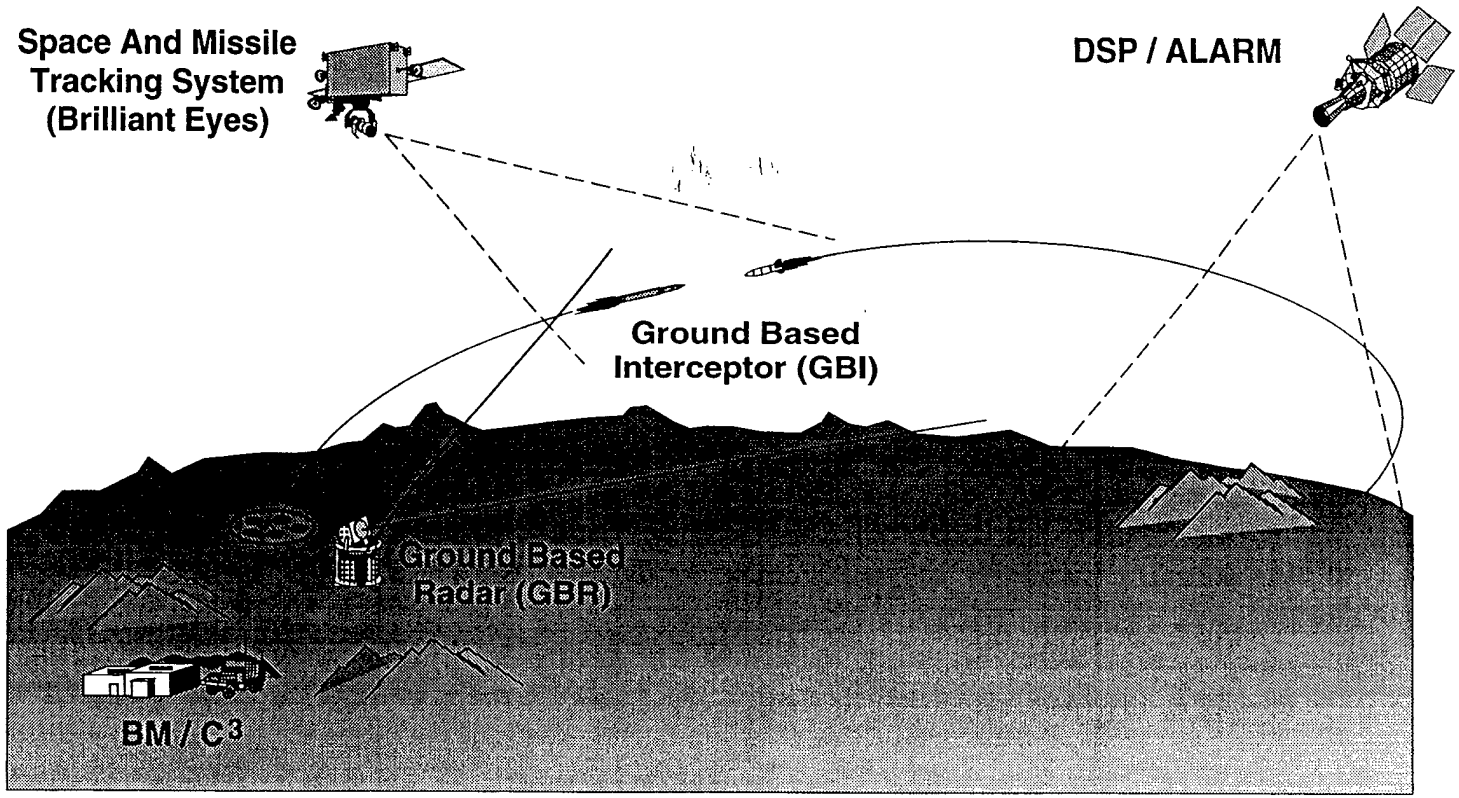
Near Term Options

Increased Capability

Decreased Deployment Time

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OBJECTIVE NMD ARCHITECTURE

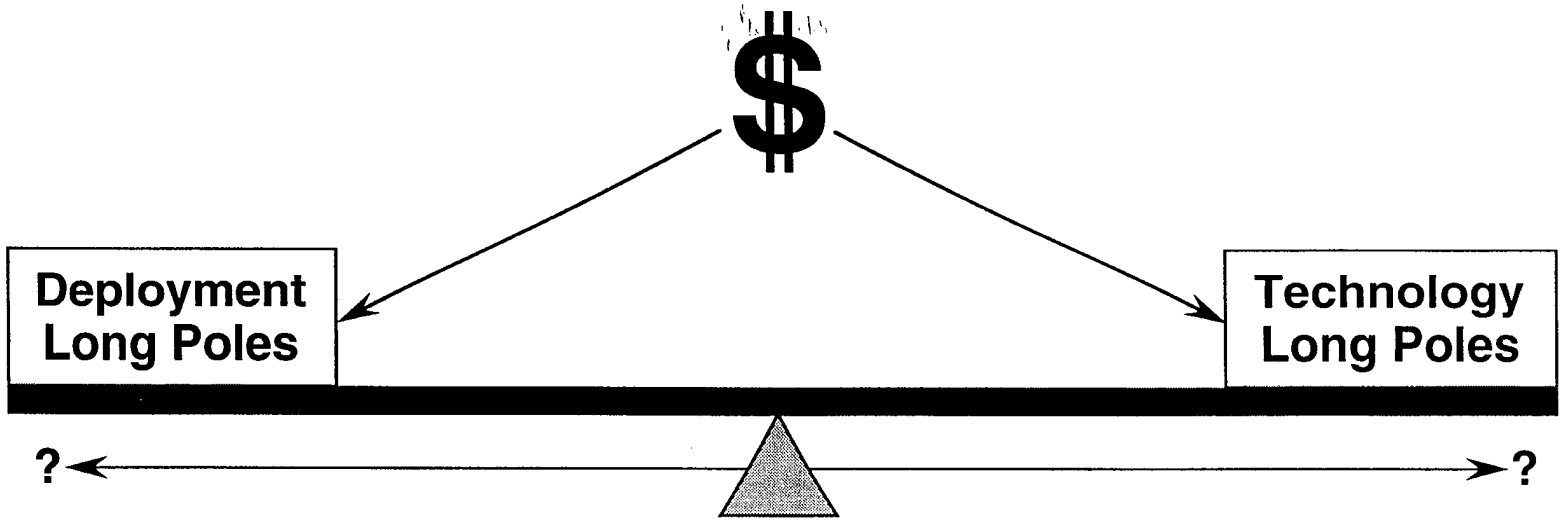


- Objective Architecture Consistent With FY 93 Through FY 95 President's Budgets And Reports To Congress
- Acquisition Of These Systems Is Unfunded
- Robust Treaty Compliant Architecture Against Limited / Simple Threats

Objective Architecture Guides The NMD Technology Readiness Program

NMD APPROACHES

Where To Invest ?

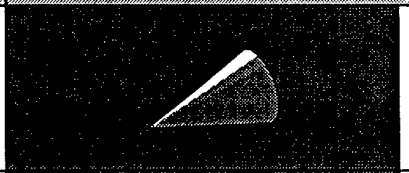
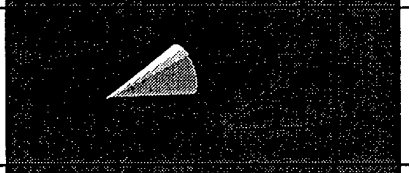
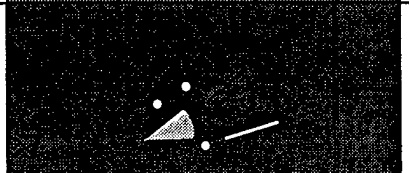
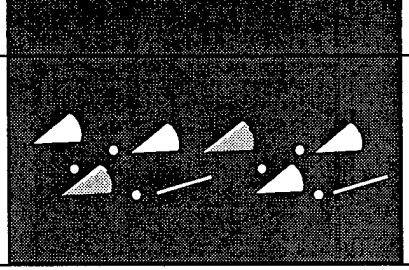


- Focus Efforts On Providing For A Contingency NMD Capability If Near Term Threat Emerges
  - Optimize Deployment Opportunity
- Focus Efforts On Developing Technology To Meet Expected Threat In The 21st Century
  - Provide Needed Performance

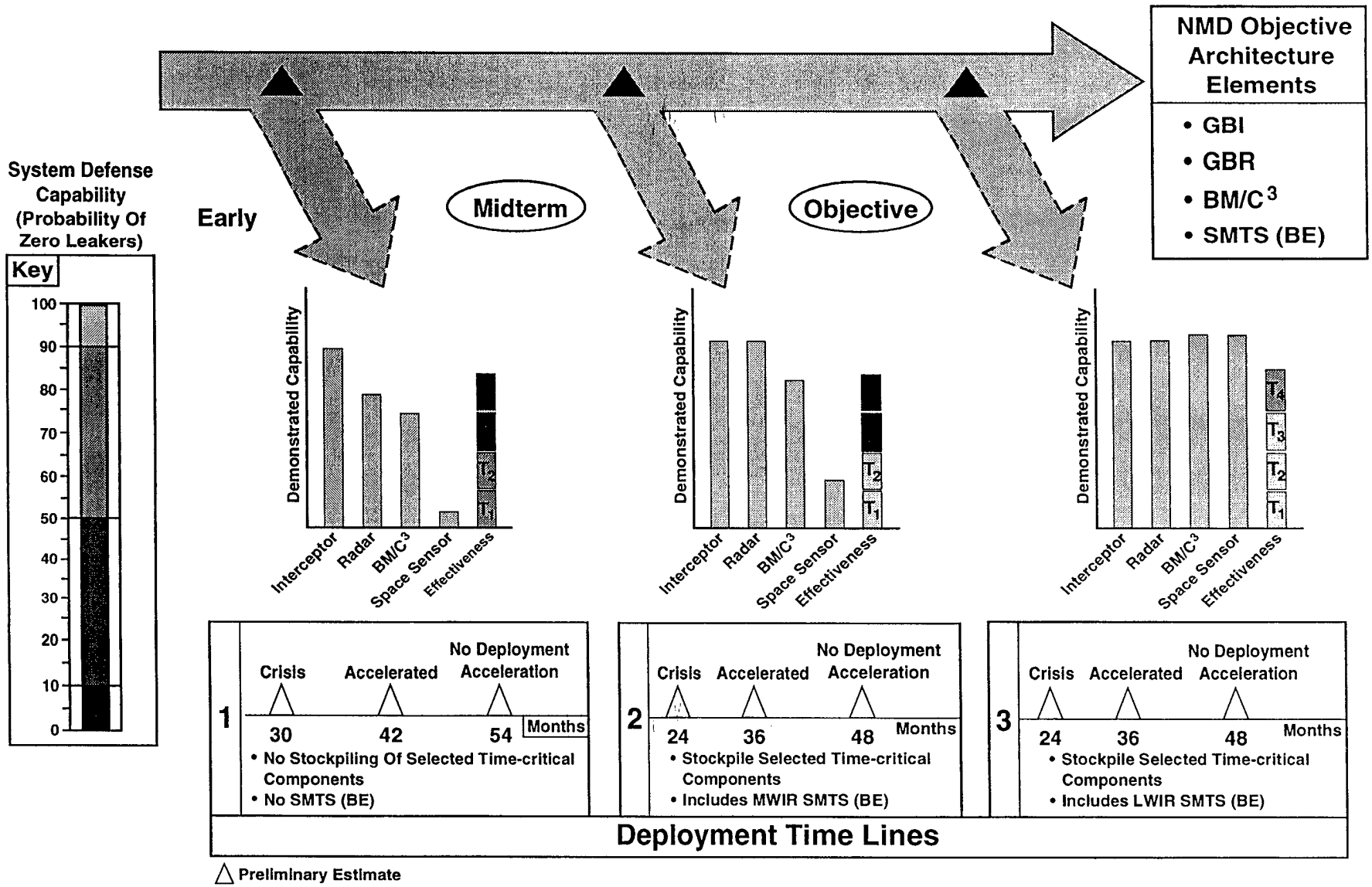
Funding Limitations Require Prudent Allocations To Maintain Robustness

THREATS

Existing Capabilities

Threat	Descriptor		Maximum Number Of Warheads
1		Large Warm Warhead(s) (No Associated Objects)	4
2		Smaller Cool Warhead(s) With An Ascent Shroud	4
3		Small Cold Warhead(s) With An Ascent Shroud, ECM Suite, And Associated Objects	4
4		Multiple Warhead Version Of Threat 3 With Contact Fuzing And Penetration Aids	20

NMD TECHNOLOGY READINESS INVESTMENT LEADS TO EARLY DEPLOYMENT OPPORTUNITIES



mj-42228HH / 021695

CONTINGENCY PLANNING

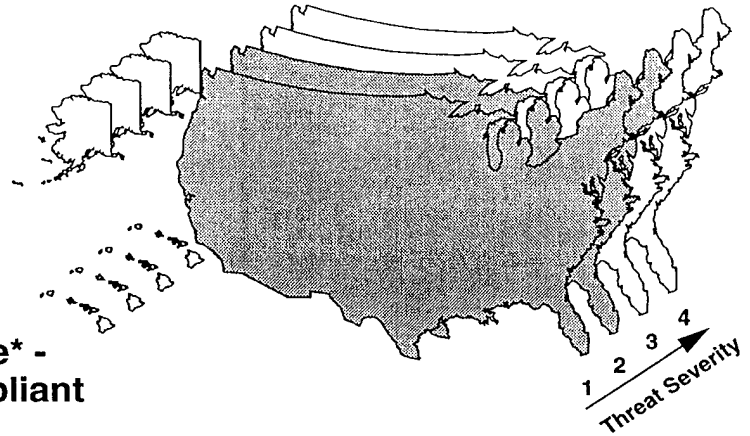
• Contracting	Contingency Contracts In Place
• Facilities, Siting And Environmental	Analyze Deployment Locations, Construction And Environmental Impact
• Operations	Develop CONOPS For Candidate Systems
• Supportability	
- Manpower	Draft Manpower Estimate Report
- Training	Initial Training Estimate Report
- Maintenance	Perform Contractor Versus Organic Support Analysis
- Supply Support	Obtain DX Priority
- Support Equipment	Estimate Requirements For Candidate Systems
- Technical Data	Establish Mechanism To Collect, Archive And Disseminate Data
• Producibility & Manufacturing	Evaluate Critical Technology Requirements Versus Capabilities And Assess Risk
• Stockpile Selected Time-critical Components	Consider Opportunities

EVOLVING NMD
DEPLOYABLE CAPABILITY VERSUS THREAT

Today's Deployed Capability

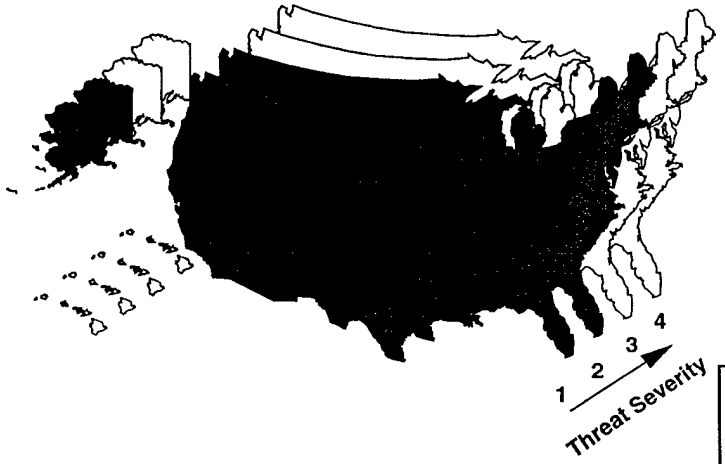


Early Capability

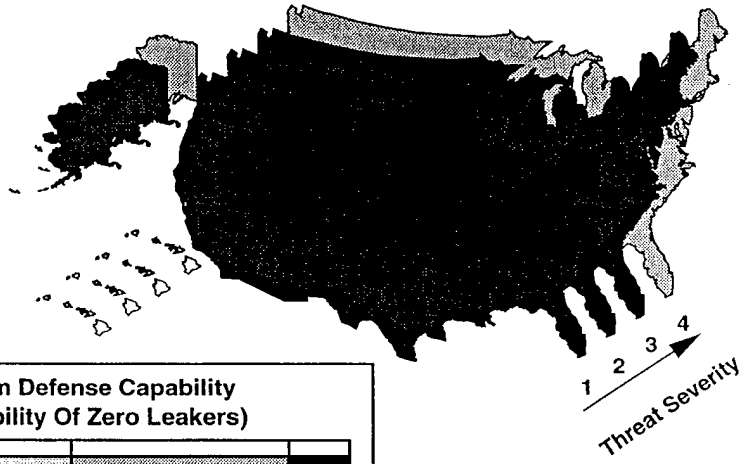


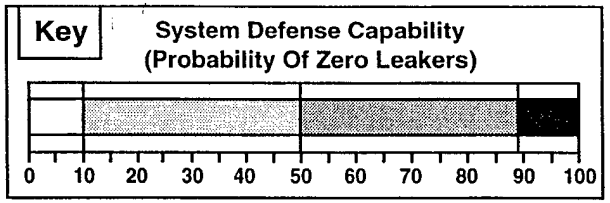
**Single Site* -
Treaty Compliant**

Mid Term Capability



Objective





* 1 Interceptor / Radar Site And Existing EWR Sites

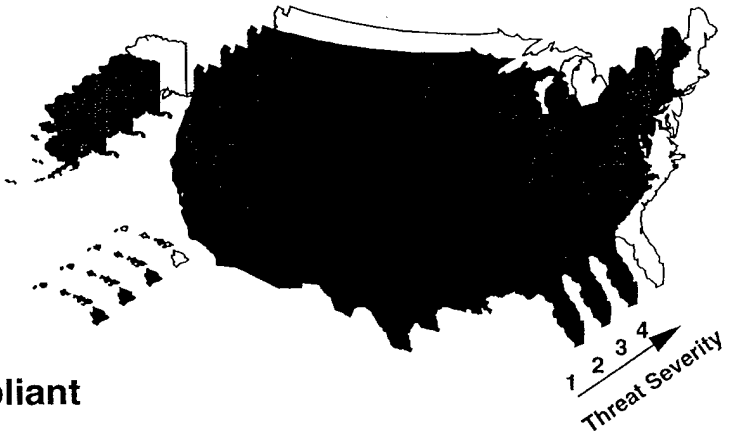
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EVOLVING NMD
MULTISITE CAPABILITY VERSUS THREAT

Today's Deployed Capability

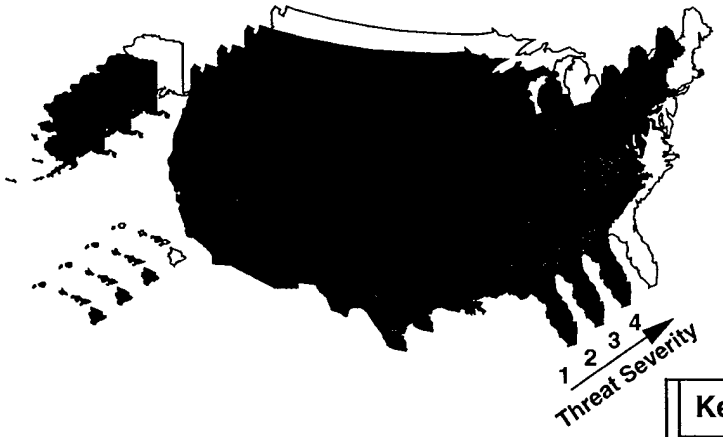


Early Capability



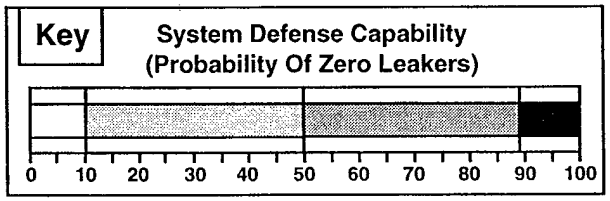
Multisite* -
Treaty Noncompliant

Mid Term Capability



Objective





* 3 Interceptor / Radar Sites -
East Coast, West Coast & Hawaii

mj-42511E / 020395

NMD TIGER TEAM
INITIAL EMERGENCY DEPLOYMENT ARCHITECTURE

Interceptors

- 20 First Generation EKV Kill Vehicles Mounted On Minuteman III* Boosters In Silos At Grand Forks
  - V_{bo} > 7 km / sec With Substantial Payload Weight Margin To Allow For Supporting Payloads
  - Nuclear Hardness Verified As > 0.01 cal / cm^2
  - Potential For Rapid Relocation

Supporting Sensors

- DSP
- Upgraded Early Warning Radars
- Link To Existing Radars Such As Millstone / Haystack, Cobra Judy, Have Stare, Relocatable Intelligence Radars, AEGIS / SPY-1
- GBR / SMTS - As Soon As Available

BM/C^3

- Open Architecture, User Approved, Linking Colorado Springs, Radar Locations, And Grand Forks

* Contingent On Deeper Analysis

mj-50150E / 022495

NMD TIGER TEAM SUMMARY

- Threat Uncertainty
  - Pace Of Proliferation And Technology Transfer
- NMD Program Requirement
  - Emergency Deployment Option (EDO) Available Soon
  - Limited Third World Threat
- Option Identified
  - ≈20 EKV On Existing Boosters, Based At Grand Forks, Supported By Existing Sensors
  - Good Protection Of Contiguous U.S. Against Limited Third World Threat
  - NMD Program Mods Identified To Achieve Two Year EDO In FY 97
  - Additional Risk Reduction Activities Identified And Recommended
- Option Not Robust Against Threat Growth In Numbers Or Sophistication Or Against Existing Russian ICBMs
  - Need GBR, SMTS, GBI To Counter

OUTLINE

- Program Rationale
- Program Guidance
- Theater Missile Defense
- National Missile Defense
- Technology Program
- Summary

ADVANCED TECHNOLOGY PROGRAM GOALS

Threats And Technology Do Not Stand Still, Therefore

- **Support TMD And NMD With *Component Technology Improvement***

Increase	*And*	Decrease
• Range		• Size
• Lethality		• Cost
• Accuracy		
• Effectiveness		

- **Pursue *Advanced Concepts* For Future Responses To An Evolving Threat**
  - **New Kill Mechanisms**
  - **High Payoff (Boost Phase Intercept)**

mj-41887 / 011895

TECHNOLOGY PROGRAM

Component

- Sensors
  - Dim Objects, Low Noise
  - Low Vibration, 10 Year Life
  - Radiation Tolerant
  - Better Tracking Accuracy
  - Resist Countermeasures
  - Solid-state Radar Modules
- Interceptors
  - Longer Range
  - Small, Cold Targets
  - Lightweight
- Phenomenology
  - Discriminate Targets From Other Objects

Advanced Concepts

- Directed Energy Boost Phase Intercept
  - High Payoff Leap Ahead Technology vs Evolved Threat
- Airborne Kinetic Energy Boost Phase Interceptor
  - Defend Against Countermeasures
  - Avoid Collateral Damage
- Innovative Science & Technology And SBIR
  - Accelerates Application Of Breakthrough Science

Support To Program

• PATRIOT • THAAD • GBR
• AEGIS • BE • GBI

Create New Options

Future
TMD And NMD

mj-41888E / 022495

INVESTMENT IN BOOST PHASE INTERCEPT CONCEPTS IS VERY HIGH LEVERAGE

- Boost Phase Intercept (All Concepts)
  - Debris Potentially Falls In Enemy Territory
  - Counters Evolving, Proliferating Threat
  - Enhances Defense Against All Viable Countermeasures
  - Provides Independent Tier
- Boost Phase Intercept (SBL)
  - Uniquely Provides Defense In:
    - Surprise Attack Scenarios
    - Rapidly Escalating Scenarios
  - Provides Continuous Near Global Coverage

RESEARCH / EXPLORATORY DEVELOPMENT (IS&T, SBIR)

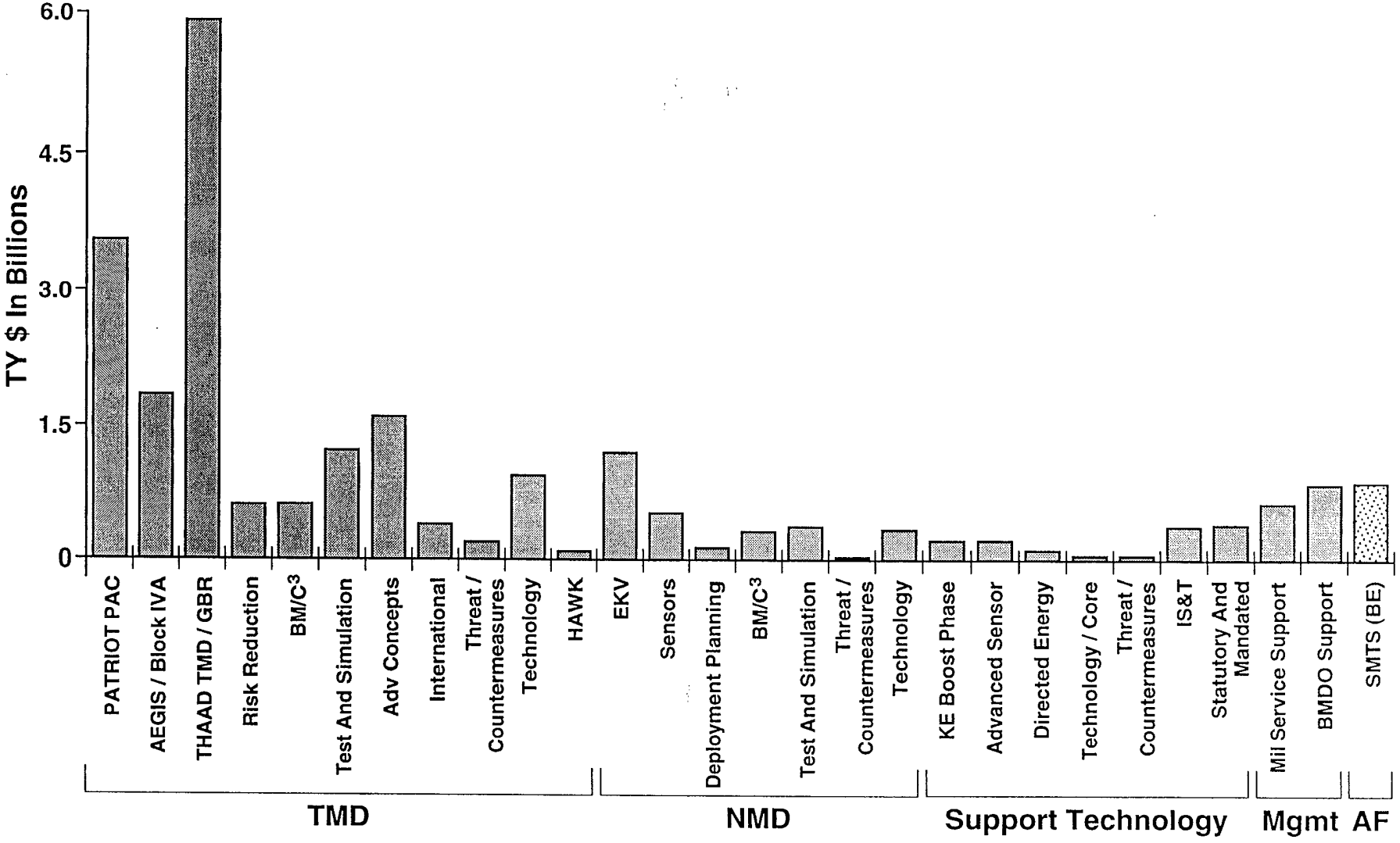
- Innovative Science And Technology (IS&T)
  - Research And Exploratory Development Targeting Breakthrough Technologies For Ballistic Missile Defense
  - Core R&D Program In Sensing, Directed / Kinetic Energy, Materials, Propulsion, Power, And Information Processing
- Small Business Innovative Research (SBIR)
  - Mandated Percentage Of Extramural R&D

OUTLINE

- Program Rationale
- Program Guidance
- Theater Missile Defense
- National Missile Defense
- Technology Program
- Summary

BMDO RESOURCES

(FY 95-01)



mj-42377M / 010495

SUMMARY

- Program Designed To Address Post Cold War Environment And Affordability Issues

- TMD Program Strategy
  - Builds On Existing Systems To Provide Near Term Capability To Meet Existing Threats

  - Adds New Systems And Enhancements To Provide Robust Protection

- NMD Program Strategy
  - Maintains And Matures Tech Base Given Threat Uncertainty

  - Provides For Evolutionary Contingency Deployment Options If Threat Suddenly Emerges

- Technology Program Focuses On Critical Technologies To Increase Capability And To Reduce Deployment Time Lines And Program Costs

Program Meets National Security Goal For Missile Defense

Advance Planning Briefing For Industry
Near Term Programs



7 MAR 95

Col John Upton, USMC
Director, System Applications
Acquisition / Theater Missile Defense Deputate
Ballistic Missile Defense Organization

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Outline

I will brief the current efforts as listed on the chart .
First the Marine Corps TMD Initiative.

OUTLINE

- **USMC TMD Initiative**
- **TALON SHIELD**
- **AWACS EAGLE**
- **Sensor Cueing**
- **Current Systems Improvement Program**

Concept Of Operations

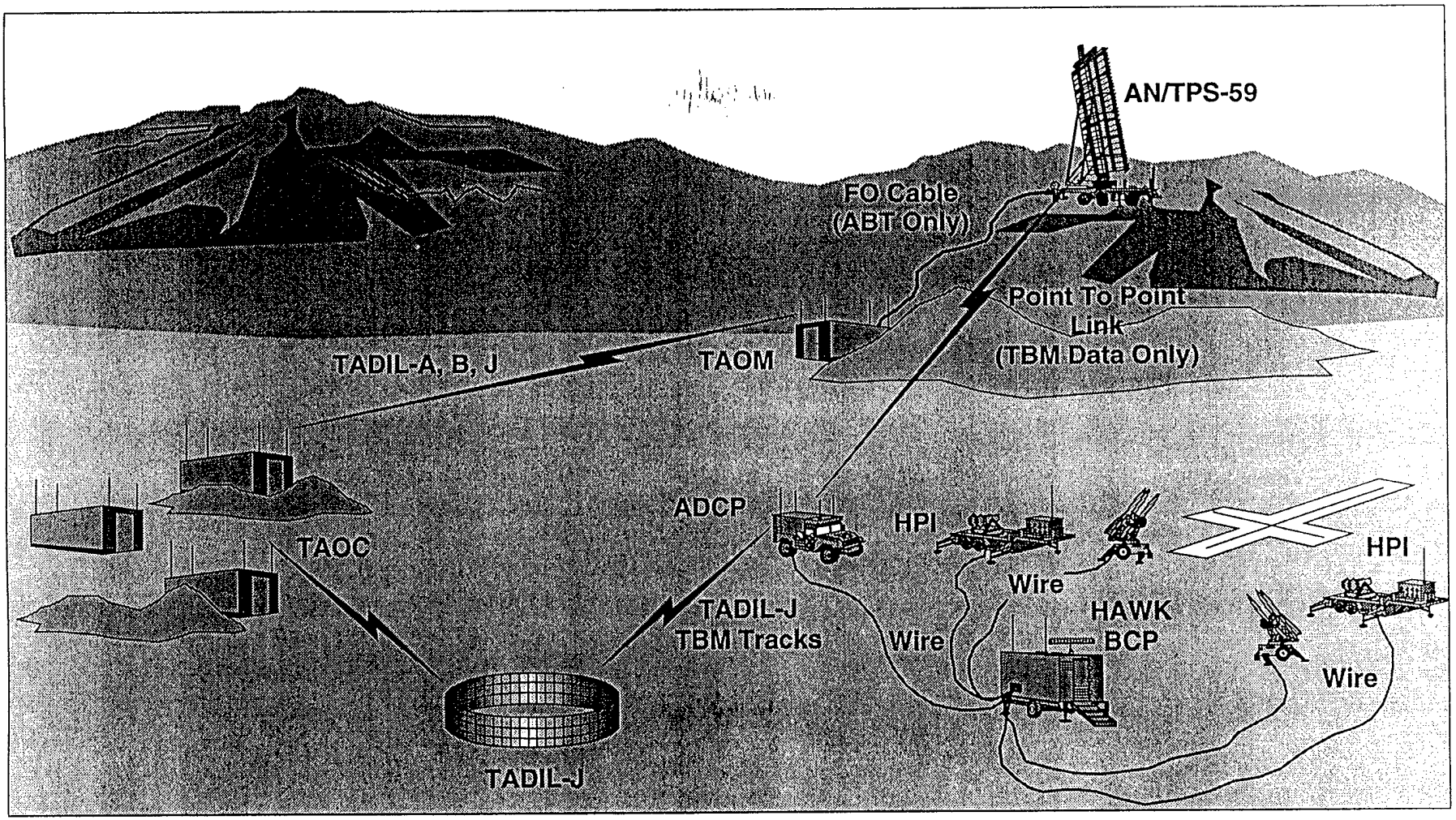
This diagram depicts the equipment and communications protocols which will be employed by the Marines during a TMD battle.

The TPS-59 will detect, classify, and track both TBMs and ABTs. The TBM targets can be detected at ranges out to 740 km and at altitudes up to 240 km. The TPS-59 will output TBM messages to the Air Defense Communications Platform (ADCP) and ABT messages to the Tactical Air Operations Center (TAOC). The TAOC is responsible for the decentralized execution of the air battle and will assign ABT targets for engagement by HAWK. The TAOC will also allow through the rules of engagement for HAWK to engage threatening TBMs.

The ADCP will filter out TBM threats that are not engageable by HAWK and will translate the TPS-59 data into intra-battery data link (IBDL) for use by HAWK.

HAWK will engage the target by assigning an HPI to detect and lock on to the target and then engaging the TBM with a HAWK improved lethality missile (ILM) guided by the HPI RF energy.

CONCEPT OF OPERATIONS



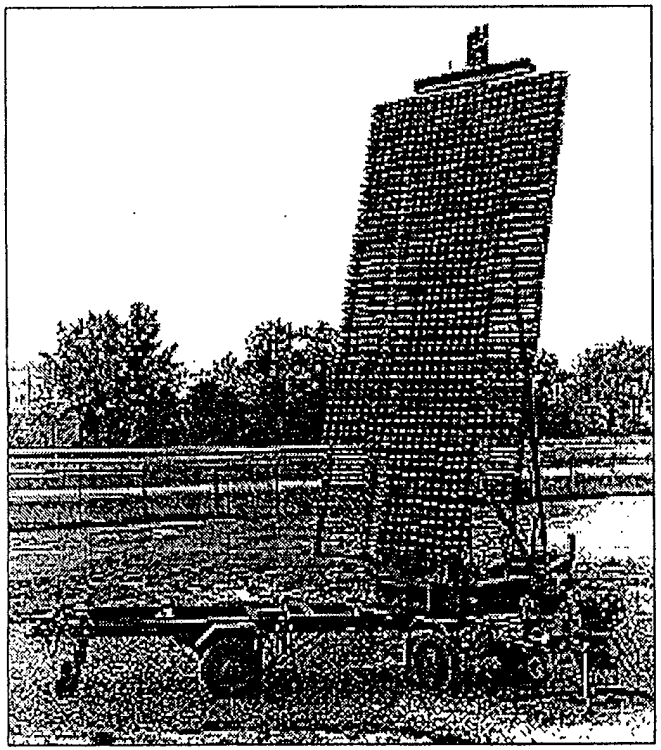
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TPS-59 And USMC HAWK

The Marine Corps' TMD initiative is jointly funded with BMDO and will yield a low-risk, near-term capability for expeditionary forces against short-range ballistic missiles. The program consists of modifying the TPS-59 long-range surveillance radar and the HAWK weapon system to allow detection, tracking, and engagement of short-range TBMs. The program will also provide a communications interface by developing the ADCP.

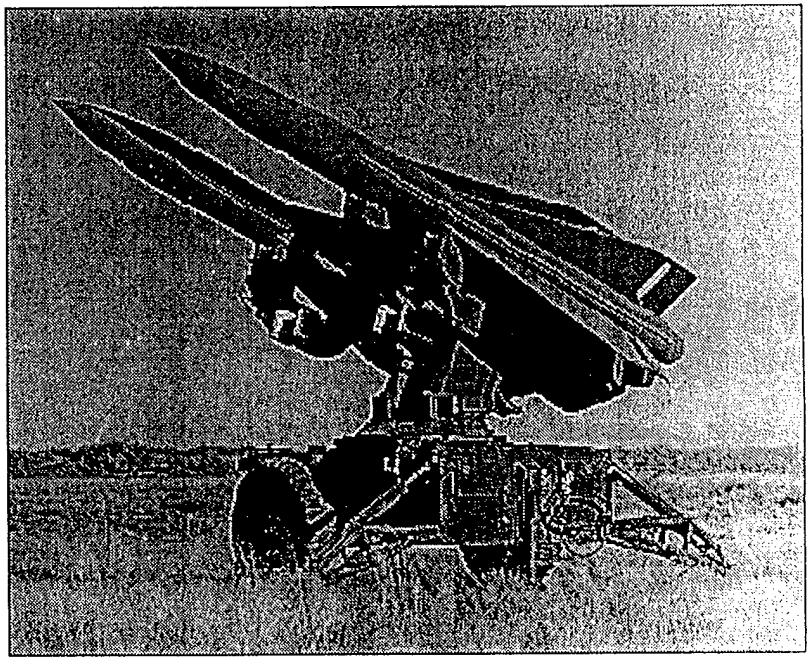
The next slide contains the schedule for the Marine Corps TMD Initiative.

TPS-59 AND USMC HAWK



BMDO Funded

- Upgrade TPS-59 To Provide Enhanced TBM Surveillance And Tracking Capability
- Air Defense Command Post To Act As A Node For Tactical Nets
  - Make TPS-59 Data Available On A JTIDS Net
- Modify Battery Command Post To Accept TPS-59 Data, For Acquisition By HAWK Radar
- Upgrade HAWK Missile Fuze And Warhead For TBM Engagements



USMC Funded

- Upgrade Of HAWK Launcher To Interface With Digital Missiles
- Upgrade Of HAWK Launcher To Increase Mobility

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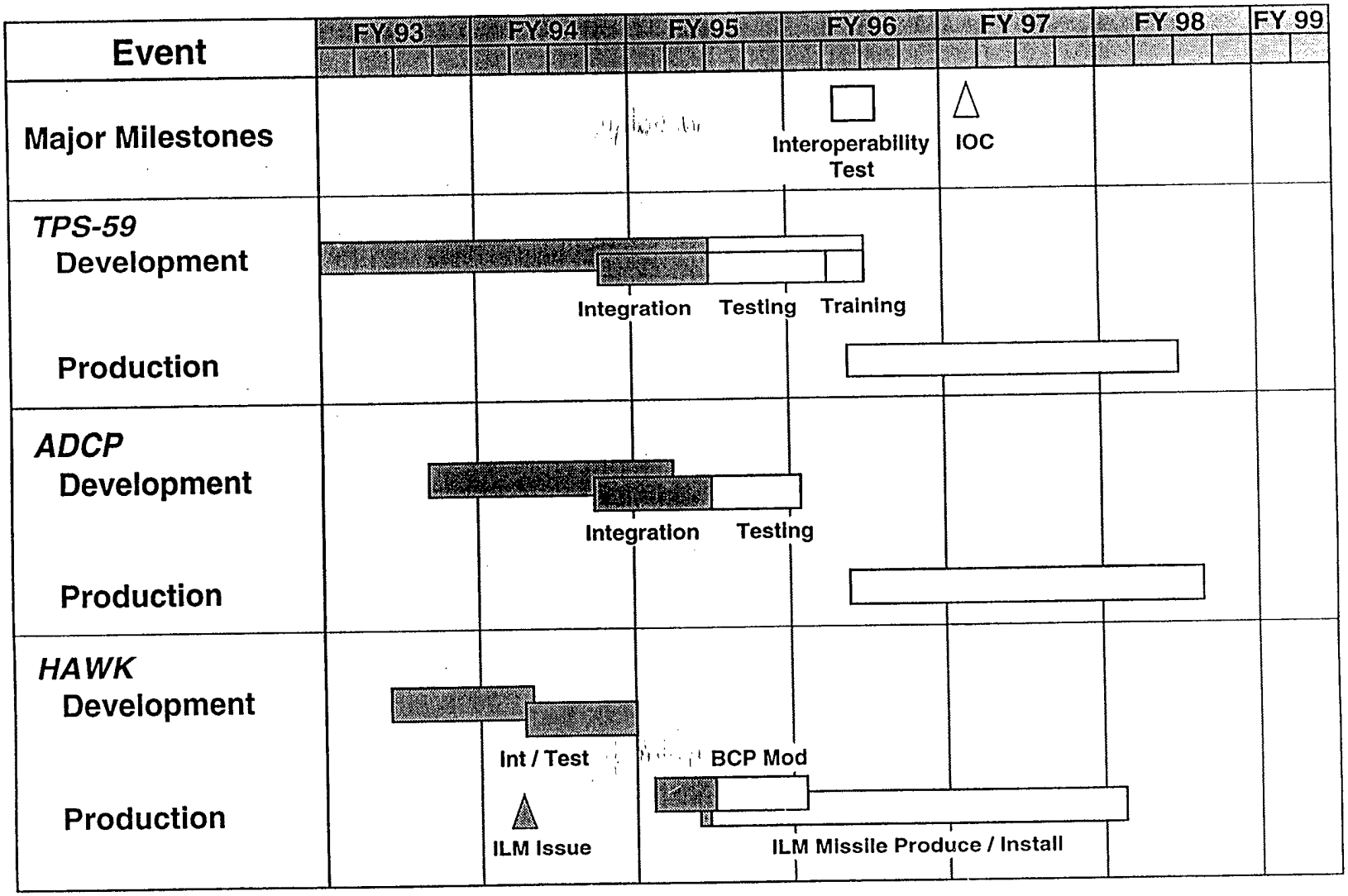
HAWK Schedule

The schedule for the Marine Corps TMD Initiative is shown here. TPS-59 technical, developmental, and operational testing is scheduled for FY 1995 and FY 1996 with production starting in FY 1996.

The HAWK weapon system modifications include upgrades to the Battery Command Post (BCP) and improvements to the missile. The modified HAWK BCP will process cueing data to control the high power illuminator radar. The missile changes will incorporate fuse and warhead improvements. The BCP and missile modifications are currently in production.

The ADCP will convert TPS-59 data messages in to TADIL-J data for transmission to other theater sensors and will provide data to HAWK. The ADCP is presently undergoing system integration. The ADCP will be tested in conjunction with TPS-59 testing during FY 1995 and FY 1996 and will begin production in FY 1996.

HAWK SYSTEM SCHEDULE



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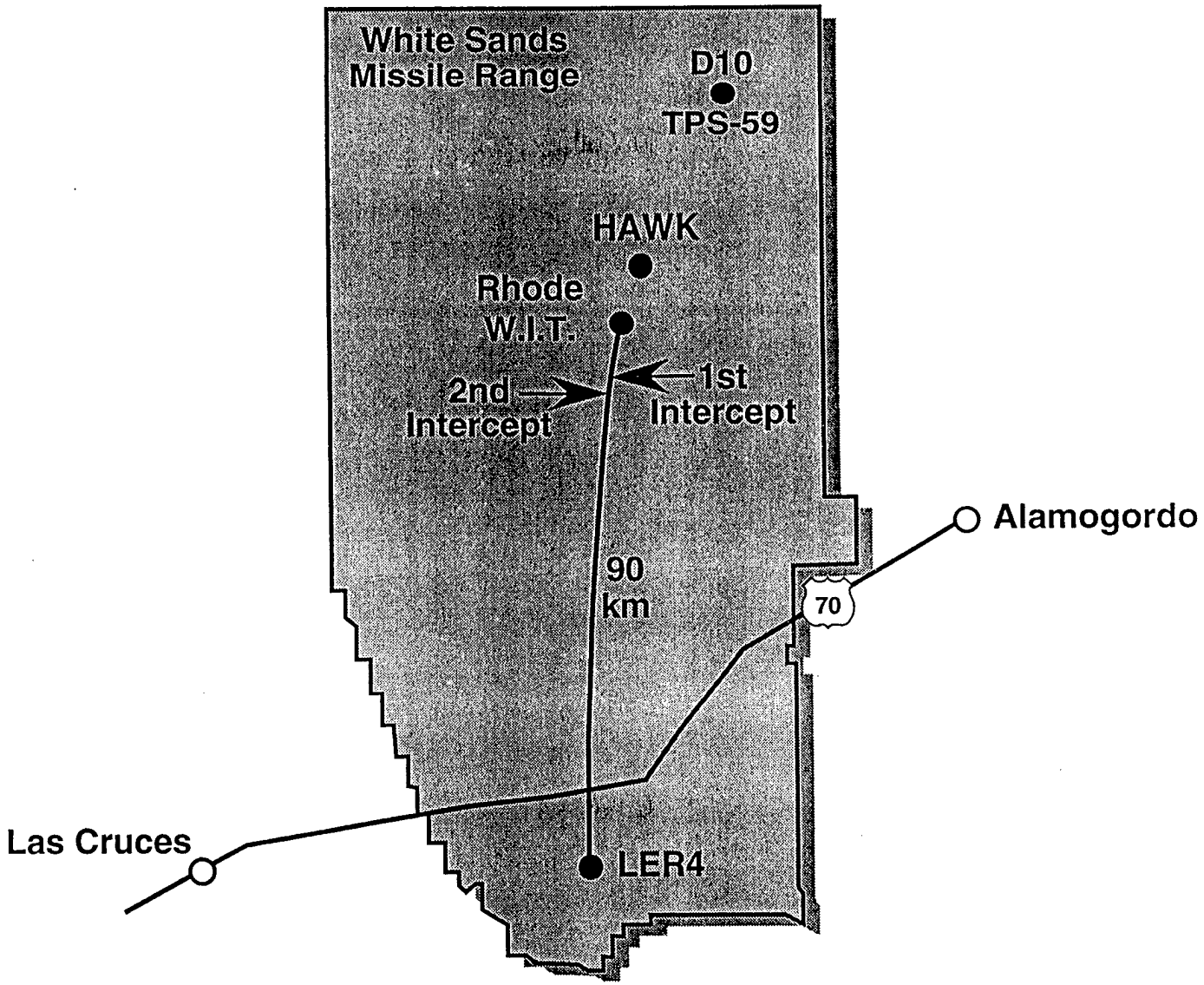
Marine Corps Demonstration Equipment Location

This slide depicts the location of the Marine Corps' equipment during a TMD demonstration conducted in September, 1994.

The TPS-59 was located about 40 km from the HAWK and HAWK was about 5 km from the expected impact point.

Lance missiles were launched from south to north as shown. The next slide shows the results of the demonstration.

MARINE CORPS DEMONSTRATION EQUIPMENT LOCATION



mj-48231 / 022495

Marine Corps Demonstration Results

The purpose of the demonstration was to check out the operation of a Multi-scan Correlator/Missile Tracker that was installed in the TPS-59 and to verify the operation of the HAWK BCP modifications.

As the slide shows, three Lance missiles were fired separated by 20 minutes and 1 hour respectively.

The results of each engagement are shown on the slide.

The demonstration was a success and has increased foreign interest in this program.

MARINE CORPS DEMONSTRATION RESULTS

- Three Lance Targets
  - First Target Launched 20 Minutes Before Second
  - Second Target Launched 1 Hour Before Third
- First Engagement - Heart Of The Envelope
  - Intercept Occurred 17.3 km Downrange, 4.6 km Cross Range, and 9.1 km Altitude
- Second Engagement - Extended The Envelope
  - Intercept Occurred 18.7 km Downrange, 5.0 km Cross Range, and 10.6 km Altitude
- Third Engagement - Beyond The Edge Of The Envelope
  - Neither HAWK Achieved Front-end Lock Of Target

Outline

The next topic that I will discuss is Talon Shield.

OUTLINE

- USMC TMD Initiative
- TALON SHIELD
- AWACS EAGLE
- Sensor Cueing
- Current Systems Improvement Program

mj-50318 / 022495

Talon Shield Overview

Talon Shield processing equipment, located at Falcon Air Force Base, receives and processes DSP and other national intelligence data on TBM events to provide timely warning of TBM launch point, time, and azimuth along with impact point predictions to tactical units.

The Air Force has fielded an operational version of Talon Shield and activated the first ALERT squadron during October, 1994.

TALON SHIELD OVERVIEW

- Real-time Data Fusion Using Multiple DSP Satellites Plus Other Sensors
- Detects And Tracks Much Dimmer Targets Than Mono System, With Faster Track Reporting And Better State Vector Accuracy
- Software And Hardware Installed At Falcon AFB, CO
- Air Force Built An Operational Version Called ALERT
- First Squadron Activated 1 OCT 94
- BMDO Commitment To Finish Other Sensor Integration And Software Development FY 95-98

Outline

The next topic that I will discuss is the Extended Airborne Global Launch Evaluator (EAGLE).

OUTLINE

- USMC TMD Initiative
- TALON SHIELD
- AWACS EAGLE
- Sensor Cueing
- Current Systems Improvement Program

mj-50319 / 022495

AWACS EAGLE Program Summary

EAGLE consists of a passive infrared search and track sensor and an eye-safe laser-ranger installed aboard the AWACS aircraft. EAGLE will provide precise cues to deployed theater sensors and highly accurate TBM launch point estimates and impact point predictions.

EAGLE has the greatest utility against mid- and long-range threats with ranges greater than 600 km. Eagle can be used to provide single beam cues to theater sensors which allows extended acquisition range and greater defended areas.

EAGLE will be installed within the next three years upon the AWACS TS-3 test aircraft and used for demonstrations .

AWACS EAGLE PROGRAM SUMMARY

- Greatest Utility Is Against Mid- And Long-range Threats (600+ km)
- Late Boost And Early Post Boost Tracking
- Consists Of An Infrared Search And Track Sensor And An Eye-safe Laser Ranger
- Can Produce More Precise Cues Than Existing Space Based Sensors, Providing *Combat Capability....*
  - Extra Time For Battle Management
  - Fire Control Radars Can Acquire Targets Farther Out – Bigger Footprint
  - Radars Can Handle More Targets
  - Operators May Employ EMCON
  - Aids In Degraded Environments
- Technology And Engineering Risk Reasonable
- Demonstration In Three Years With Full User Support

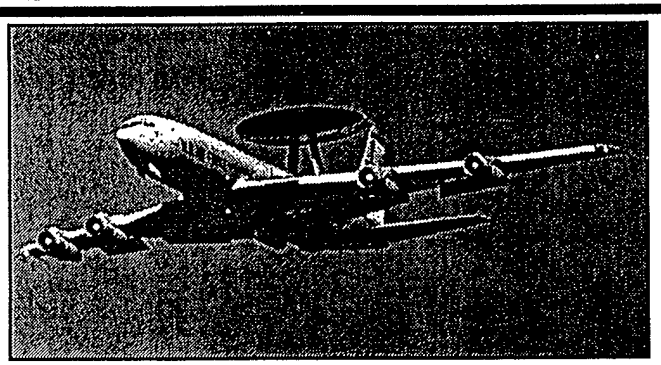
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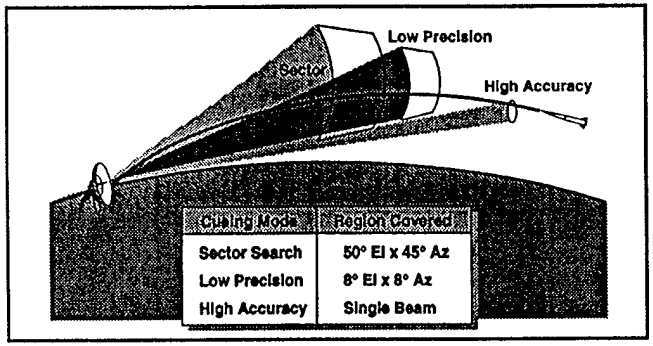
AWACS EAGLE
(Infrared Search And Track)

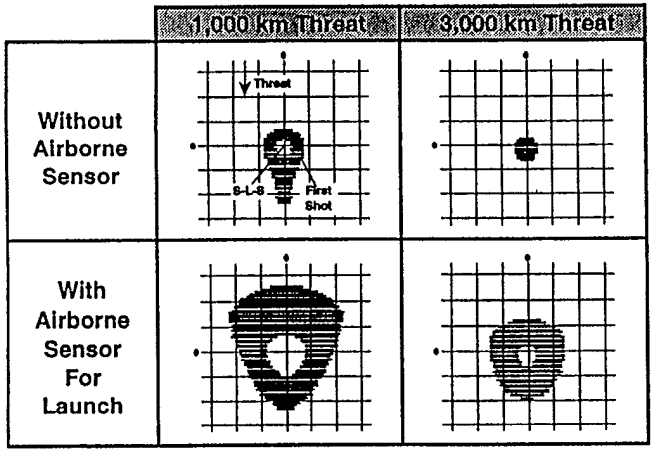
The AWACS EAGLE program is an effort to develop and field a highly precise cueing sensor aboard the AWACS TS-3 test aircraft. This type of cueing maximizes the footprints that our interceptors can defend by telling fire control radar systems when and where to look for the incoming threat. As the middle diagram shows, these single-beam cues enable the earliest possible radar acquisition. EAGLE detects the threat shortly before burnout using a medium wave infrared (MWIR) sensor and tracks it for a few seconds after burnout. With the aid of an eye-safe laser ranger, EAGLE generates a trajectory that is far more accurate than the projections available from space-based sensors.

The black areas in the center of the bottom diagrams depict representative footprints defended by an interceptor system co-located at the center point. Cueing offers the greatest benefits against threats of greater than 600 km range. As the diagrams illustrate, precision cueing dramatically expands the defended areas. Black areas can be defended with one shot or salvo, while the smaller white areas can be defended with two.

AWACS EAGLE
(INFRARED SEARCH AND TRACK)







- Objective
  - Develop And Demonstrate Prototype Airborne Sensor For Late Boost / Early Post Boost Missile Detection And Tracking
  - Transmit Highly Precise Cues To Fire Control Radars To Maximize Footprints And Situational Awareness
- Status
  - ACC Approved The Concept Of Operations
  - On Track For 1Q FY 98 Fielding Aboard AWACS TS-3 Test Aircraft
  - Potential French Role

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AWACS EAGLE Current Status

The EAGLE technical requirements document has been completed and acquisition planning is in progress .

The EAGLE program has high-level Air Force support with an approved concept of operations and an operational requirements document nearing completion.

AWACS EAGLE CURRENT STATUS

- EAGLE Technical Requirements Document Completed
  - Threat, Scenarios, Sensor Performance, Reporting Time
- Acquisition Planning / Documentation In Progress
  - ESC / AWD-D (AWACS SPO)
  - Contract Award Anticipated 4Q FY 95 (Boeing Prime, Compete The Sensor)
  - Prototype Sensor Design / Fabrication / Integration Onto AWACS TS-3 Test Aircraft (November 1997)
- Air Combat Command (ACC) Concept Of Operation Signed
- ACC Operational Requirements Document In Draft For Final Comments

mj-40508 / 022495

Outline

The next topic that I will discuss is Sensor Cueing.

OUTLINE

- USMC TMD Initiative
- TALON SHIELD
- AWACS EAGLE
- Sensor Cueing
- Current Systems Improvement Program

mj-50320 / 022495

Tactical Advantages Of Cueing

Cueing provides extended target acquisition range for fire control sensors. Cueing prevents the radar from limiting the defended area and allows for the full kinematic capability of the missile to be used.

Cueing can also improve the sensor's performance in non-benign environments such as weather or jamming because the cueing sensor will not be affected by weather or jamming to the same level as the fire control system due to different viewing angles and frequency spectrum.

TACTICAL ADVANTAGES OF CUEING

- Extending Target Acquisition Range Through Cueing Prevents Radar From Limiting Defended Area Footprints
- Reduces Radar Loading For TBM Detection And Track By Decreasing Search Volume
- Improves Beam Scheduling To Handle TBM Saturation Raids
- Emission Control (EMCON) Easier To Implement To Counter ARMs
- Provides Target Acquisition In Non-benign RF Environments (i.e., ECM, Weather)

Theater Tactical Approach

The approach to tactical cueing is depicted on this slide. This program includes providing cueing from JTAGS, SPY-1, and TPS-59 to PATRIOT's MPQ-53 radar. The plan is to use tactical communications between the sensors.

A JTAGS to MPQ-53 cueing mission will be conducted this June at White Sands Missile Range.

A dual cueing mission using the TPS-59 and JTAGS to the MPQ-53 will be conducted during 1996.

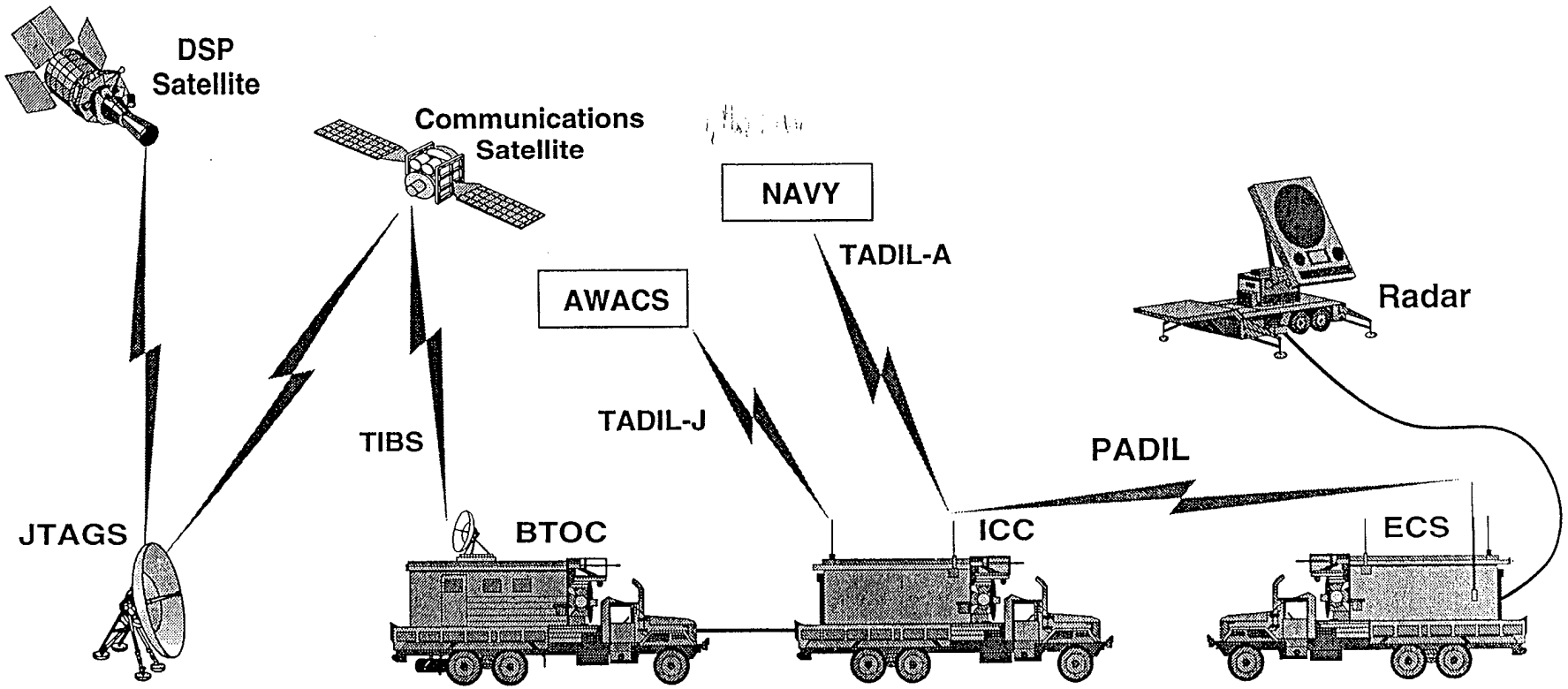
THEATER TACTICAL APPROACH

- Define Near Term Communications Architecture For All Theater Sensors
  - SPY-1, TPS-59, MPQ-53, DSP
- Desire To Use JTIDS Or TIBS
- Conducted "Admin Cue" Demo In September 1993 Using JTAGS To MPQ-53 And TPS-59 To MPQ-53 Connectivity
- Conduct JTAGS To MPQ-53 Cueing Mission During June 1995 Using TIBS
- Conduct JTAGS And TPS-59 To MPQ-53 Cueing Mission During FY 96 Using JTIDS And TIBS

Cued Patriot Demonstration

The cueing and netting program is providing improvements to PATRIOT software that allows the MPQ-53 PATRIOT radar to receive and process cueing information over tactical data links. These cues allow the radar to use a small number of high powered beams to acquire Tactical Ballistic Missiles at a significantly longer range than possible in a standard search mode. In FY 95, the program is coding and testing cueing software, integrating the code into designated PATRIOT equipment, and conducting a tactical demonstration against a target launched from White Sands Missile Range for another program. Cues will be received from DSP via JTAGS and from any IR or radar sensor capable of sending missile warning messages via TIBS.

CUED PATRIOT DEMONSTRATION



- Launch Point Estimate
- Burnout State Vector And Covariance Data
- Impact Point Prediction
- Boost Phase Detection

- Alert Unit
- TAC Planner Display
  - Launch Point
  - In Flight Position
  - Impact Point
- Reformat TIBS Messages To PADIL

- Discard Nonthreatening Cues
- Correlate Cues And Tracks To Prevent Redundancies
- Determine FU Engageabilty
- Direct FU Acquisition

- Execute Cued Acquisition Requested By ICC
  - Search Pattern
  - Initiation / Stop Logic
  - High Energy Waveform Directive Search

mj-49485B / 022495

Outline

The last program that I will brief is the Current Systems Improvement Program (CSIP).

OUTLINE

- USMC TMD Initiative
- TALON SHIELD
- AWACS EAGLE
- Sensor Cueing
- Current Systems Improvement Program

mj-50321 / 022495

Current Systems Improvement Program (CSIP)

CSIP was started during FY 1994 to provide the Services and BMDO with a standardized process to identify TMD improvements to existing systems which could be implemented within 4 years. The program's goal was that each improvement would directly lead to a capability which would be fielded within one or more Services.

The CSIP working group evaluated over 30 proposed improvements as part of this process. 3 joint improvements were recommended by the working group for continued consideration.

Improvements to the Air Force's Control Reporting Center and Marine Corps' Tactical Air Operations Center were initiated as part of CSIP.

CURRENT SYSTEMS IMPROVEMENT PROGRAM (CSIP)

- CSIP Initiated November 1993 And Continued Throughout FY 94
  - Program Provides The Services And BMDO With A Standardized Process To Identify TMD Improvements To Existing Systems Which Can Be Implemented Within Four Years
  - Numerous CSIP O-6 Level Working Groups Were Conducted In FY 94
    - Evaluated 32 Proposed Improvements Based Upon Value Added To The Overall TMD Program's Goals
    - Recommended Three Joint Improvements To The Flag Officer Steering Committee (FOSC)
  - CSIP FOSC Reviewed Working Group Results And Provided Feedback To RADM West
  - CSIP Program Plan Approved 22 JUN 94
- CSIP Is Providing Partial FY 95 Funding For One Improvement
  - Combat Information Center / SAAWC Operations Facility (CIC / SOF)

Combat Information Center/SAAWC Operations Facility (CIC/SOF)

The Combat Information Center/ SAAWC Operations Facility is a joint effort to improve the CRC/TAOC.

The CIC/SOF provides the information needed to accomplish the command and control functions required for the decentralized execution of the TMD battle.

The use of current intelligence and a common air and ground picture which contains missile tracks will allow the warfighter to readily use the time-sensitive combat information available to them.

COMBAT INFORMATION CENTER / SAAWC OPERATIONS FACILITY (CIC / SOF)

- Joint Air Force / Marine Corps Effort
- CIC / SOF Provides Improved Receipt And Useability Of Time Sensitive Combat Information At The Combat Reporting Center / Tactical Air Operations Center (CRC / TAOC) For
  - Area Limitation / Sensor Integration (AL / SI)
  - Tracking Of Missile Targets
  - Developing A Common Air And Ground Picture
  - Receiving And Automatically Processing The Joint Air Tasking Order (ATO)
- Improved CRC / TAOC Will Provide C^2 Functions Needed To Accomplish Decentralized Execution Of The TMD Battle

Advance Planning Briefing To Industry
TMD C^3 Program

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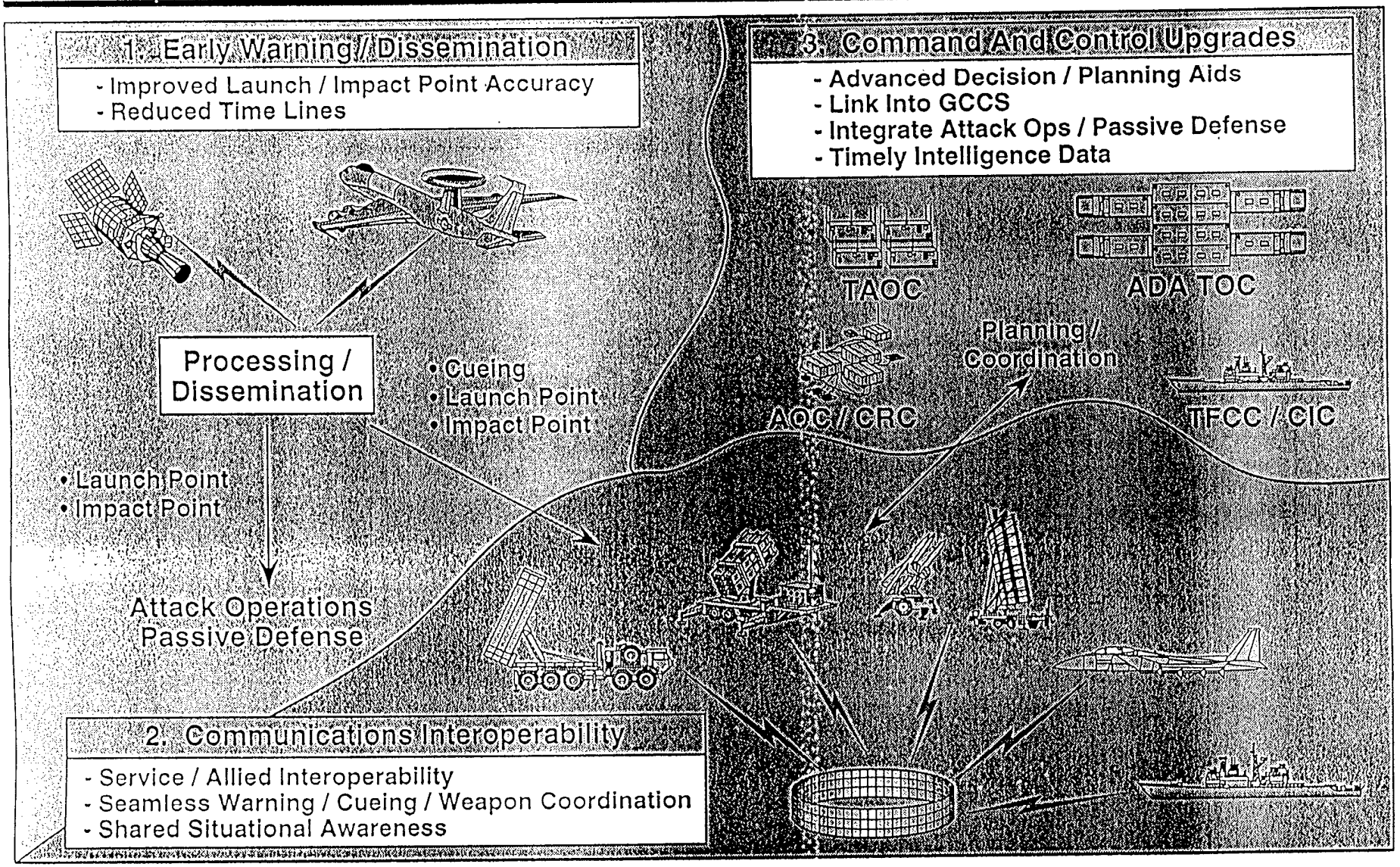
Col Richard A. Ritter, USAF
Director, System Integration / BM/C^3
Acquisition / Theater Missile Defense Deputate
Ballistic Missile Defense Organization

TMD C^3 ARCHITECTURE GUIDELINES

- Theater Missile Defense (TMD) Is An Extension Of Theater Air Defense
- TMD C^3 Must Integrate With And Capitalize On Existing Heavy Service Investment In Air Defense C^3
- Must Include Timely Warning And Cueing From Space, Air, Ground, And Sea Based Surveillance
- Service / Joint / Allied Interoperability Is Critical

Provide The CINC A C^3 Capability With The Flexibility For A Wide Range Of TBM Scenarios And Deployments

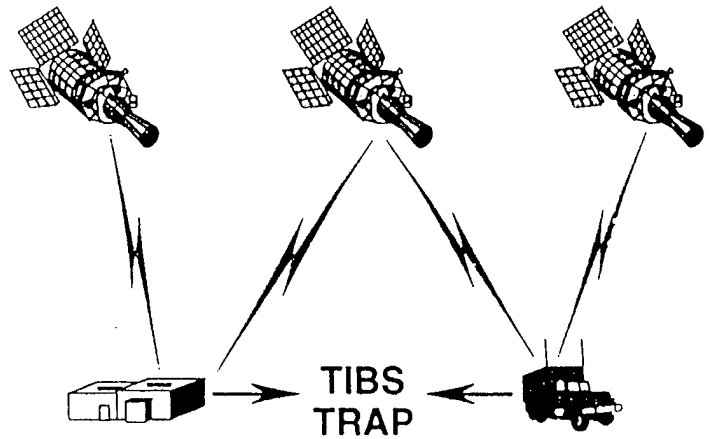
TMD C^3 PROGRAM
MAJOR THRUSTS AND OBJECTIVES



mj-49095 / 012095

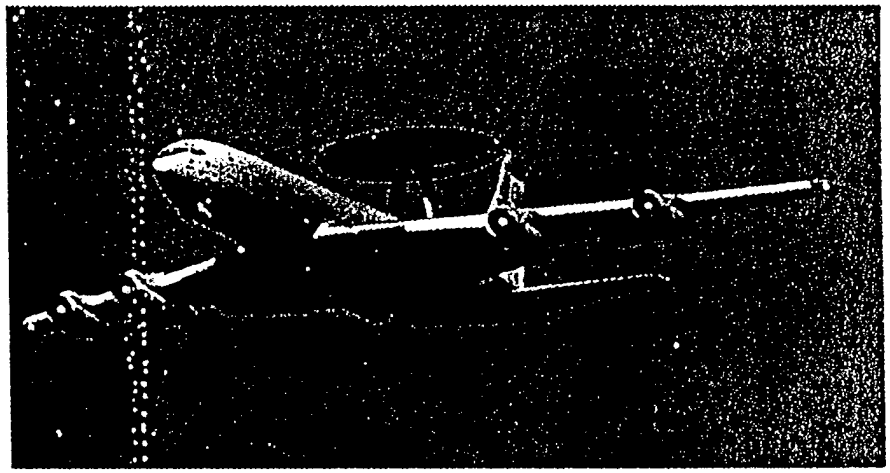
EARLY WARNING AND DISSEMINATION

ALERT / JTAGS
Stereo DSP Processing



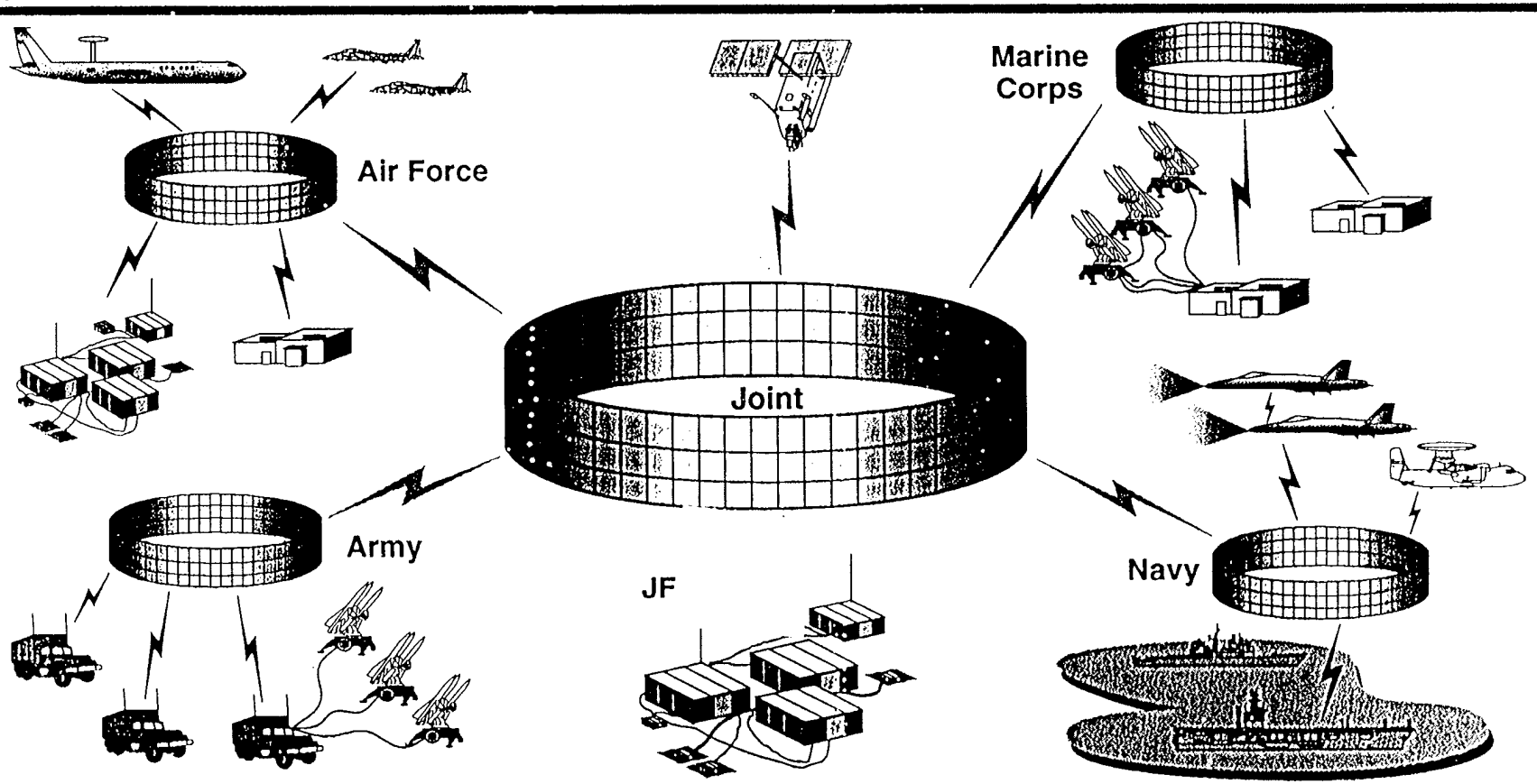
- Objective
  - Improve Accuracy And Timeliness Of Warning Data
  - Provide Missile Track Data To ALERT And Cue Surveillance And Fire Control Radars

AWACS EAGLE
IRST And Laser Ranger



- Benefits
  - Increase Fire Control Radar Acquisition Range And Defended Footprint
  - More Accurate / Timely Launch And Impact Point Predictions For Attack Operations And Passive Defense

TMD JOINT SURVEILLANCE ARCHITECTURE



- JTIDS Based
- Accommodates New Platforms
- Supports ASD C^3I Tactical Data Link Policy

- Theater CINC Flexibility
- Seamless Information Transfer
- Interoperability With
- Services / Allies

- Early Warning / Cueing
  - Launch Point
  - Impact Point
  - State Vector

- Weapon Coordination
- Near Real-time Information
- Situational Awareness
- Shared Surveillance Information

mj-31034F / 010695

THEATER DEFENSE NETTING STUDY CONCLUSIONS

- Netting Effectiveness Is Scenario Dependent, But It Generally Improves The Defense Effectiveness
- Netting Benefit Is A Function Of Sensor Overlap, With A Higher Payoff For Cruise Missile (CM) Defense - Especially For Supersonic Cruise Missiles
- JTIDS / CEC Complementary
- CEC / Platform Integration / Cost Trade Studies Required (AWACS, PATRIOT, THAAD)
- ~~Advanced~~ An Enhanced Airborne Sensor Platform Could Restores Coverage Lost To Low Altitude, Small RCS CM
  - Platform Could Be Integrated Into JTIDS / CEC

TMD C^3 INTEROPERABILITY STATUS

Established

- TADIL-J / Link 16 As Primary TBM Data Link

- Standard DoD Ballistic Missile Messages
  - Launch And Impact Point
  - Missile State Vector
  - Reporting Responsibilities
  - Engagement / Coordination

- Joint Data Net Concept
  - Army JTIDS Procurement Baselined And Funded

Future

- NATO Approval Of Standards Expected March 1995

- Standard Integrated Into TIBS Intell Net FY 95

TBMD C^2 LEVELS AND FUNCTIONS

Theater Level

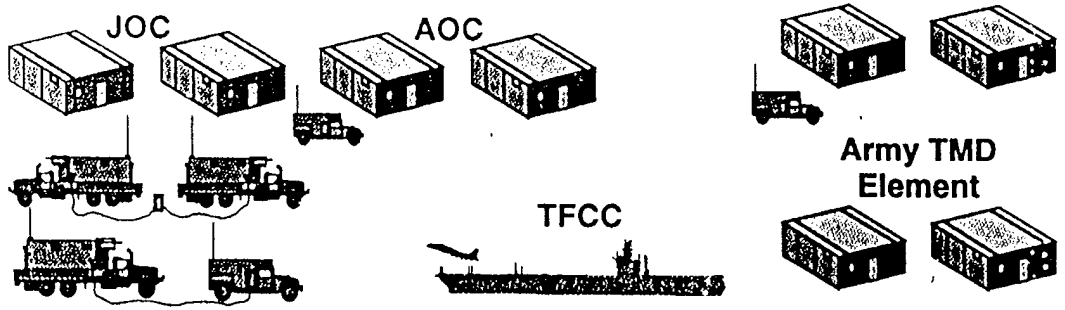
JOC

AOC

TACC-MC

Army TMD Element

TFCC



Planning

- Establishes Rules Of Engagement
- Establishes Defended Asset Priorities
- Provides Defense Guidance And Planning
- Directs Readiness States
- Conducts Theater Performance Assessment
- Manages Joint Data Network

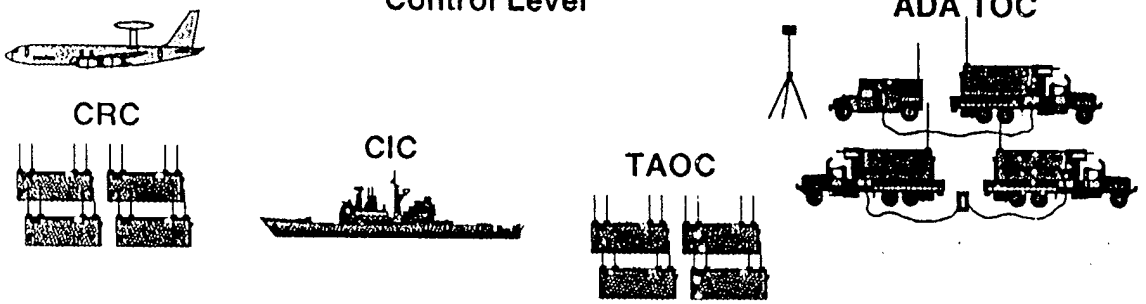
Control Level

CRC

CIC

TAOC

ADA TOC



Force Coordination

- Recommends Defense Guidance
- Provides Weapon / Sensor Control
- Manages Airspace Coordination
- Coordinates Engagements
- Reports Force Status
- Develops Defense Design
- Establishes Warning / Weapon States

Weapon System Level

THAAD

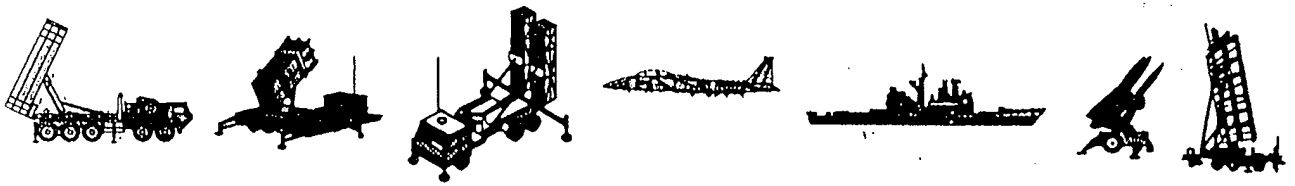
PATRIOT

Corps SAM

BPI

Navy TBMD

HAWK / TPS-59

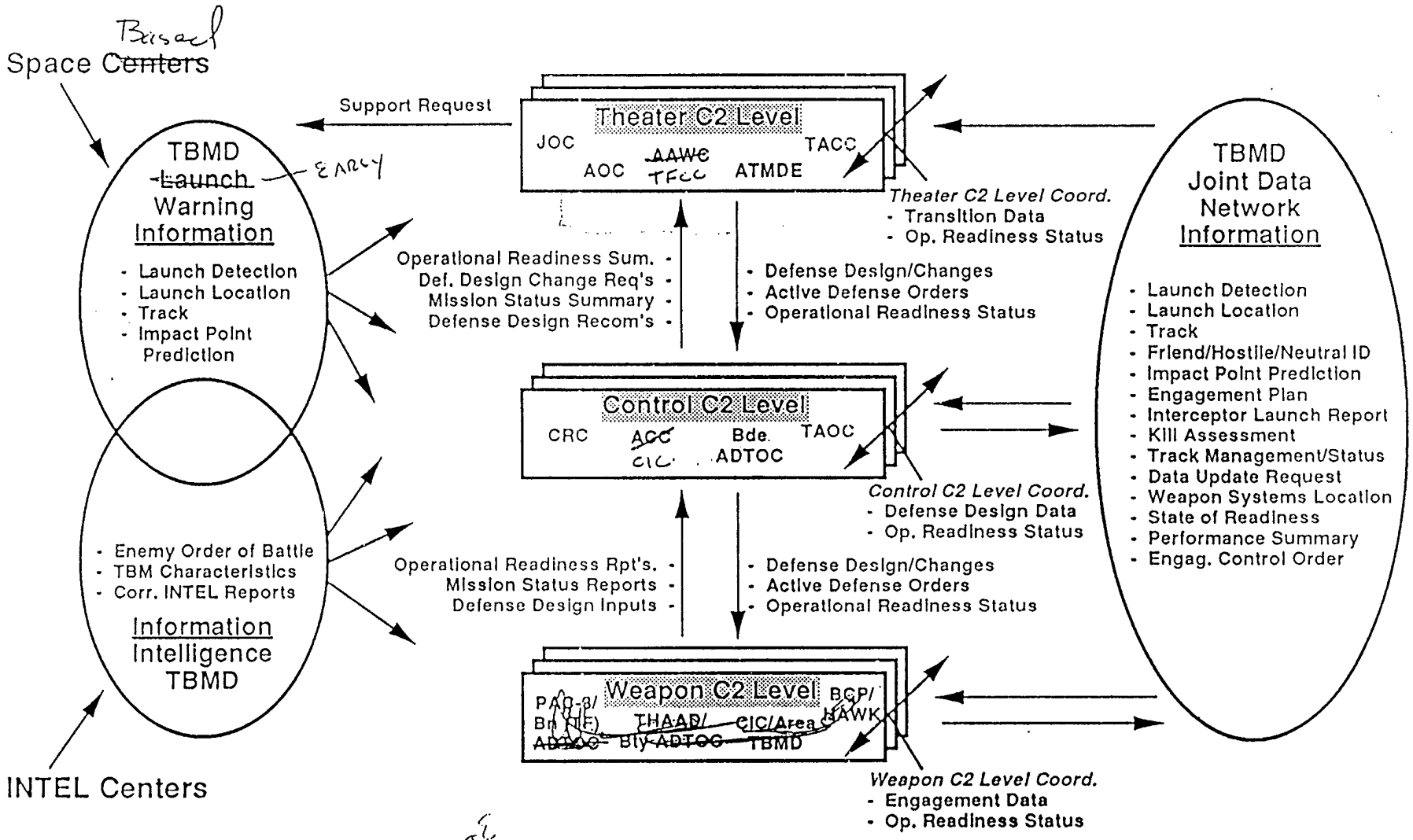


Execution

- Implements Defense Design
- Performs Weapon / Target Pairings
- Conducts Engagements
- Reports Engagement Status

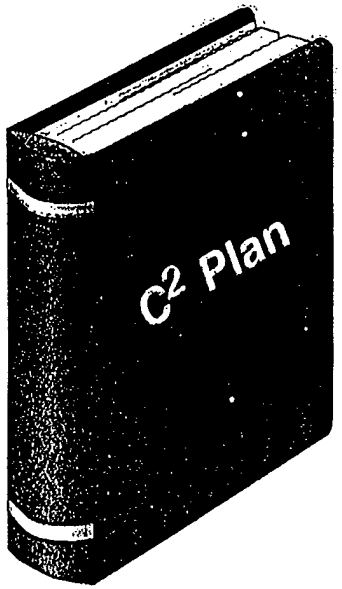
Major TBMD Information Exchange

- Active Defense -



MITRE

COMMAND AND CONTROL PLAN



Purpose

- Supports TMD Capstone COEA
- Foundation For TAD BM/C^4I EA Architecture Effort

Enduring Impacts

- ASD(C^3I) Acquisition Decisions
- Guidance To BMDO / Service TAD BM/C^4I Programs
- Information To CINCs

Contains

- TMD Operational Concept
- TMD BM/C^4I Integration Architecture
- Implementation Strategies
- Identification Of Necessary Interoperability Demonstrations

REVIEW GROUP GUIDANCE SUMMARY

- Focus On Active Defense And Identify Contributions To Attack Operations And Passive Defense
- Includes Both Ballistic And Cruise Missile
  - Initial Focus On Ballistic Missiles (March 1995)
- Advanced Concepts Such As Advanced Airborne Surveillance To Be Treated Notionally
- Focus On Primary Cruise Missile C^3 Problem - Search, Detect, Track, ID
  - Incorporate Combat Identification Results Addressed By Other Activities
- High Altitude Nuclear Events Consistent With Scenarios

TMD C^2 PLAN REPORT OUTLINE

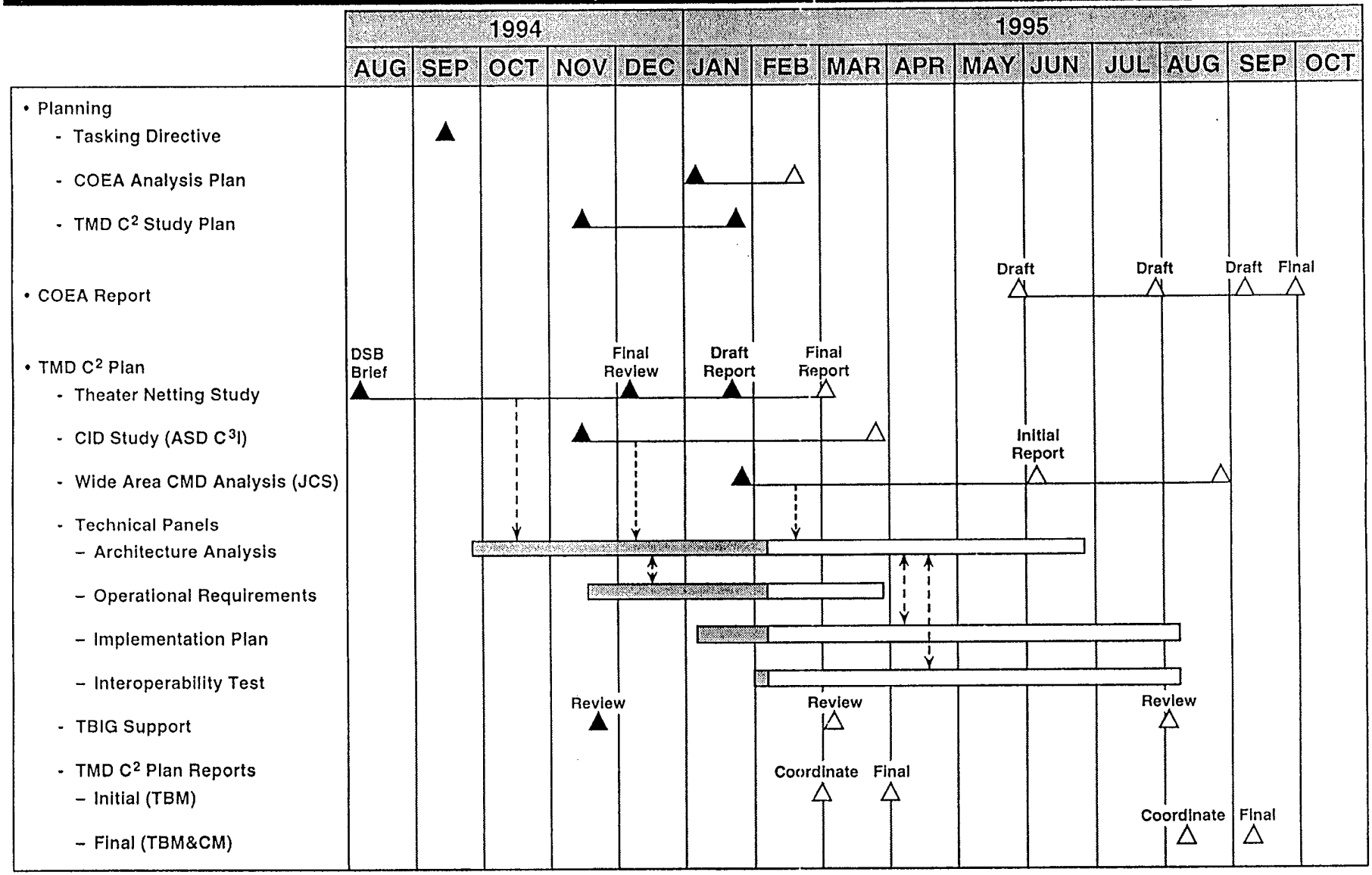
Main Report

1. Executive Summary
2. Approach
3. Scope
4. Operations Concept
5. Integration Architectures
6. Implementation Strategy
7. Interoperability Demonstrations
8. Summary Of Issues

Annexes

A. Nuclear Environment (BMDO)
B. Combat ID (BMDO)
C. Tactical Event System Description (BMDO)
D. Cooperative Warning (BMDO / JCS)
E. Cueing Benefits (BMDO)
F. Correlation (ESC)
G. Link-16 Decision And Implementation (ESC)
H. CEC Support (BMDO)
I. TIBS Support (AIA)
J. TRAP Support (Navy)
K. GCCS / JMCIS / CTAPS / STACCS (EA)

TMD C^2 SCHEDULE



mj-49894 / 020995

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

TMD C^3 SUMMARY

- Integration Strategy Provides The Forum To Implement Change
- Architecture Capitalizes On Existing And Planned Air Defense C^3 Structure
- Integrates Space Based Warning And Cueing
- Provides Warfighting CINC A C^3 Capability With The Flexibility For A Wide Range Of TBM Scenarios And Deployments

TMD C3 ARCHITECTURE GUIDELINES

My presentation describes the Theater Missile Defense (TMD) C3 program being conducted in BMDO. The objective of this program is to integrate the C3 components of multiple programs which are being developed independently into a single, cohesive, seamless Battle Management/C3 system that will realize the maximum synergy of the combined weapons and sensor systems.

In developing the TMD C3 architecture, we have been guided by a number of principles which have been recognized for several years.

Consistent with joint doctrine for TMD and the Joint Mission Need Statement (JMNS) for TMD, C3I builds upon the existing capability for air defense. We recognize the heavy investment in existing C3 and seek to enhance this capability to satisfy unique TMD requirements in terms of time of response and area of interest. This approach is economically sound as an entirely new force structure for TBMD would not be affordable.

We must draw upon all sources of information to maximize our success in engaging hostile TBMs. This means use of space based warning and cueing and total interoperability among services and allies to share engagement information.

TMD C3 PROGRAM MAJOR THRUSTS AND OBJECTIVES

Our program is directed along three thrusts to achieve our objective. First is the early warning and dissemination of space based target information. This allows cueing of sensors to focus on the immediate threat and the warning of all activities to take passive defense measures and engage in attack operations where possible.

Communications interoperability is the critical means to pass this information around within the theater. this involves the establishment and enforcement of standards and the use of open systems wherever possible.

Finally, command and control center upgrades necessary to allow existing C2 centers to process and act upon the TBMD information.

EARLY WARNING AND DISSEMINATION

Because of the quick flight times of ballistic missiles, early warning of launches and missile flight information allows fire control radar to focus their beams and acquire missiles for tracking at longer ranges. This ultimately allows multiple engagements, if necessary, and reduces the possibility of leakage. The dissemination of launch point estimates and impact point predictions allows attack operations forces to respond to find and destroy the launchers and allows all forces to take passive defensive measures to reduce potential damage from the missile.

Our areas of interest for early warning include both space based sensor and processing systems and emerging in-theater assets.

TMD JOINT SURVEILLANCE ARCHITECTURE

The dissemination of information and interoperability among Services is built upon a Link-16 (TADIL-J) data network. All Services are procuring and installing Link-16 equipment in their TBMD platforms and will share common protocols and message formats. This data network has considerably greater capacity than previous data links and is highly resistant to jamming and hostile interference. The Army, Navy, Marines, Air Force, and Joint organizations will all share information on this network. Allied participation is also possible as they develop their Link-16 capability.

TMD C3 INTEROPERABILITY STATUS

We have accomplished a great deal in the area of interoperability starting with the acceptance of Link-16 as the primary data link for TBMD and the development of Link-16 message standards which respond to the unique information required for TBMD. We have developed message standards for launch and impact point, missile in-flight information (state vectors), and engagement status to avoid unnecessary duplicate engagement of TBMs. We have also agreed upon reporting responsibility rules to prevent excessive congestion on the network.

Through discussions with the ASD(C3I) and the Army, we have the Army firmly on board to integrate Link-16 into their platforms.

Our message standards have been approved by U.S. agencies and have been submitted to NATO for acceptance in the international arena. Additionally, we are expanding the baseline of equipment that will use the message content (data elements) standard to include non-Link-16 terminals.

The specific goal of the TDNS was to evaluate the effectiveness of potential improvements in theater ballistic missile, cruise missiles and air defense through the introduction of netting systems and where necessary, modifications or additions of sensor or weapons systems. The study examined two time periods (1997–2001 and post–2001) based upon coordinated threat scenarios, Blue force laydowns, and concepts of operation established by the Army, Navy and Air Force. Recommendations for netting implementations along with estimates of performance improvements were provided to BMDO and the Air Defense community.

The conclusions reached by the TDNS are given below:

1. Netting can improve defense effectiveness against threats composed of ballistic missiles, cruise missiles, and aircraft by:
   a. decreasing the leakage
   b. reducing the interceptor wastage
   c. improving combat identification
   d. providing more robust performance against electronic countermeasures.
2. However, the value of netting is scenario-dependent on the
   a. level of overlapping radar coverage.
   b. mix of theater ballistic missiles and air breathers
   c. interceptor fly out capability
   d. subsonic or supersonic air breathers.

3. Against cruise missiles and aircraft, netting is of greatest benefit to the defense when there is considerable overlap of radar coverage. Against ballistic missiles, the amount of overlap is of lesser importance, because ballistic missile trajectories can be predicted accurately before atmospheric reentry.

8. The nets currently in the POM (JTIDS Wide Area, CEC) appear well-suited to provide the benefits of netting in most cases

4. There are important cases where overlap of radar coverage by surface radars is small. These includes:
   a. cruise missiles with small radar cross sections flying at low altitudes
   b. operations in extended geographic areas.

5. In these cases, an airborne platform with surveillance and fire control radars could restore the coverage, commit and direct interceptors, and aid in combat identification.

TBMD C2 LEVELS AND FUNCTIONS

Our Command Center Upgrades focus on three levels of TBMD C2. These three levels have different functions and timelines during which they must act. At the highest level, we have the senior headquarters who do the advance planning and have hours to days to prepare necessary direction. At the force coordination level, plans are optimized for the current situation and actions normally take place in hours and minutes. The weapons system level actively defends against incoming missiles and engagements take place within minutes and seconds.

The BMDO focus on C2 upgrades is on the planning and force coordination level with the weapons system C2 centers being left to the weapons systems program offices. The inter-Service position of BMDO is especially important here as current doctrine could have the Joint Task Force Commander selecting any mix of command centers to organize his TBMD ;and assign any Service to coordinate the effort. In such a situation, common tactics, techniques, and procedures among the services, which BMDO can encourage, are essential for optimum operation.

MAJOR TBMD INFORMATION EXCHANGE

The design, development, and execution of the three thrusts depends on a solid architecture to build upon. BMDO has done considerable work in developing an Information Architecture which defines all the process interactions and information flows among the TBMD elements. This work has been done in coordination with the Services and includes consideration of the results of their own studies.

The Architecture will help design communications networks for adequate throughput and speed of service, identify common processes and areas for enhancement, assist war gamers and modelers with their simulations, provide system developers with necessary information, and assist CINCs as they develop the specific concepts of operations for their commands.

COMMAND AND CONTROL PLAN

All our efforts and plans are being documents in a Command and Control Plan which will serve as the baseline for development for years to come.

The C2 Plan is one of three comprehensive analysis documents for TBMD directed by OSD. The principal document, which the C2 Plan will support, is the TMD Capstone Cost and Operational Effectiveness Analysis (COEA). The other is the Commonality Study to identify areas and opportunities for shared development.

The C2 Plan is being developed with the Executive Agent for Theater Air Defense and will become the TMD portion of the overall TAD C2 Plan. It will guide and assist both Service acquisition activities and CINCs in the development of doctrine.

REVIEW GROUP GUIDANCE SUMMARY

OSD gave us specific guidance as to what should be included in the plan and the environment to consider. We have responded to this guidance and are preparing the plan through the efforts of multiple panels, representing all the Services, to consider the operational concepts, the desired architectures, the implementing strategies to execute the architecture, and the necessary test and evaluation to ensure the developed BM/C3I system works.

TMD C2 PLAN REPORT OUTLINE

This slide shows the broad scope of work for the study. Not only will the basic document cover the essential elements required by OSD but will include a number of annexes covering many areas of C2 interest in detail.

TMD C2 SCHEDULE

This chart shows you the schedule for the C2 Plan and a number of other documents being developed during this time frame. We will deliver an initial report focusing exclusively on TBM in March. Our final report will expand to include aspects of cruise missile C2 and include the final annexes. It will be delivered in September 95 and support the COEA that will be delivered during the same time frame.

TMD C3 SUMMARY

TMD C3 will be the glue that ties together all the systems being developed for theater missile defense. We are on the right track and following the initial architectural guidance provided by OSD along with the subsequent areas of interest expressed in the C2 Plan guidance. Our ultimate goal is to provide the war fighting CINC a C3 capability that with the flexibility to respond to a wide range of TBM scenarios and deployments. We are confident we will reach that goal.

Test And Evaluation Testing, Facilities, Siting And Environmental Advance Planning Briefing For Industry



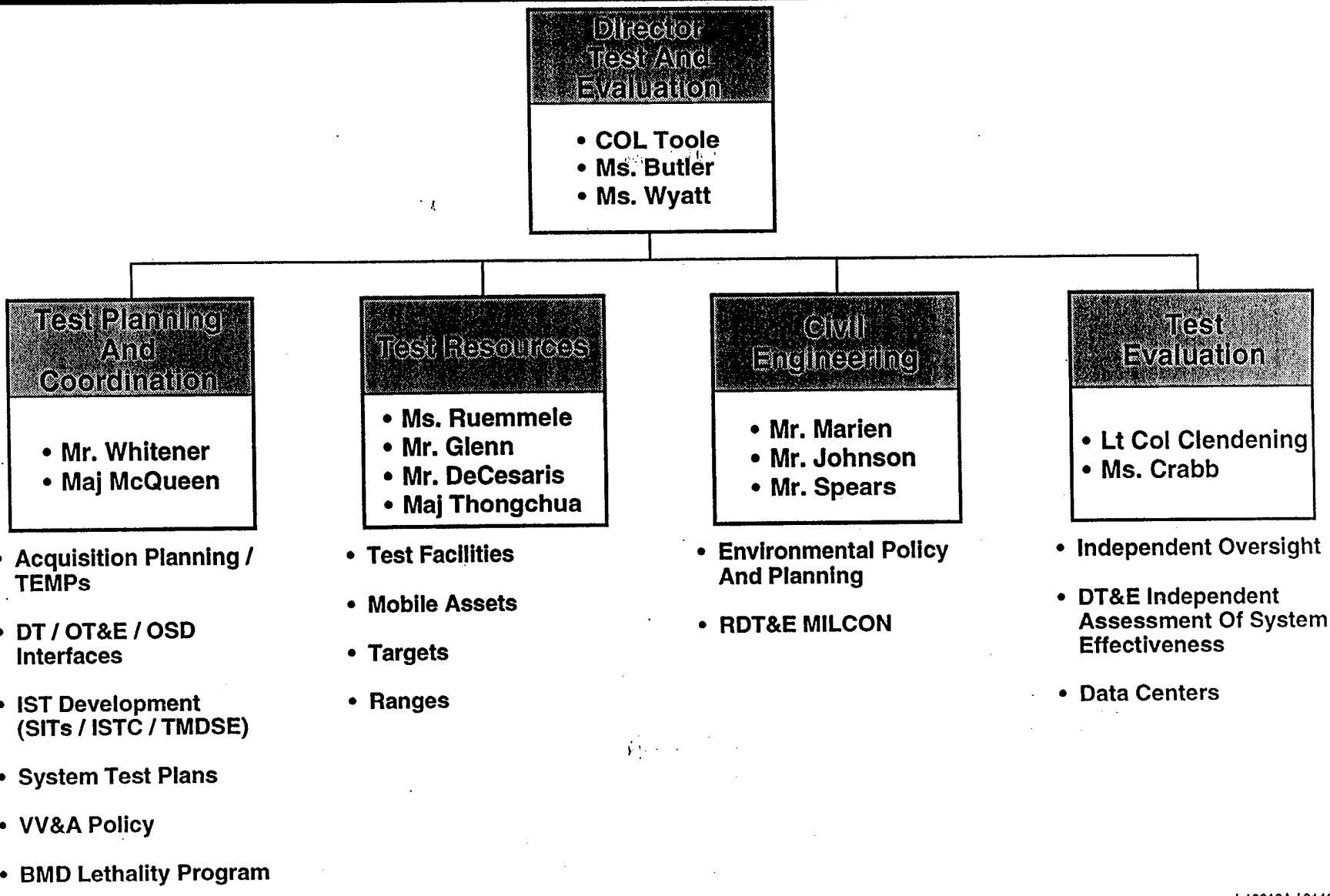
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7 MAR 95

COL Michael Toole, USA
Director, Test And Evaluation
Acquisition / Theater Missile Defense Deputate
Ballistic Missile Defense Organization

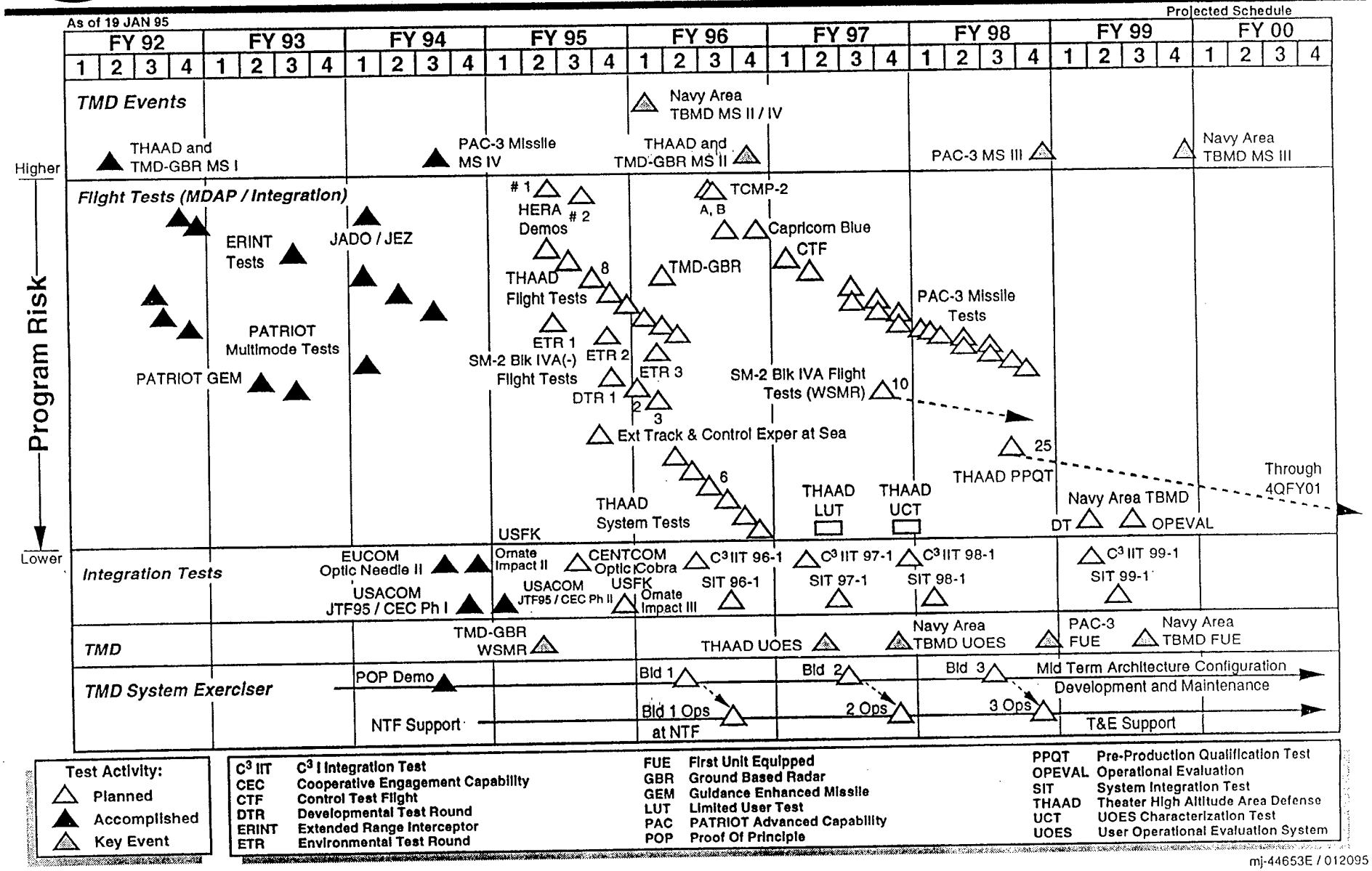
mj-50582 / 020295

TEST AND EVALUATION ORGANIZATION



mj-45616A / 011295

TMD RISK REDUCTION THROUGH EARLY COMPREHENSIVE TESTING

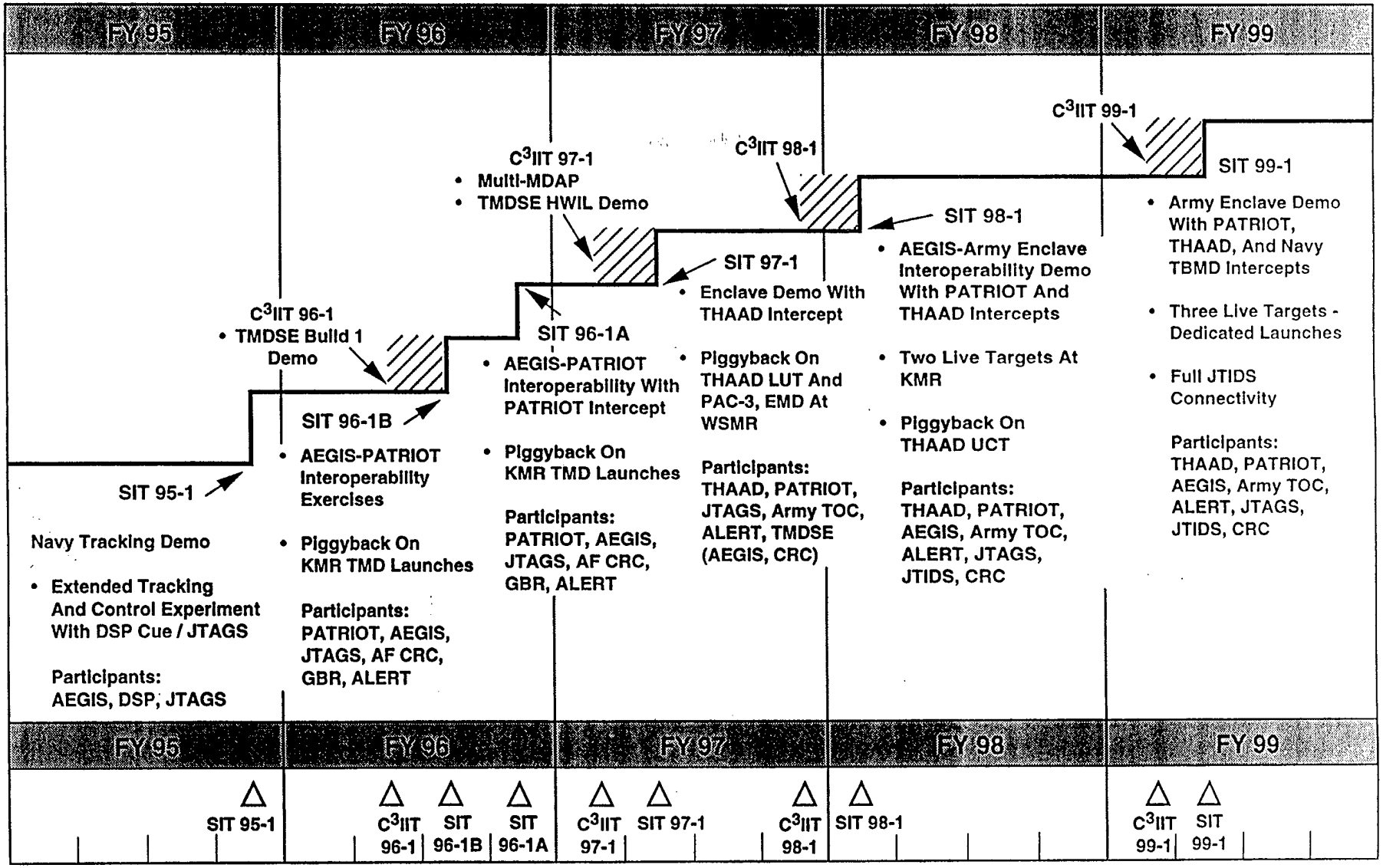


Test Activity:
- Planned
- Accomplished
- Key Event

C3 IIT	C3 I Integration Test
CEC	Cooperative Engagement Capability
CTF	Control Test Flight
DTR	Developmental Test Round
ERINT	Extended Range Interceptor
ETR	Environmental Test Round
FUE	First Unit Equipped
GBR	Ground Based Radar
GEM	Guidance Enhanced Missile
LUT	Limited User Test
PAC	PATRIOT Advanced Capability
POP	Proof Of Principle
PPQT	Pre-Production Qualification Test
OPEVAL	Operational Evaluation
SIT	System Integration Test
THAAD	Theater High Altitude Area Defense
UCT	UOES Characterization Test
UOES	User Operational Evaluation System

mj-44653E / 012095

TMD INTEGRATION TESTS



mj-50220 / 020995

TMD INTEROPERABILITY DEMONSTRATION APPROACH

- Building Block Approach
- Event Driven
- Piggyback On Scheduled Tests, Demos And Experiments
- Use Models, Simulations, Emulators, HWIL, Planned Flight Tests
- Avoids Duplicative Testing

Incremental Satisfaction Of BMDO ITP / Army / Navy / Air Force Objectives And Resolution Of TMD Issues

FY 95

- Initiate Detailed Demo Planning
- Determine Test Support Hardware Requirements
- Participate In AWE / War Games / C^3I Experiments
- Conduct Navy Tracking Demo
- Conduct JTAGS / PATRIOT Cueing Demonstration

FY 96

- Collect / Assess Data From Project Experiments
- Participate In AWE / C^3I Experiments
- Conduct TMDSE Build 1 Demonstration (C^3IIT)
- Conduct SIT 96-1 (Piggyback On KMR TMD Launches

FY 97

- Collect / Assess Data From Project Experiments
- Participate In AWE / C^3I Experiments
- Conduct TMDSE Build 2 Demonstration (C^3IIT)
- Conduct Army Enclave Demonstration / SIT 97-1 (Piggyback THAAD LUT At WSMR)

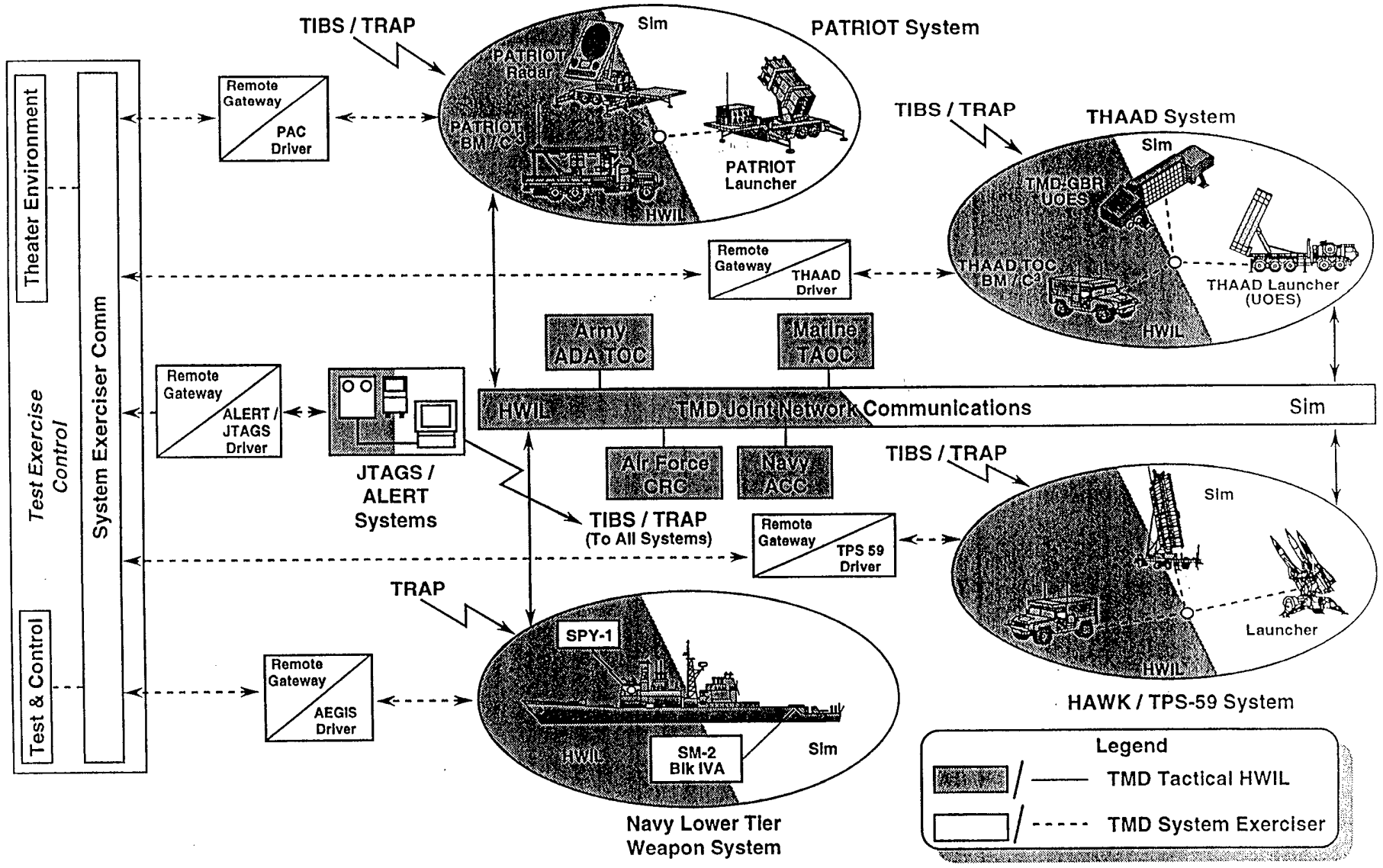
FY 98

- Collect / Assess Data From Project Experiments
- Participate In AWE / C^3I Experiments
- Conduct TMDSE Build 3 Demonstration (C^3IIT)
- Conduct Army Enclave Demonstration (Piggyback THAAD UCT At KMR)

Demos Leverage All Available TMD Test / Experiment Opportunities

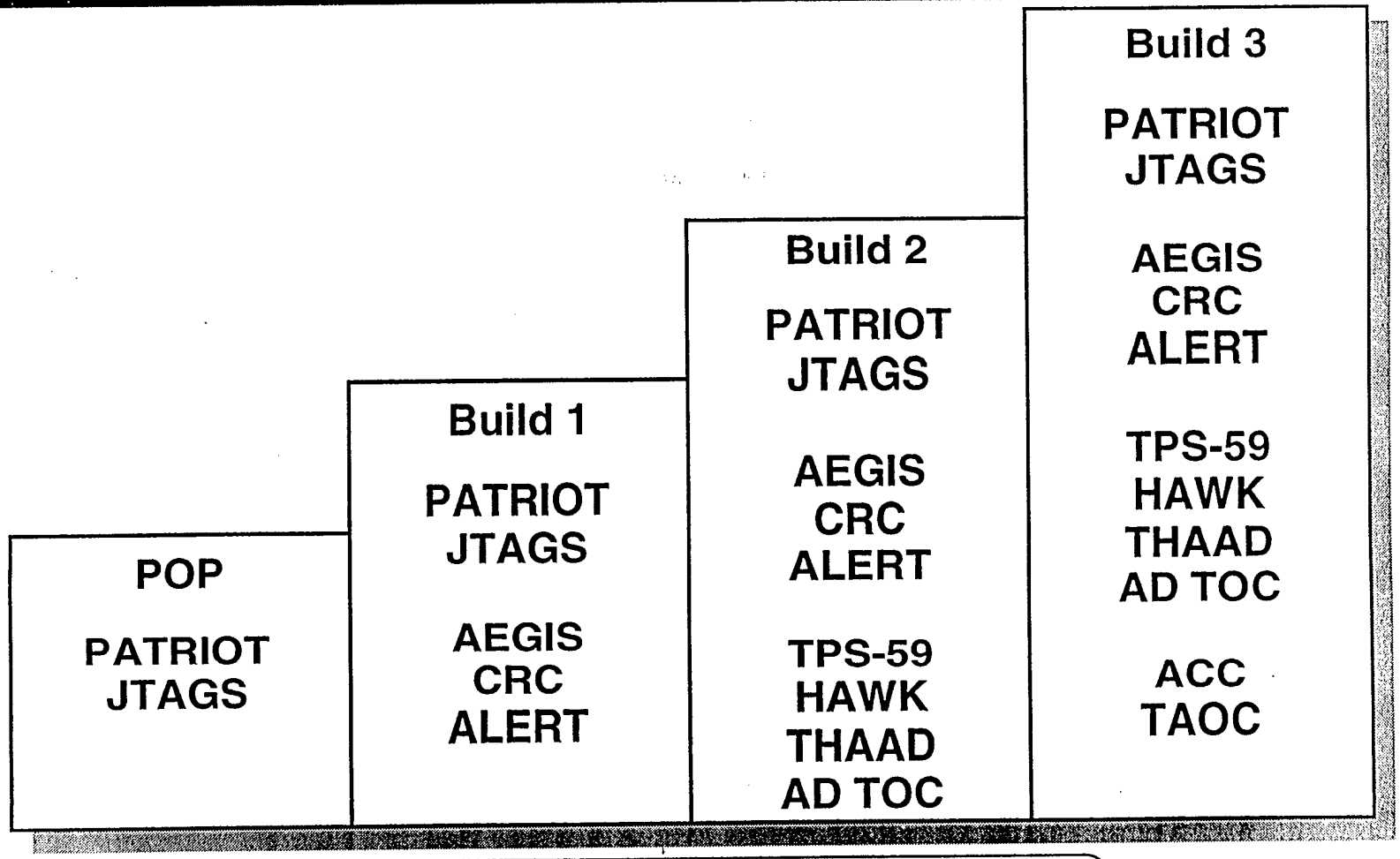
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TMD SYSTEM EXERCISER ARCHITECTURE
MID TERM TIME FRAME



mj-42804 / 120694

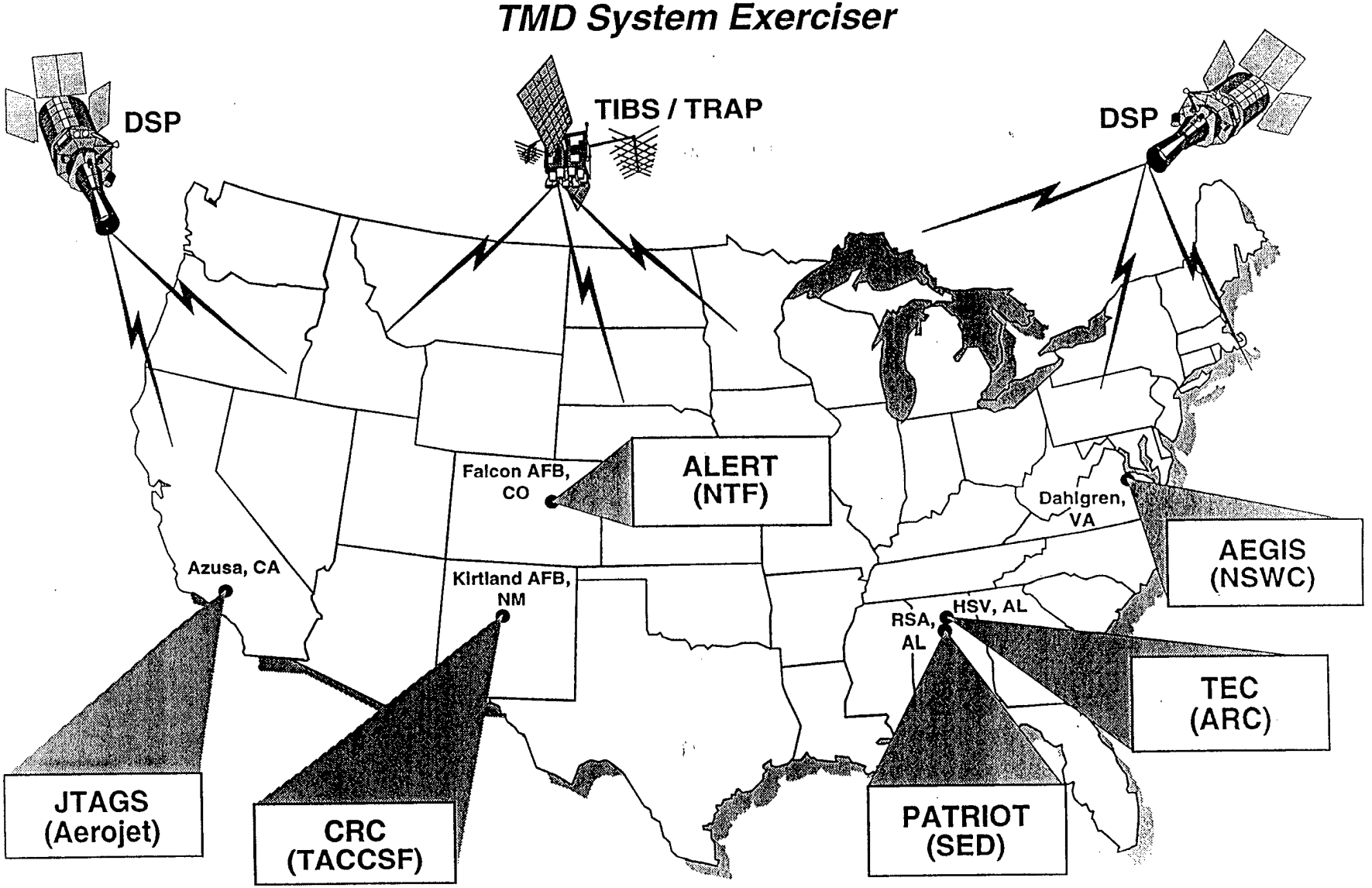
TMDSE DEVELOPMENT BUILDS



Builds Driven By ITP Test Objectives And TMD Development Programs

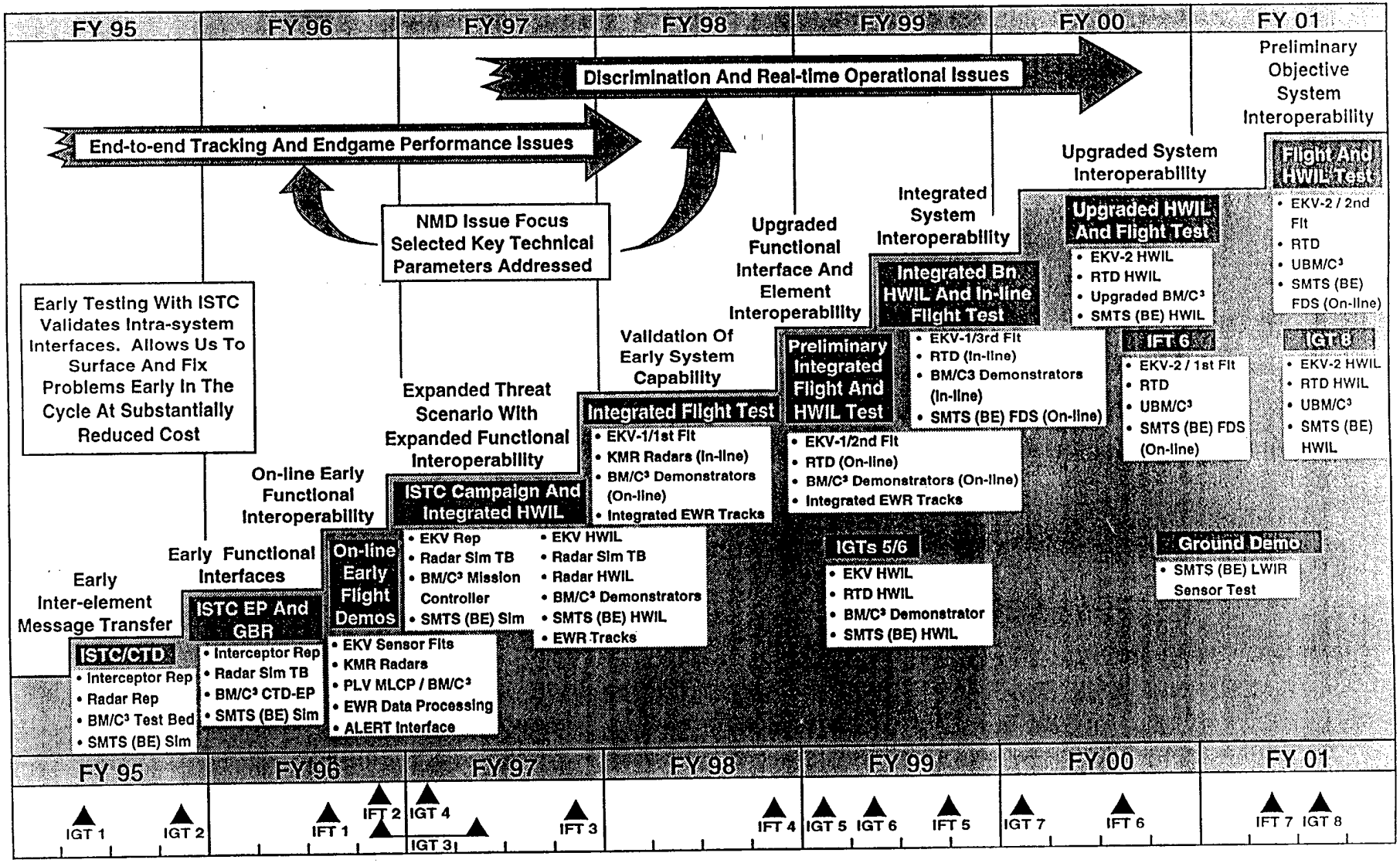
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BUILD 1 DISTRIBUTED CONFIGURATION



mj-49310 / 120894

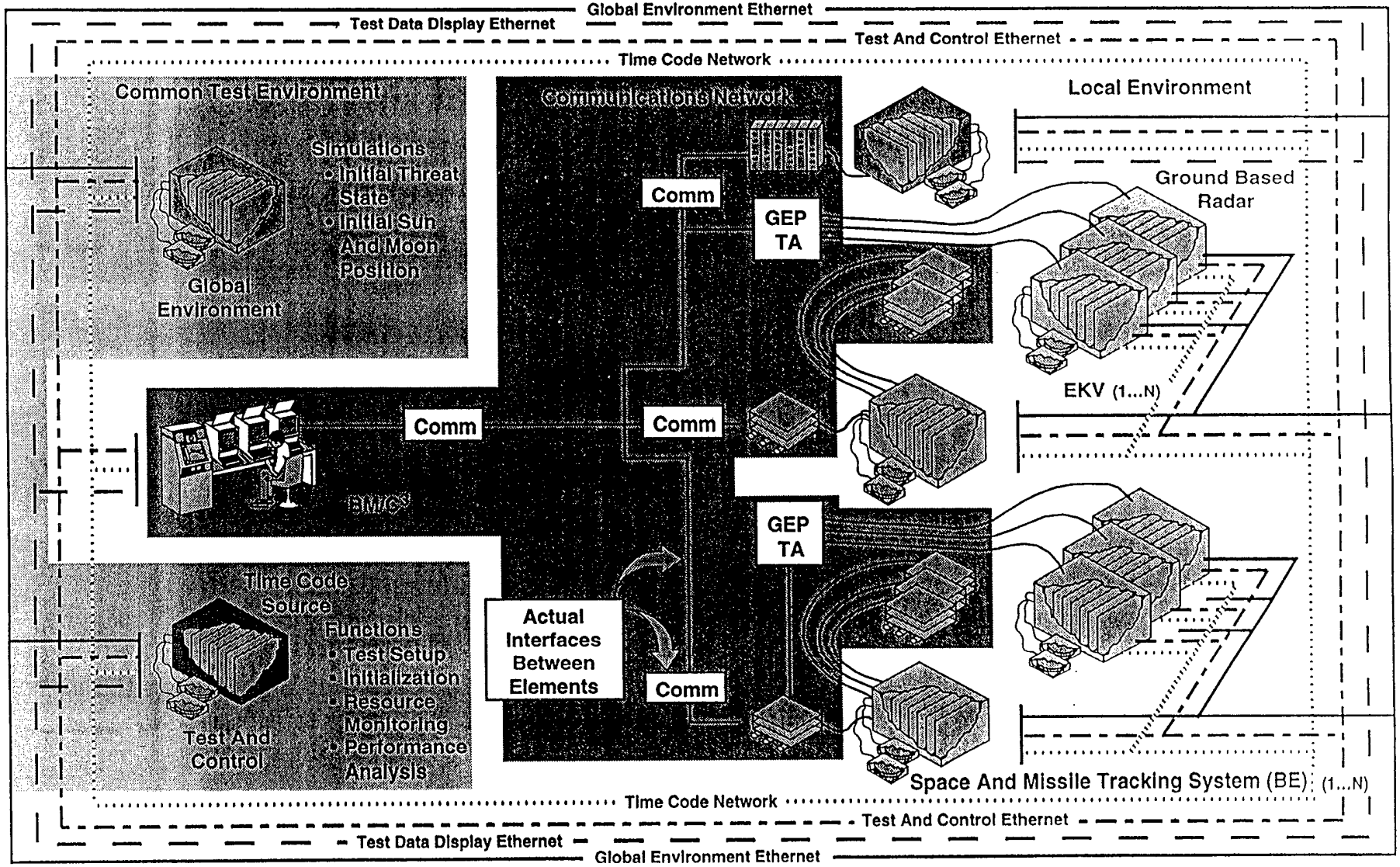
NMD INTEGRATED TEST AND EVALUATION



mj-46483 / 100694

NATIONAL MISSILE DEFENSE
INTEGRATED SYSTEM TEST CAPABILITY

(Objective Configuration)



mj-46975 / 120294

RANGE SAFETY SYSTEM REQUIREMENTS

- Flight Termination System And Missile Status Monitoring
- Provide TSPI And Impact Prediction
- Dual System Redundancy
- Integrated Flight Test Vehicle Safety Telemetry And GPS Position Data Downlink
- Near Launch Pad Augmentation
- Mobile / Transportable
- Compatible With KMR Expanded S-band Telemetry Spectrum And Existing Range Equipment
- Intended To Be Compatible With Future Range Architectures

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GPS RANGE TECHNOLOGY REQUIREMENTS

- Broad Requirements Poll In Progress
  - Translator Versus Receiver Technology
  - PEOs, Facilities, Ranges, BMDO Staff Polled
- Wide Spectrum Of Current Technology
  - Transfer Technology
    - Real-time Differential Correction (EKV)
    - Postflight, Differential, Relative Accuracy (EKV)
  - Receiver / IMU Technology
    - Unaided Receivers (HERA)
    - IMU-Aided Receivers (STORM)
    - Drift-rate Corrected IMUs (STARS)
    - Differentially Corrected Receiver (STORM)

RANGE INSTRUMENTATION FOR MULTIPLE SHOT ENGAGEMENTS (RIMSE)

- Range Safety For Target Launches
  - Upgrade Mobile Range Safety System (MRSS)
    - MRSS Provides Single Launch Safety
    - Upgrade Provides Dual Launch Safety
  - Airborne Range Safety
    - Backup For Upgraded MRSS
    - Provides Safety Coverage For Third Target
- Telemetry For Intercept Zone
  - One Receive / Record System Per Target
  - One Receive / Record System Per Interceptor
  - Possible Backup Required For Each (3 Interceptors Versus 3 Targets With Backup = 12 Systems)

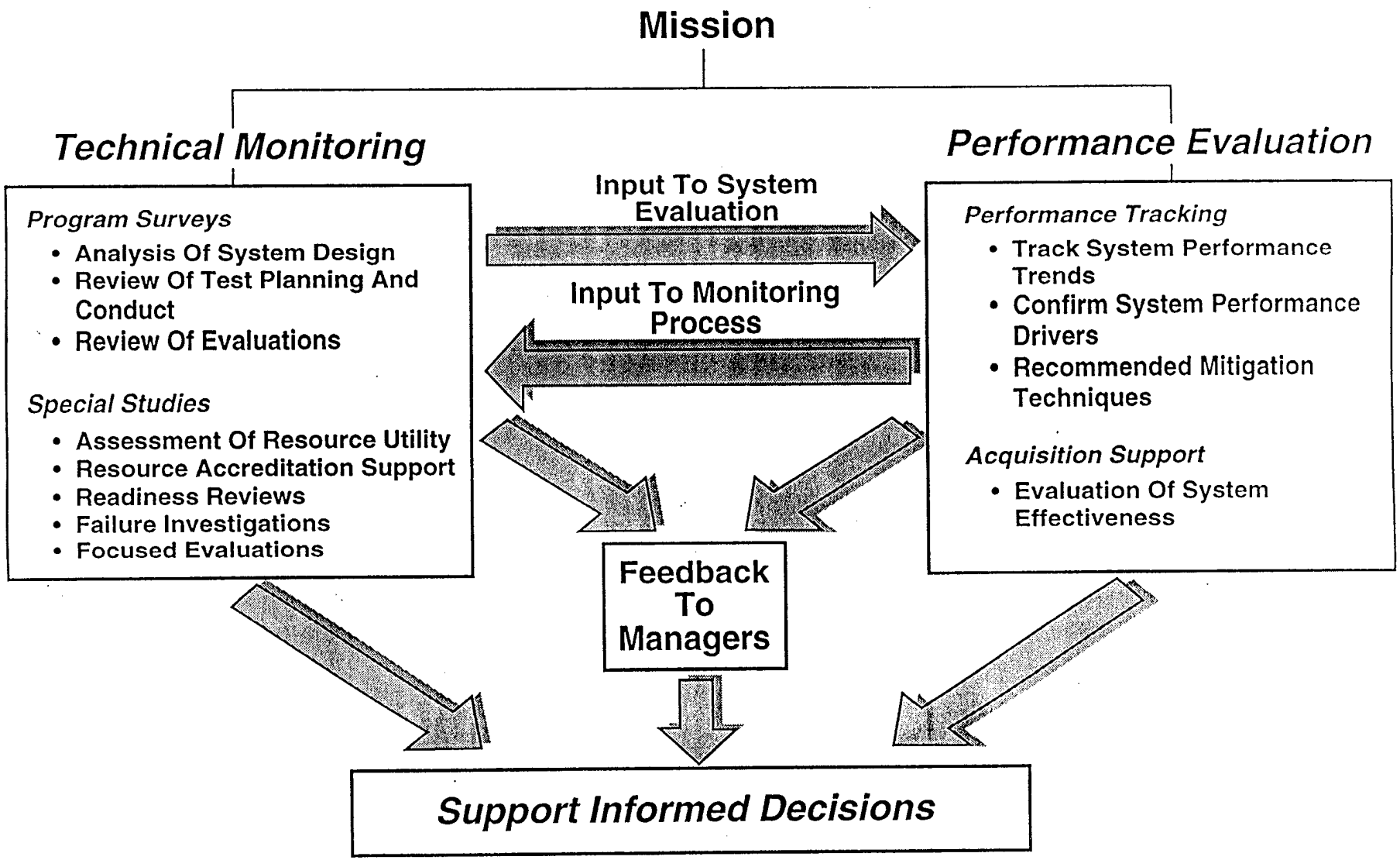
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CIVIL ENGINEERING AND ENVIRONMENTAL OPPORTUNITIES

	Estimated RFP Release
• BMDO Technical Services Contract	FEB 95
• THAAD Launch Facilities (Various Locations)	APR 95
• Missile Assembly Buildings (Two At WSMR)	APR 95
• THAAD First Battalion Facilities (Ft Bliss)	JAN 96

mj-50585 / 020295

BMD INDEPENDENT EVALUATION



mj-46661 / 011095

Joint Force Directorate
"The Bridge To The Warfighter"

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

7 MAR 95

CAPT John Langknecht, USN
Director, Joint Force
Acquisition / Theater Missile Defense Deputate
Ballistic Missile Defense Organization

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Background

- **Impetus For AQJ – TMD System Management Panel Report of 16 OCT 92**
  - **"It Is Critical That All Phases Of The TMD Development Stay Coupled With The Users (Warfighting CINCs) To Ensure That It Adequately Reflects Evolving Military Need."**
  - **"Establish An Activity To Provide Close Coupling / Frequent Interaction With The Users . . ."**
- **AQJ Answers These Needs And In Conjunction With SRI Extends The Principles To Interaction With The Allies**

Joint Force Directorate

- **Two Divisions**

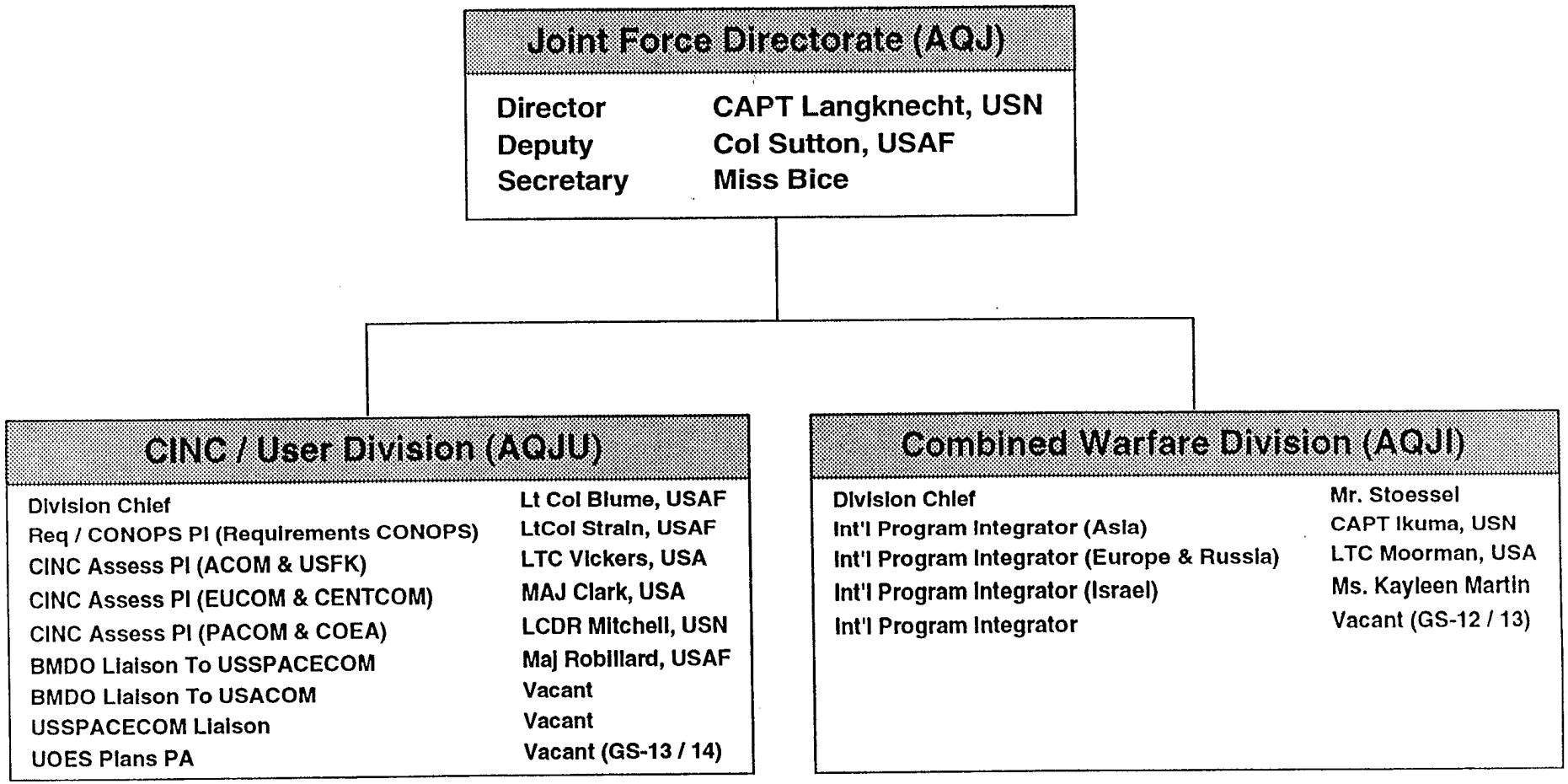
One Basic Mission

- **Integration Of TMD Into Joint And Coalition Warfighting Plans / Capabilities To Counter The Theater Missile Threat**

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

JOINT FORCES

Joint Force Directorate (AQJ) Organization



Joint Force Approach
The Premise

- **How The Warfighter Intends to Fight Should *Influence* The TMD Systems We Deliver**

The Challenge

- **Get The Warfighter To Decide How He Intends To Fight**

The Process

- ***Inform*** **The Users (U.S. And Allied) Of The Threat**
- ***Facilitate*** **The Integration Of Effective TMD In Their CONOPS**
- ***Stimulate*** **The Development Of Effective TMD Doctrine**
- ***Enhance*** **Feedback To Refine TMD Requirements**

The Tools

- CINC's Assessment
- WALEX
- Gaming And Simulations
- Architecture Studies
- Conferences
- Briefings / Dialogue
- Joint Development

We Will Use What's Appropriate

WALEX, Gaming And Simulations

- **WALEX**
  - FLAG Or Action Officer Seminar Game
  - Samples: PACOM, Allied Attaches, NATO (STC) (6 - 10 / yrs)
- **NTF Wargame**
  - Large Scale Simulation At Facility That Incorporates Time And Human Interaction (2 - 3 / yrs)
- **GLOBEX**
  - Global Annual Strategic War Game At Naval War College (1 / yr)

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

JOINT FORCES

Conferences / Briefings / Dialogue

- Supporting CNAD AD HOC Working Group On TMD (More Than 15 Technical Groups Being Focused To 3 Areas)
- Dialogue With FSU / Eastern Europe On TMD
- U.S. / Russian TMD Exercises

Architecture Studies / Joint Development

- **Israeli ARROW / ACES / ADP**
  - **Test Bed / SEIC**
- **Joint Development Programs Are Assigned To The Most Sensible Office**
  - **CORP SAM In AQS For Example**
- **U.S. / Japan Bilateral Concept Study**

BALLISTIC
MISSILE
DEFENSE
ORGANIZATION

JOINT FORCES

CINC's TMD Assessments

Accomplishments

- DSP Launch Warning In Desert Shield / Storm (Voice And Data) – AUG 90 - MAR 91
- DSP Data To Military Forces Conducting Attack Operations During Desert Storm – JAN 91
- TBM Target Data Base Development – SEP 91, MAY 92
- Integration Of Naval Forces Into TMD Operations – MAY 92
- Warning And Cueing Net Established In USEUCOM – MAY 92
- Planning For Joint Project Optic Needle Paved The Way For Real World Use Of ADSI In Operation Deny Flight – JUN 93
- Optic Needle Efforts Also Led To Real World Use Of TSD In Support Of USEUCOM And USCENTCOM – MAR 93

Exercises

Past	• Quiet Sunset	1989	• Keen Edge	1994
	• Torpid Shadow	1990	• Optic COBRA	1994
	• Torpid Shadow	1991	• Ornate Impact II	1994
	• Quester Grail	1992	• Dynamic Guard	1994
	• Optic Needle Excerpts	1993	• Kitty Hawk Battle Group	1994
	• Ornate Impact	1993	• Atlantic Resolve	1994
			• African Eagle	1994

Pending	• Optic Cobra I	3Q/FY95	FTX CENTCOM
	• Optic Needle III	4Q/FY95	FTX USEUCOM
	• Ornate Impact III	4Q/FY95	USFK
	• Keen Edge	1Q/FY95	USPACOM

Commands

- USEUCOM
- USPACOM
- USCENTCOM
- USSPACECOM
- USACOM
- USFK

Joint Force Directorate

- **Focus On Joint And Combined Warfare**
- **BMDO's Bridge To The Warfighter**
  - **Our Joint Commanders**
  - **Our Allies**

TMD Overview
Advance Planning Briefing To Industry



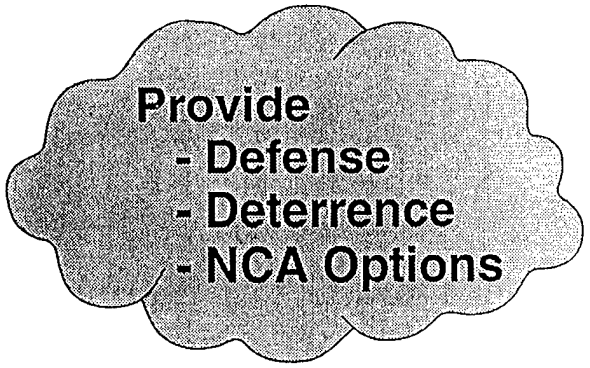
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7 MAR 95

RADM Richard D. West, USN
Deputy For Acquisiton / Theater Missile Defense
Ballistic Missile Defense Organization

MISSIONS

- Protect Population Centers
  - Long-range Threats
  - Friends And Allies
  - Large Area Protection
  - Low Leakage
- Protect Fixed Military Units And Economic Assets
  - Airfields, Ports, Staging Areas
  - Headquarters, Bases, Depots
  - C^3I, Government
- Protect Mobile Military Units
  - Maneuver Assault Units
  - Amphibious Objective Area And Ships
  - High Mobility / Transportability Required
  - Combined TBM / Cruise Missile Threat



TMD PROGRAM STRATEGY

Acquire And Field Capability

Goal

- Address Full Spectrum Of Threat Over Time Through
  - Multiple Tiers
  - Multiple Basing Modes
  - Multiple Shot Opportunities

Acquisition Strategy

- Core Systems
  - Rapidly Increase Capability By Upgrading Existing AEGIS And PATRIOT Systems
  - Develop THAAD Program To Provide Tiered Defense
- Advanced Capability (As Funds Permit)
  - Develop MEADS To Protect Maneuver Forces
  - Expand AEGIS To Navy Theater Wide Capability
  - Pursue Boost Phase Interceptor

mj-42375J / 020695

TMD ACQUISITION APPROACH

- Build On Existing Capability
- Focus On Active Defense BM/C^3
- Plan Flexible System To Handle Wide Range Of Scenarios And Deployments
- Proceed With Low-to-Moderate Risk
- Provide Early UOES Capabilities
- Introduce TMD Upgrades To Theaters Through CINC Experiments Program
- Encourage International Participation

THEATER MISSILE DEFENSE PROGRAM CANDIDATES

Lower Tier

- PAC-3
- AEGIS / SM-2 Block IVA
- Corps SAM

Upper Tier

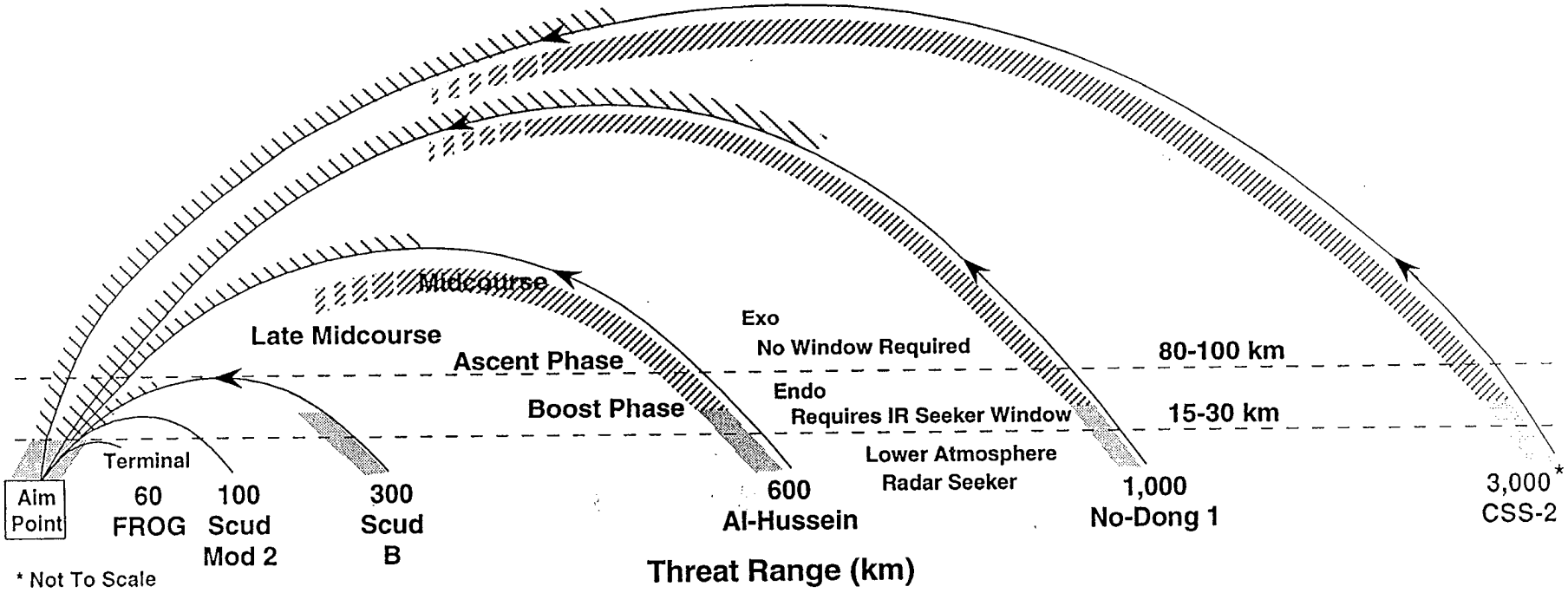
- THAAD
- Sea Based Interceptor (THAAD Or LEAP)

Midcourse

- Ascent Phase Interceptor (LEAP)

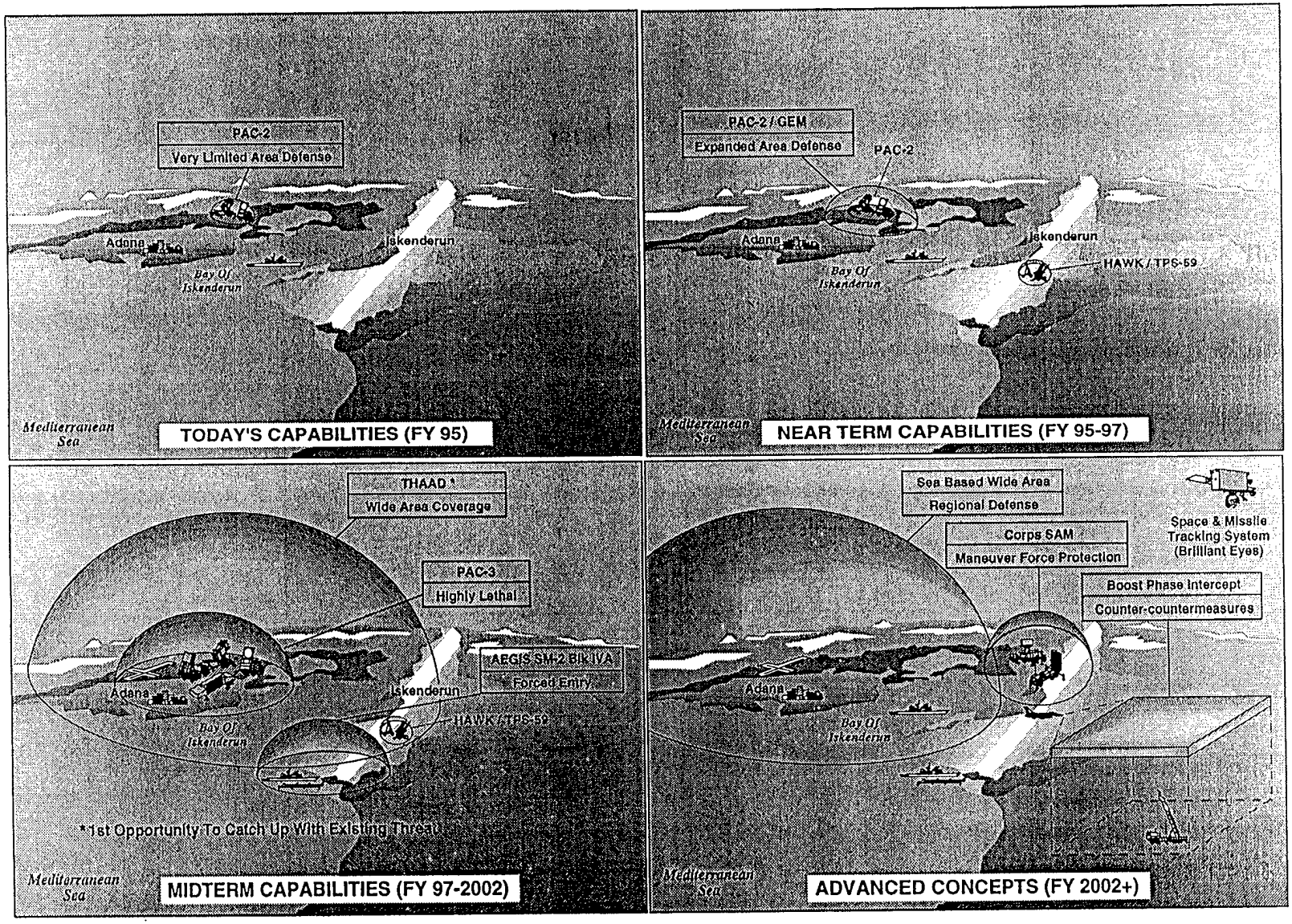
Boost Phase

- Fighter Or RPV Based Interceptors



mj-34863F / 100394

EVOLVING TMD CAPABILITY



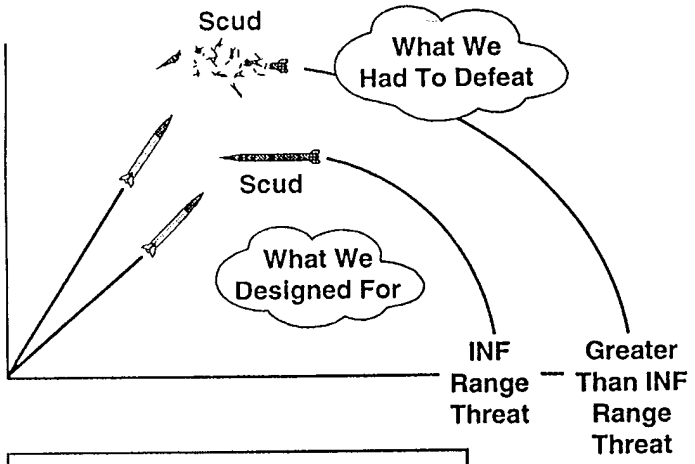
mj-42512D / 012395

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FUTURE PATRIOT CAPABILITY (PAC-3) IS GROWN FROM PAC-2

PAC-2: Our Desert Storm Capability

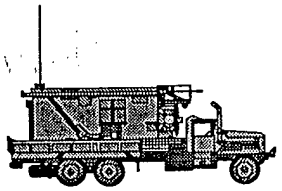
- Defense Against TBMs
- Improved Warhead And Software Guidance Changes



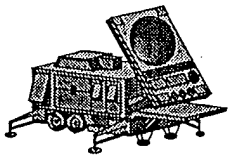
PATRIOT Lessons Learned

- Better Lethality
- Increase Radar Detection
- Increase Footprint
- Automatic Data Recording

PAC-2 → Time Phased Incremental Growth → PAC-3



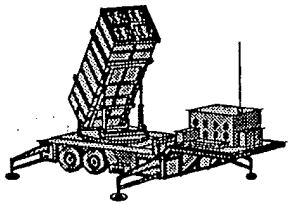
- Engagement Control Station
  - Better Computer
  - Improved Communications
  - Embedded Data Recording



- Radar
  - Improved Target Acquisition And Track
  - Improved ABT / TBM Engagement
  - More Accurate Target Identification
  - Faster Setup



- Missile
  - PAC-3 Integration
  - Improved Lethality
  - Expanded Engagement Envelope

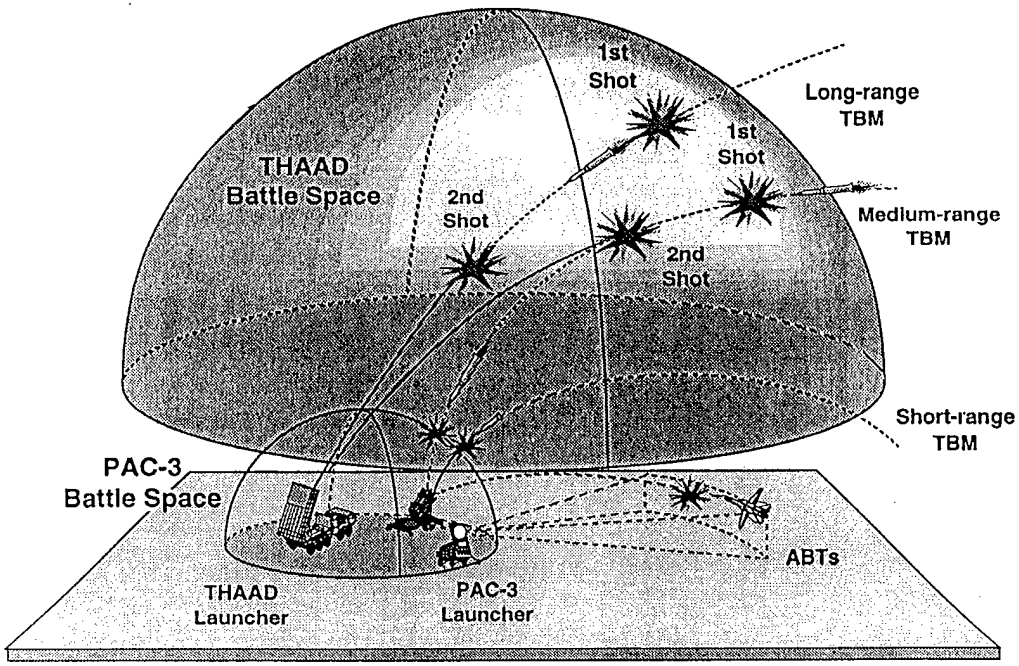


- Launcher
  - Faster Setup
  - Remote Launch

Buy Back Battle Space Against ABT And TBM Threat

mj-43940 / 071194

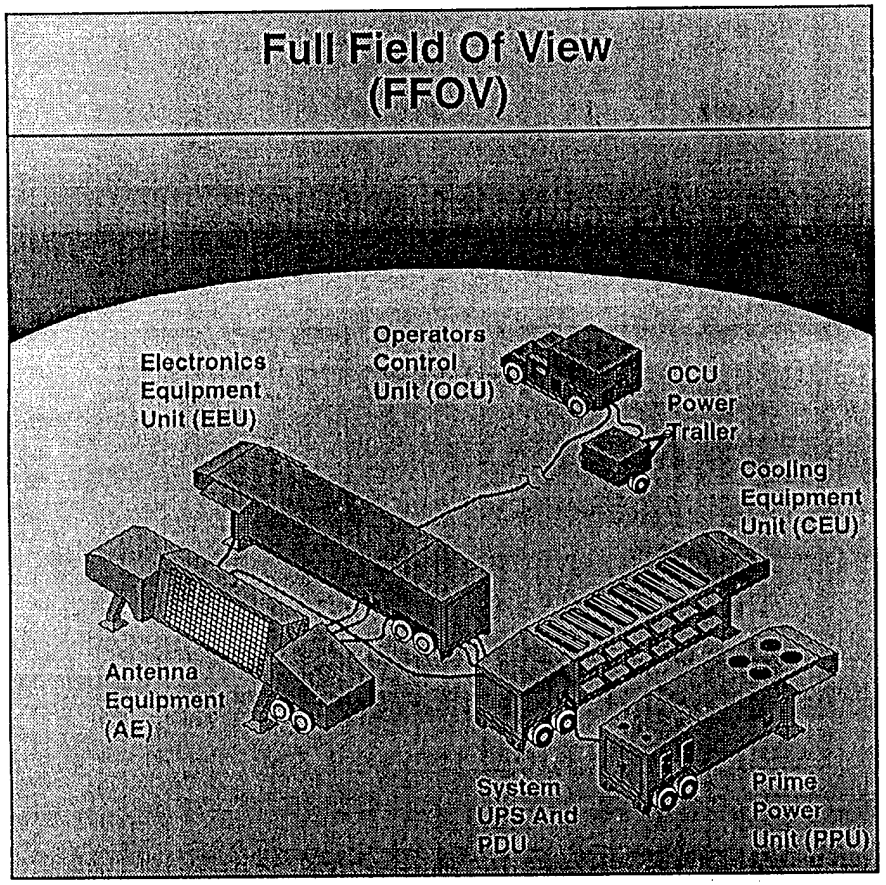
THAAD MISSION / SYSTEM DESCRIPTION



- Upper Tier Of Two-tiered TBM Defense
- Exo And Endo Intercepts Using Hit-To-Kill
- Utilizes TMD-GBR X-band Radar
- Interoperable With Other Army And Joint Systems
- Air Transportable

THAAD Provides Effective Defense Against TBM Threats

TMD-GBR DESCRIPTION



Mobility Is A Major Asset For The TMD-GBR System

Wideband Phased Array

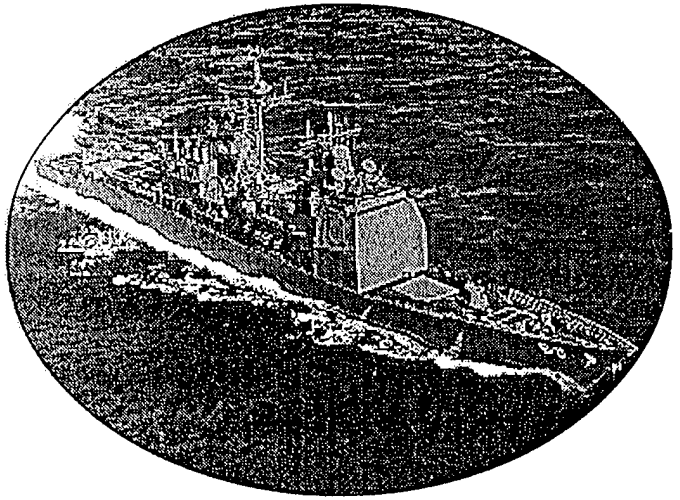
Aperture	= 9.2 m^2
Transmitter	= Solid-state
Field Of View	= Electronic - FFOV
Detection Range	= 1,000 km

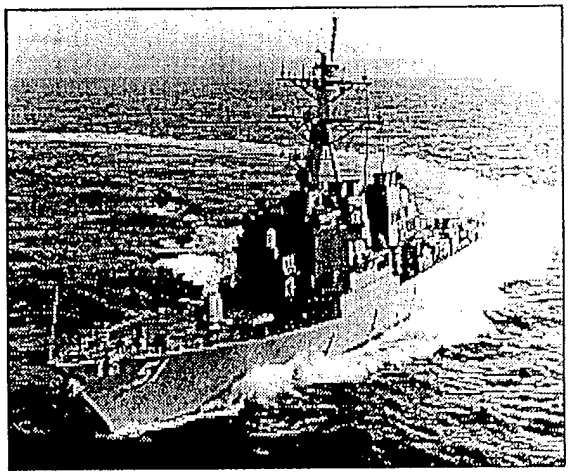
Special Features

- Acquisition Plus Fire Control
- Transportable - C-130
- Flexible / Expandable Software

mj-39326 / 082594

NAVY AREA TBMD



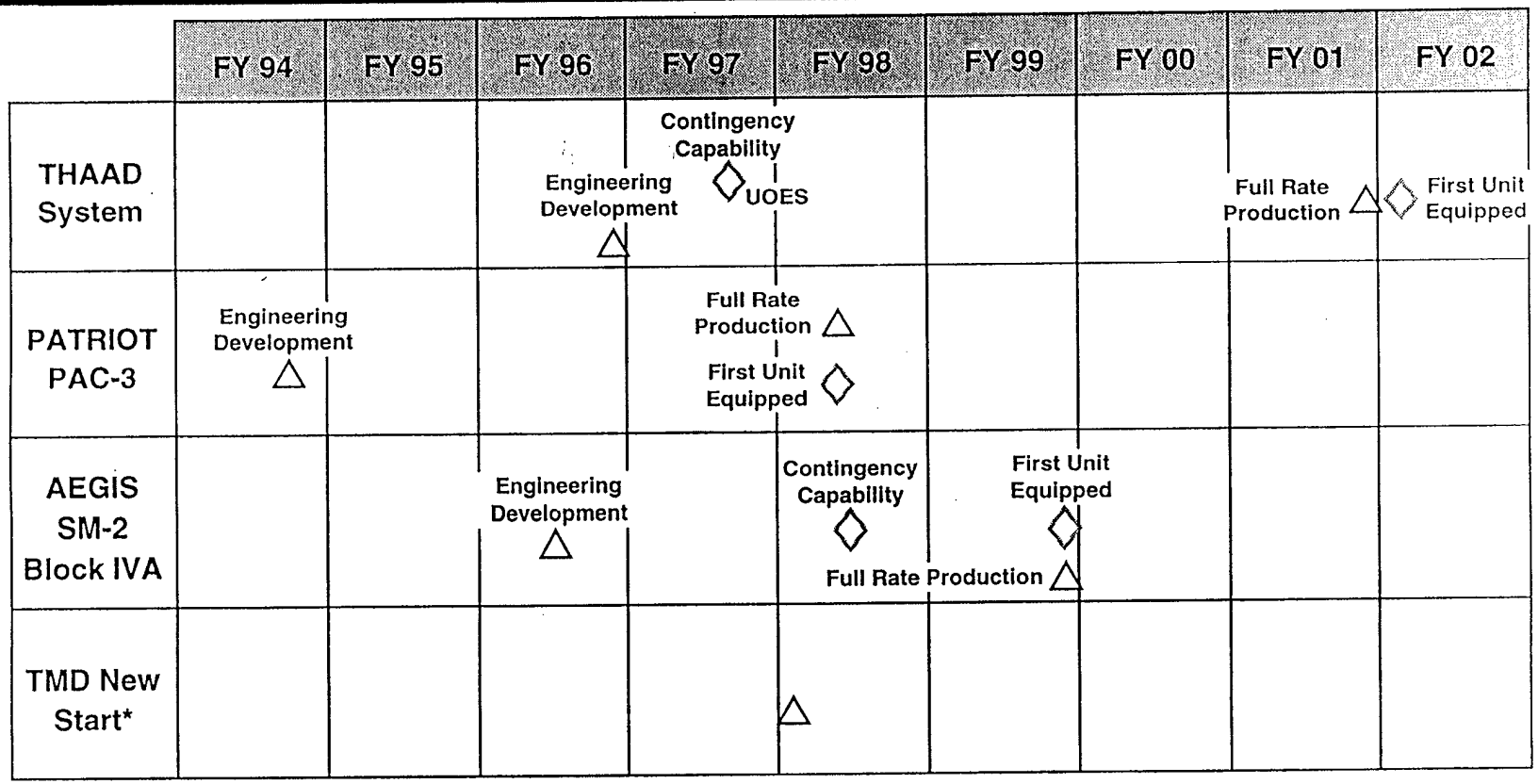


- Unique Capability For Forced Entry
- Arms The Warfighter (UOES 98, FUE FY 00) To Respond To The Urgent Requirement
- Capitalizes On Existing Deployed Combat Systems As Required By The Missile Defense Act
- Modifications To AEGIS And Standard Missile For TBMD

Provide TBMD Capability To More Than 50 Combat Systems With More Than 5,000 Missile Launch Cells

mj-44749 / 020695

THEATER SCHEDULE



* TMD New Start Candidates
- Corps SAM
- Sea Based Wide Area
- BPI

Orange Yellow Green Blue

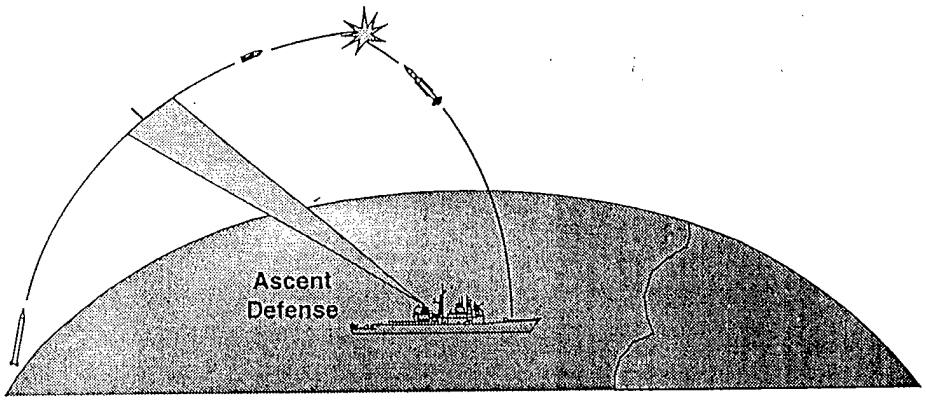
Capability

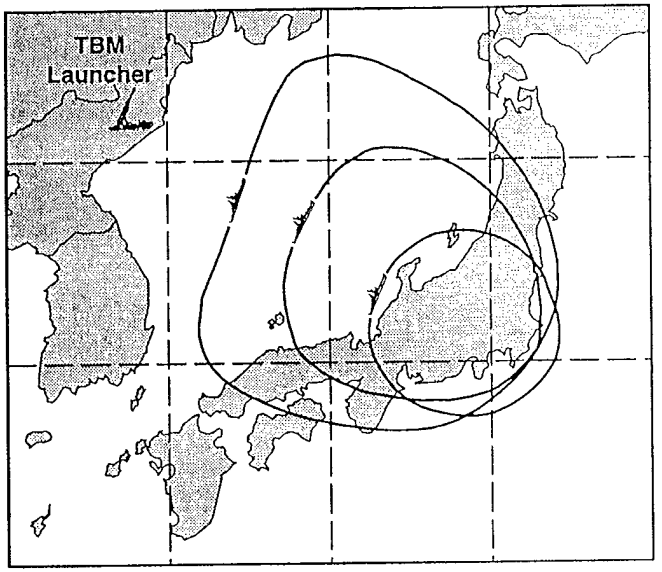
mj-39912G / 102794

ADVANCED CONCEPTS
(FY 2002+)

Program Area	What We Are Going To Do
• Navy (Theater Wide) TMD Interceptor	• Significantly Increase Range And Lethality Of Missile • Provide Greater Defense In Depth • Increase Shot Opportunities = Higher Probability Of Kill
• MEADS	• Provide Maneuver Forces TBM Protection • Counter Cruise Missile Threat • Increase Tactical Mobility • Decrease Strategic Lift Requirement
• Ascent / Boost Phase Intercept	• Kill TBM In Ascent And Boost Phase • Counter Advanced Submunitions • Defeat Deployed Countermeasures • Assure Shortfall Of Debris And Unexpected Munitions

NAVY THEATER WIDE TBMD

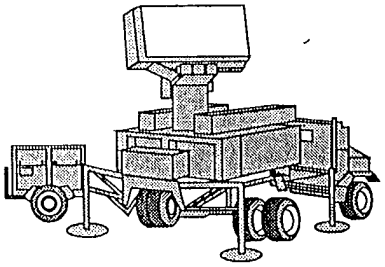


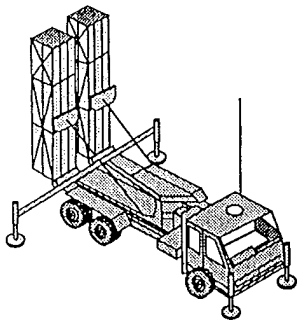


- Navy Theater Wide Defense
  - Can Be Made Effective For Ascent Phase Intercepts
  - Can Be Positioned For Terminal Defense
  - Can Position Ships Close To Launch Point In Many Scenarios

Navy Theater Wide Defense Offers Dramatic Overland Defense

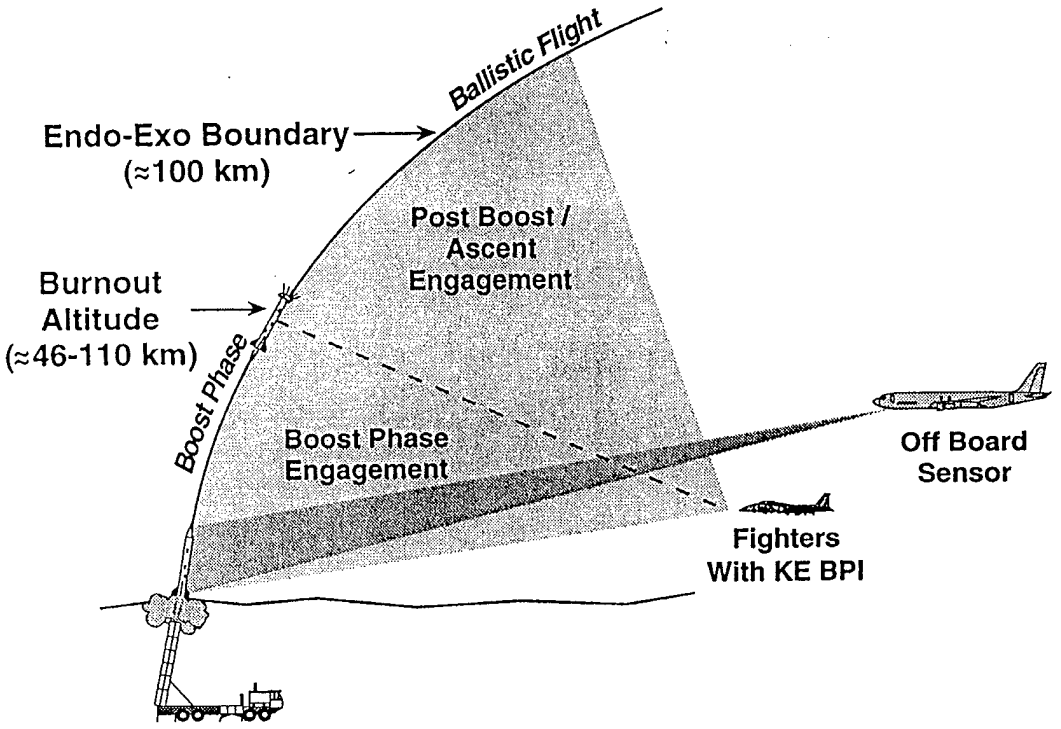
MEADS MISSION / SYSTEM DESCRIPTION





- Provides 360 Degree Protection Against Short Range Tactical Ballistic Missiles, Cruise Missiles And Other Air Breathing Threats
- Supports Maneuver And Expeditionary Forces
- Highly Survivable And Operationally Versatile Distributed / Netted Architecture
- Strategically / Tactically Deployable (C-141 / C-130) With Tactical Mobility To Support Maneuvering Forces

AIR BASED KINETIC ENERGY (KE)
BOOST PHASE INTERCEPT MISSION / SYSTEM DESCRIPTION

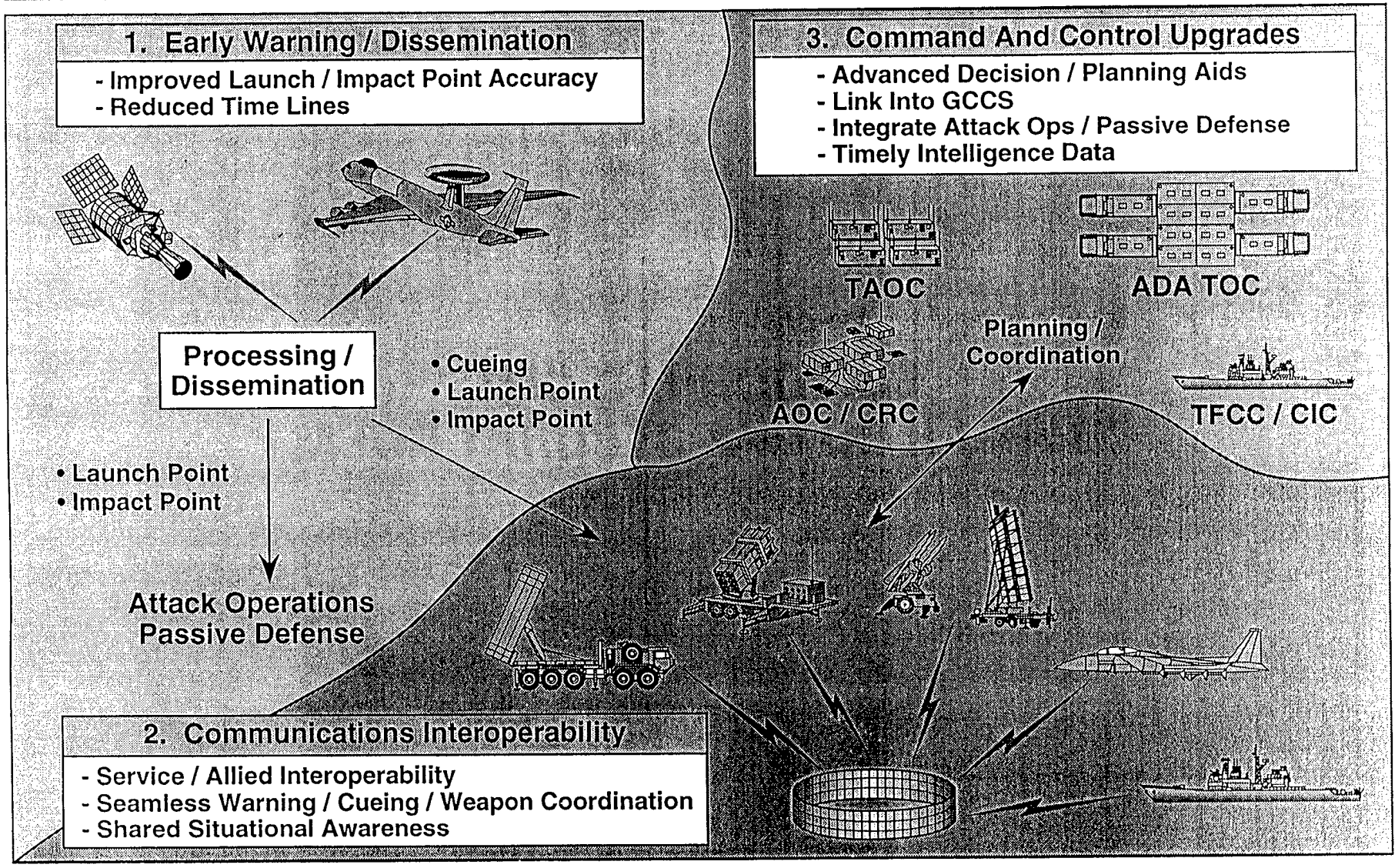


- Negates TBMs During Boost And Post Boost Ascent Phase
- Most Forward Defense-In-Depth Tier
- Defense Against Advanced Submunitions And PENAIDS
- Deterrence Of Weapons Of Mass Destruction

Air Based KE BPI Pushes The Defense Of TBMs Out Over Enemy Airspace

mj-47132A / 102494

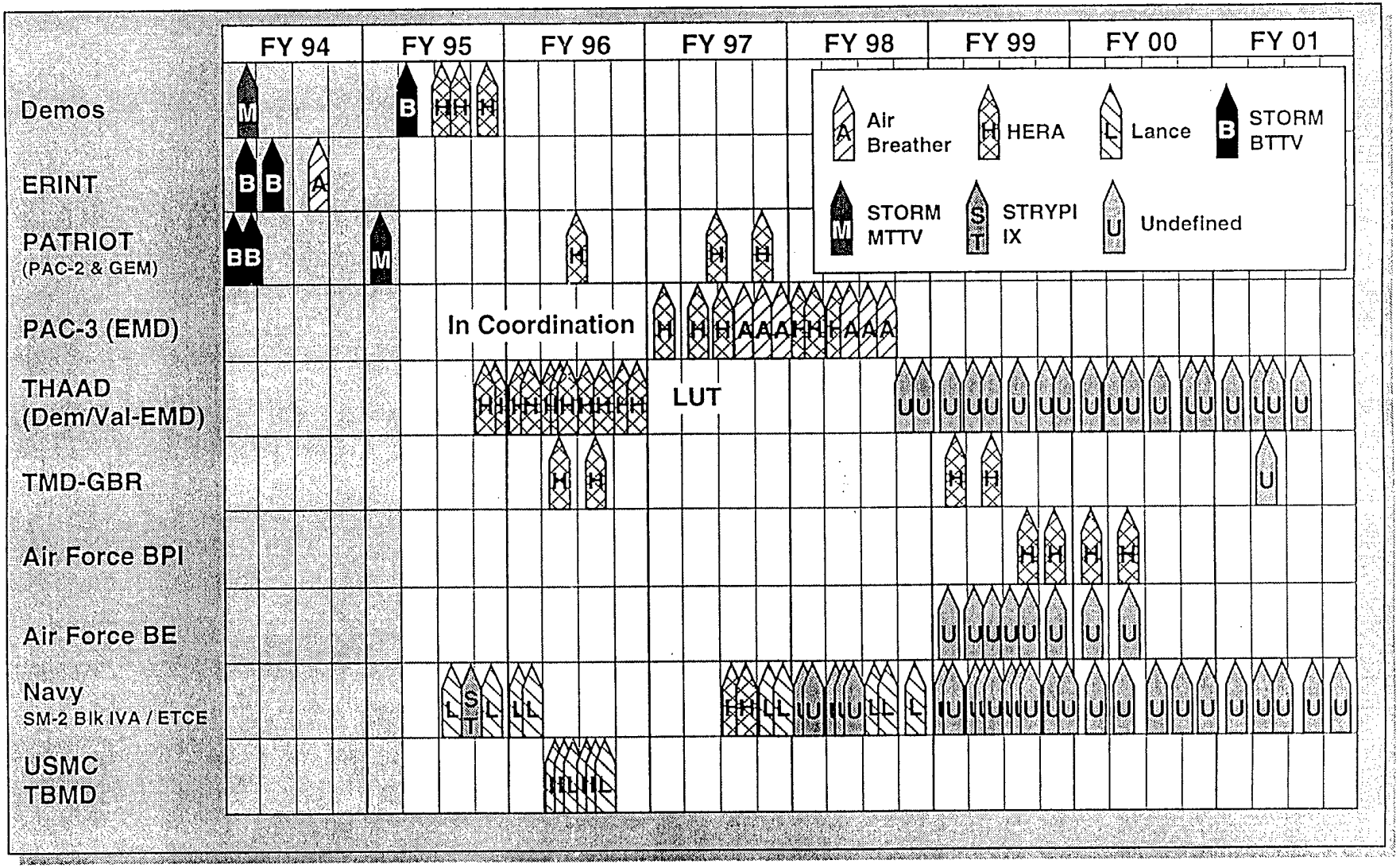
TMD C^3 PROGRAM
MAJOR THRUSTS AND OBJECTIVES



mj-49095 / 012095

TMD TARGETS SCHEDULE

As Of 22 FEB 95

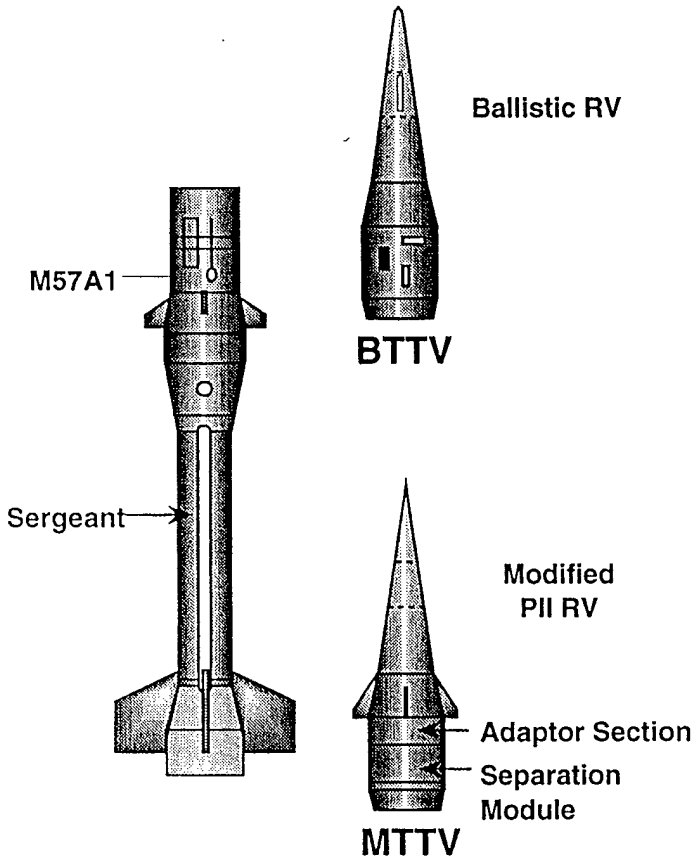


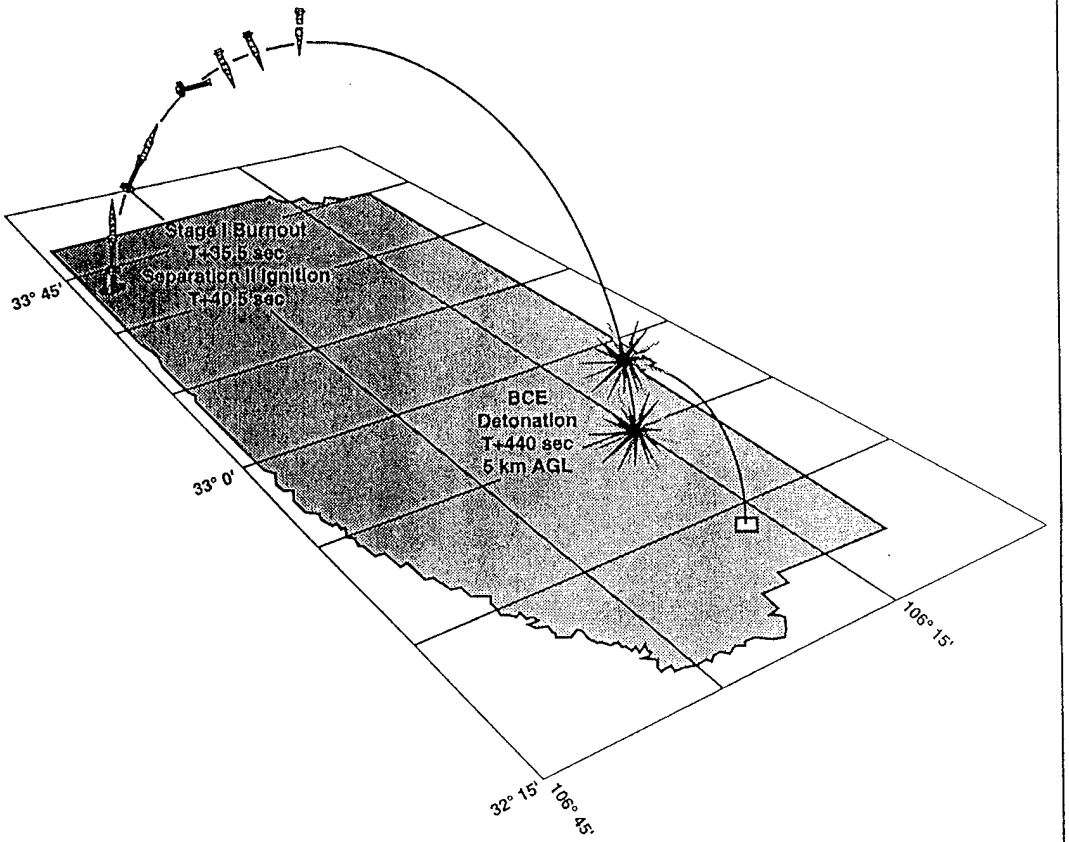
LUT = Limited User Tests

mj-41058C / 022295

STORM TARGETS

Common Subsystems





New Subsystems

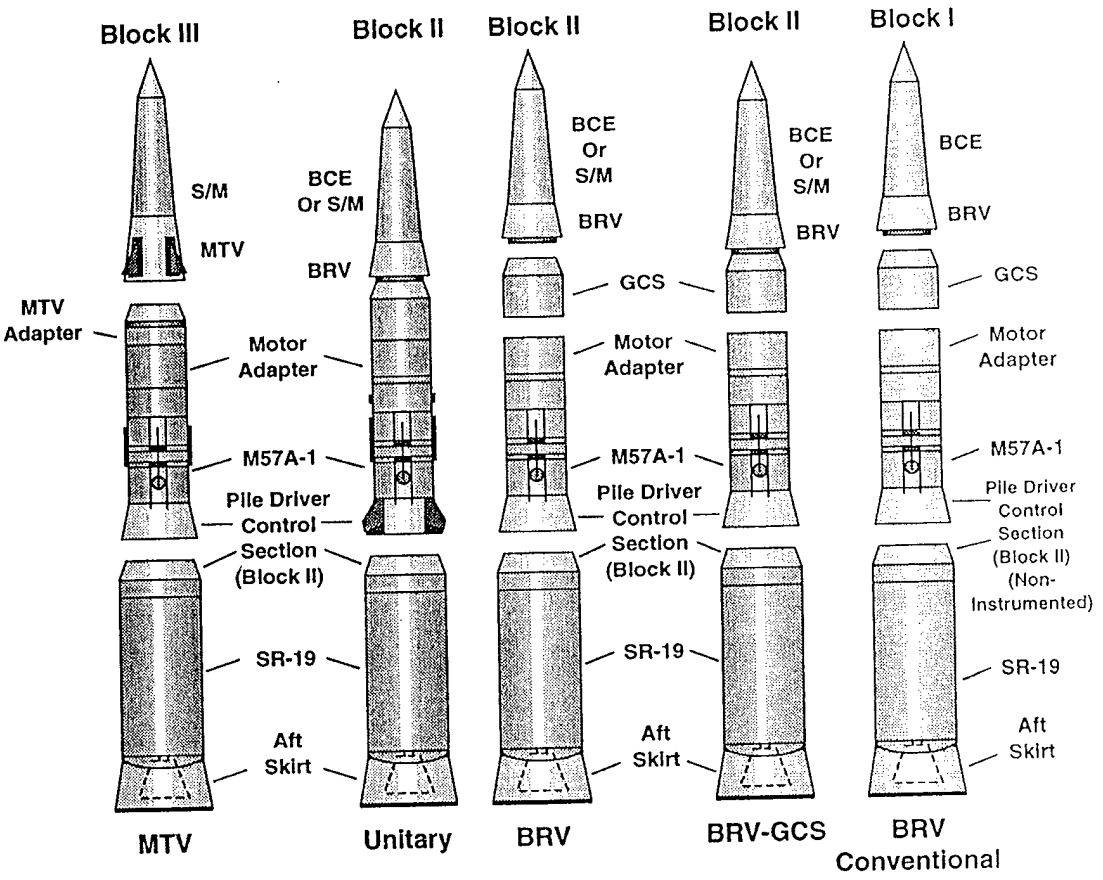
- Guidance And Control System
- Power Distribution System
- Telemetry System
- Pyrotechnic System
- RV Cables
- Ground Support Equipment
- Automatic Test Equipment
- Flight Software

mj-45633 / 081594

HERA

- Vehicle Characteristics And Capabilities

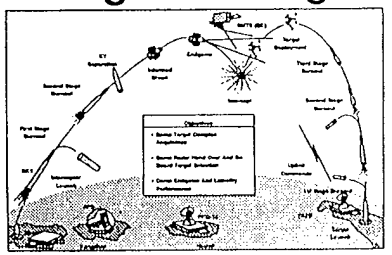
- Propellant	Solid
- # Stages	2
- Stage 1 Motor	SR-19 (MM2 / Stage 2)
- Stage 2 Motor	M57A1 (MM1 / Stage 3)
- Payload	2,000 lbm
- Angle @ Burnout	40 deg
- Vel @ Burnout	2.86 km / sec
- Reentry Vel @ 80 km	< 3.00 km / sec
- Apogee	330 km
- Range	1,173 km
- Exo-time	479 sec (Above 100 km)
- Inventory	0
- Launch Modes	Rail, Ship
- Launch Sites	WSMR



mj-41061B / 101994

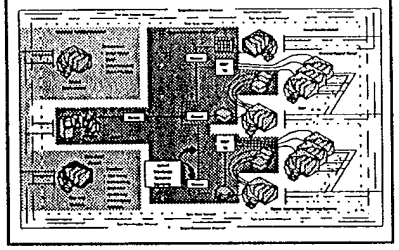
BMD TESTING METHODS

Flight Testing

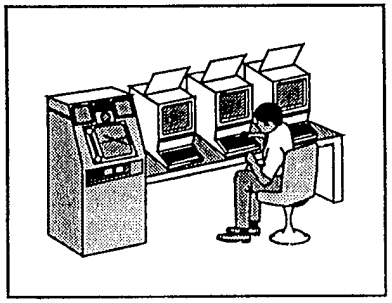


HWIL / SWIL

BMDSE

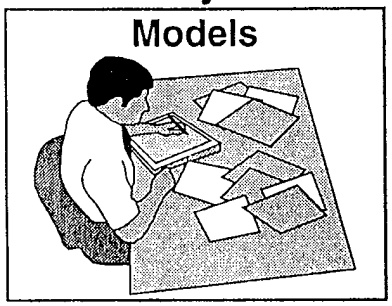


Simulation



Analysis

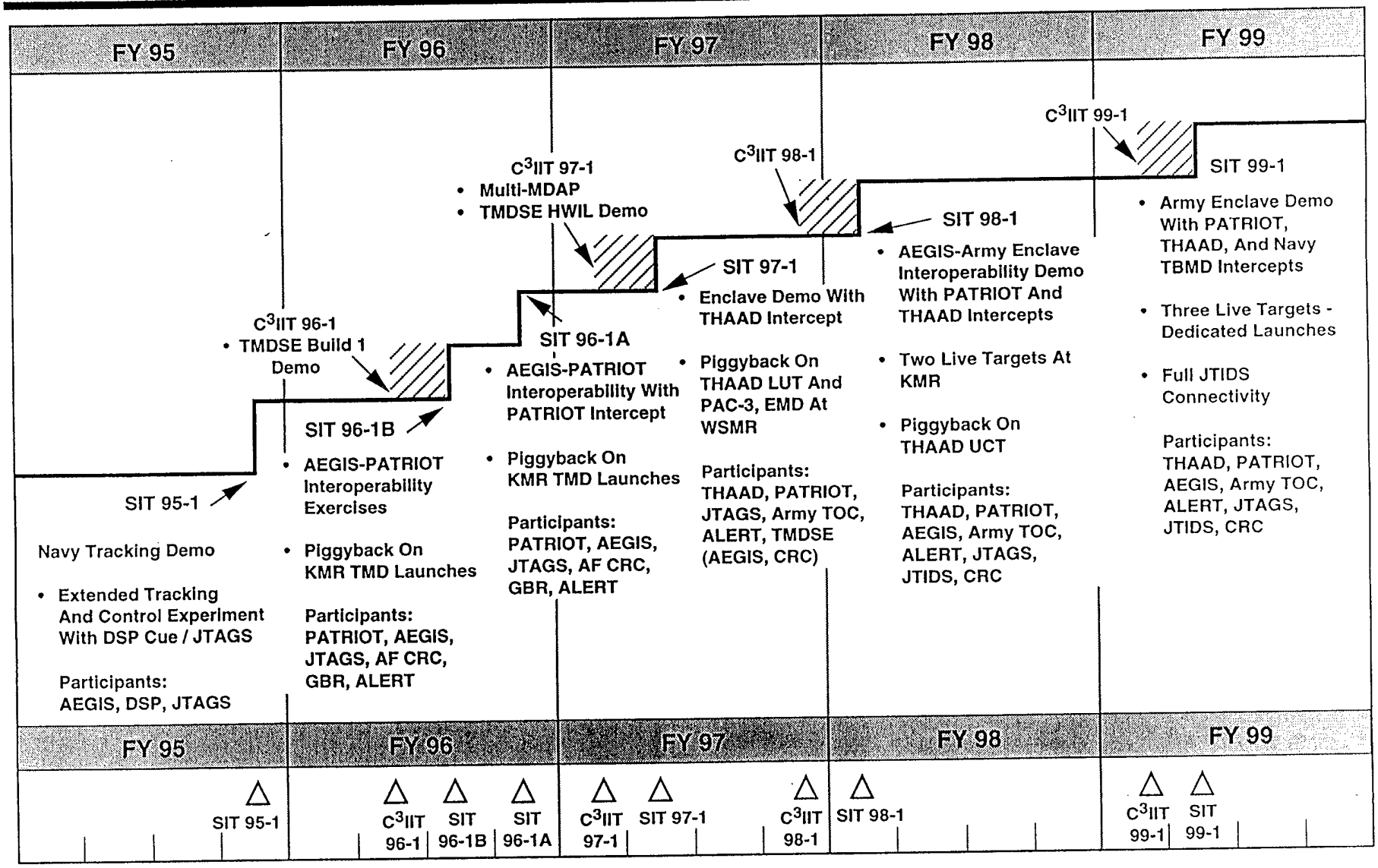
Models



Cost Per Test

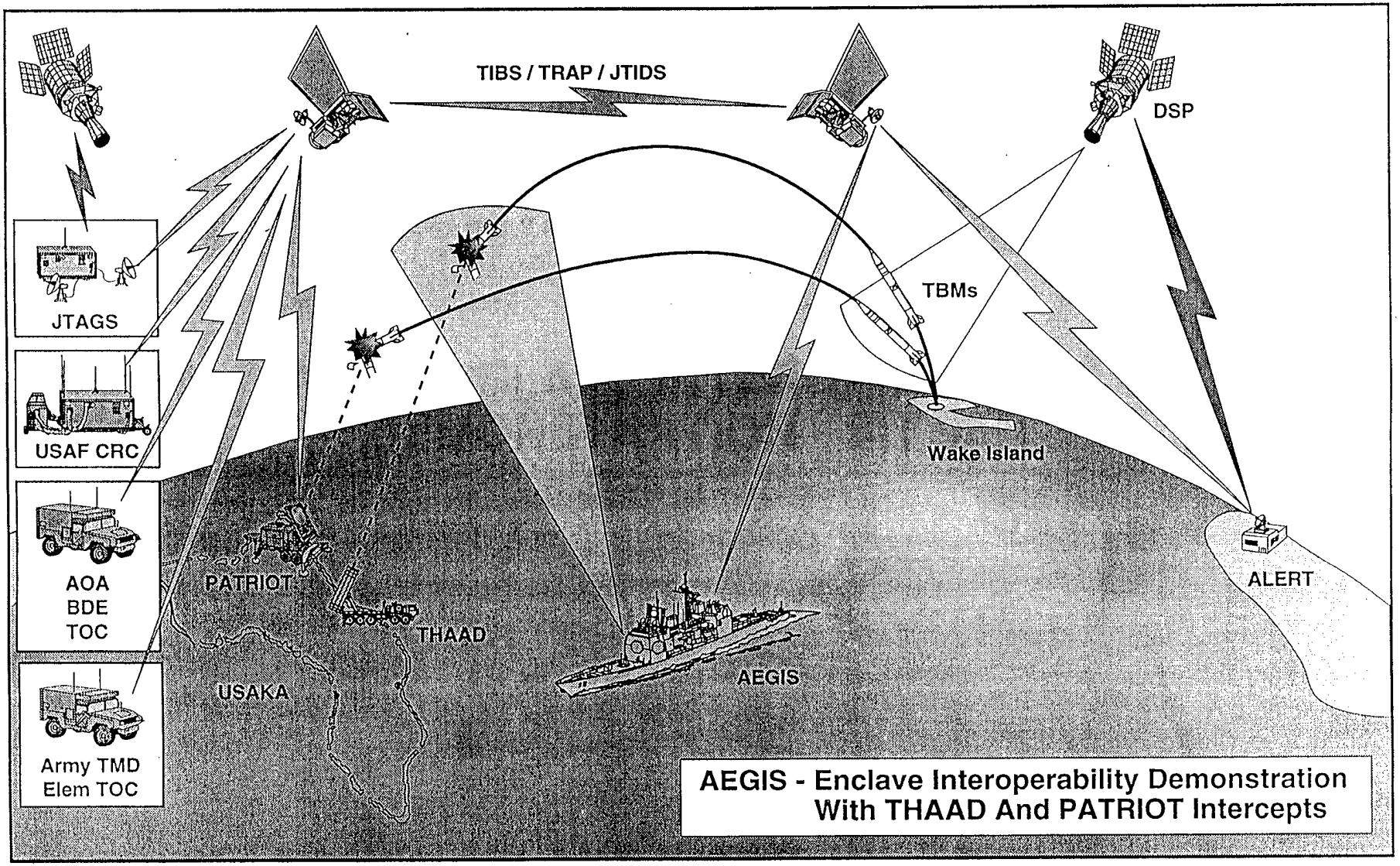
Confidence

TMD INTEGRATION TESTS



mj-50220 / 020995

FY 98 ENCLAVE INTEROPERABILITY DEMONSTRATION - SIT 98-1



mj-49082 / 121594

SUMMARY

- Theater Ballistic Missile Threat Very Real And Growing
- BMDO Is Now Focused On TMD - And Developing And Acquiring Systems
- TMD Program Strategy
  - Builds On Existing Systems To Provide Near Term Capability To Meeting Existing Threats
  - Adds New Systems And Enhancements To Provide Robust Protection

Program Meets National Security Goal For Missile Defense



BMDO
Advanced Planning Briefing For Industry

A.Q. Oldacre
Deputy Program Executive Officer

7 March 1995

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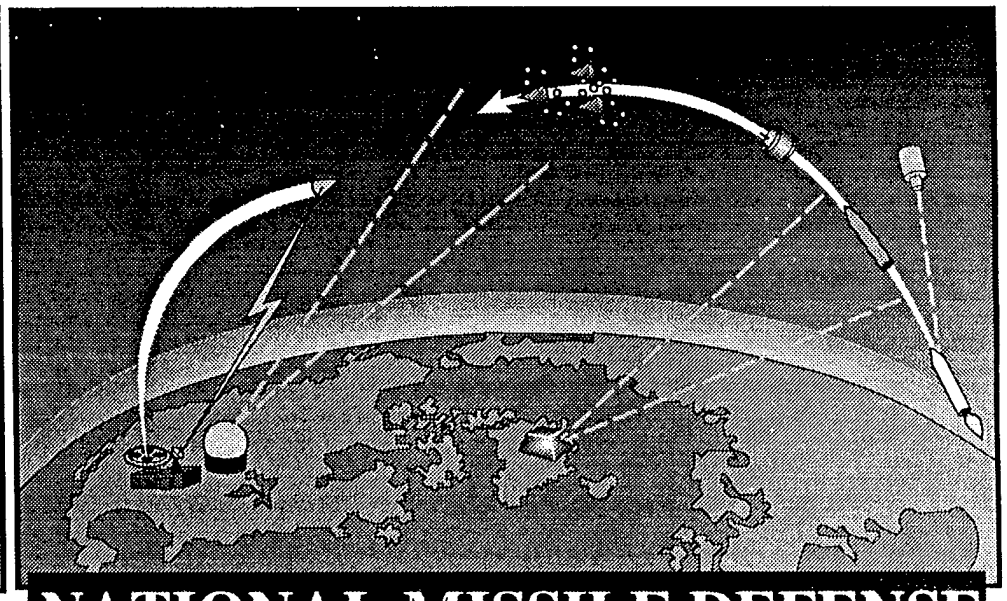
ARMY MISSILE DEFENSE PROGRAM STRATEGY



THEATER MISSILE DEFENSE

Develop And Field A Robust, Two-tiered Theater Missile Defense System

- **Responds To Total Threat Spectrum**
- **Enables Flexible Response And Deployment**
- **Provides Low Leakage Defense Of Critical Assets**

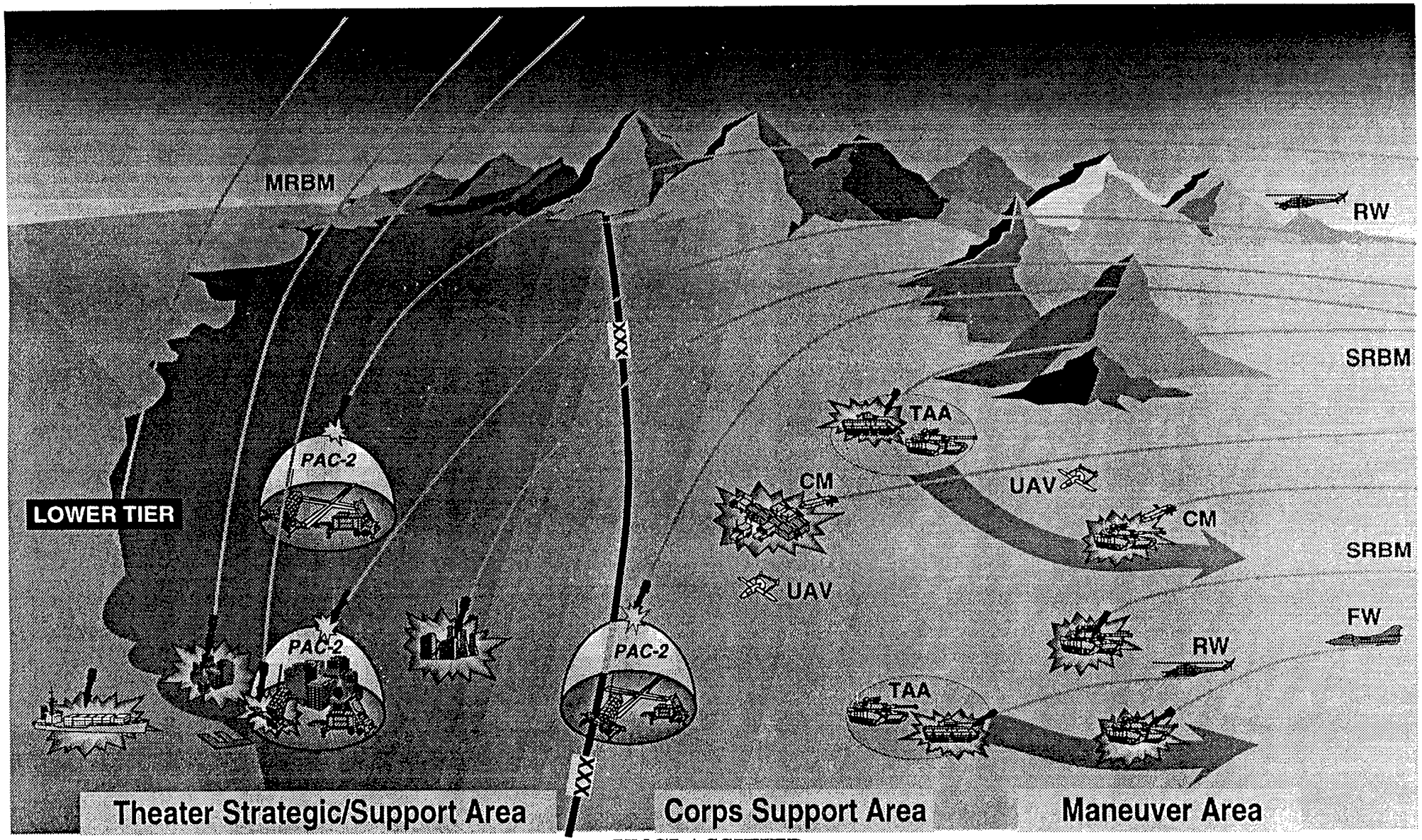


NATIONAL MISSILE DEFENSE

Develop And Posture For Deployment A National Missile Defense System For Homeland Defense

- **Compliant With ABM Treaty**
- **Protects Against Intentional, Unauthorized Or Accidental Launches**
- **Focused On Reduced Deployment Leadtime**

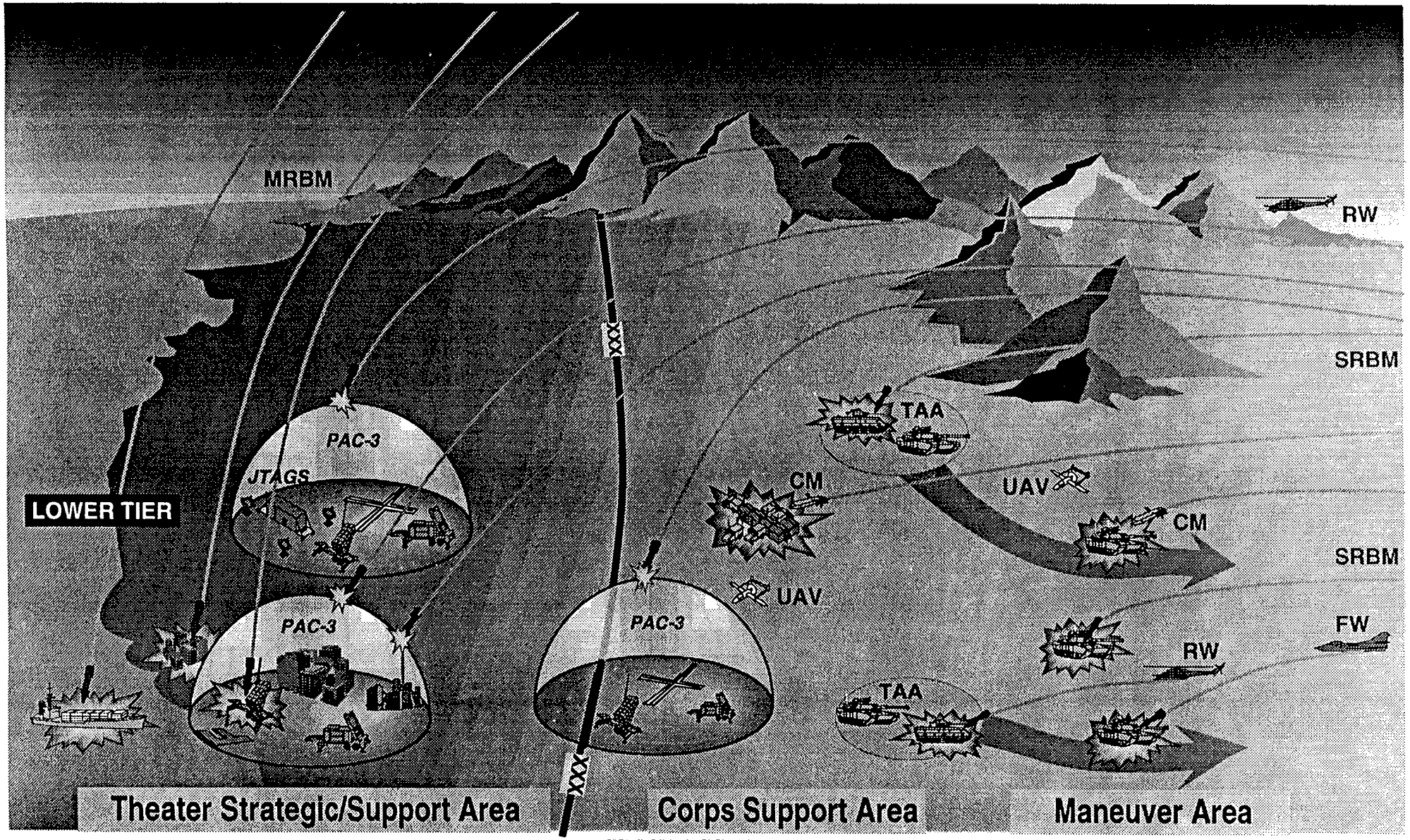
ARMY THEATER MISSILE DEFENSE
CURRENT



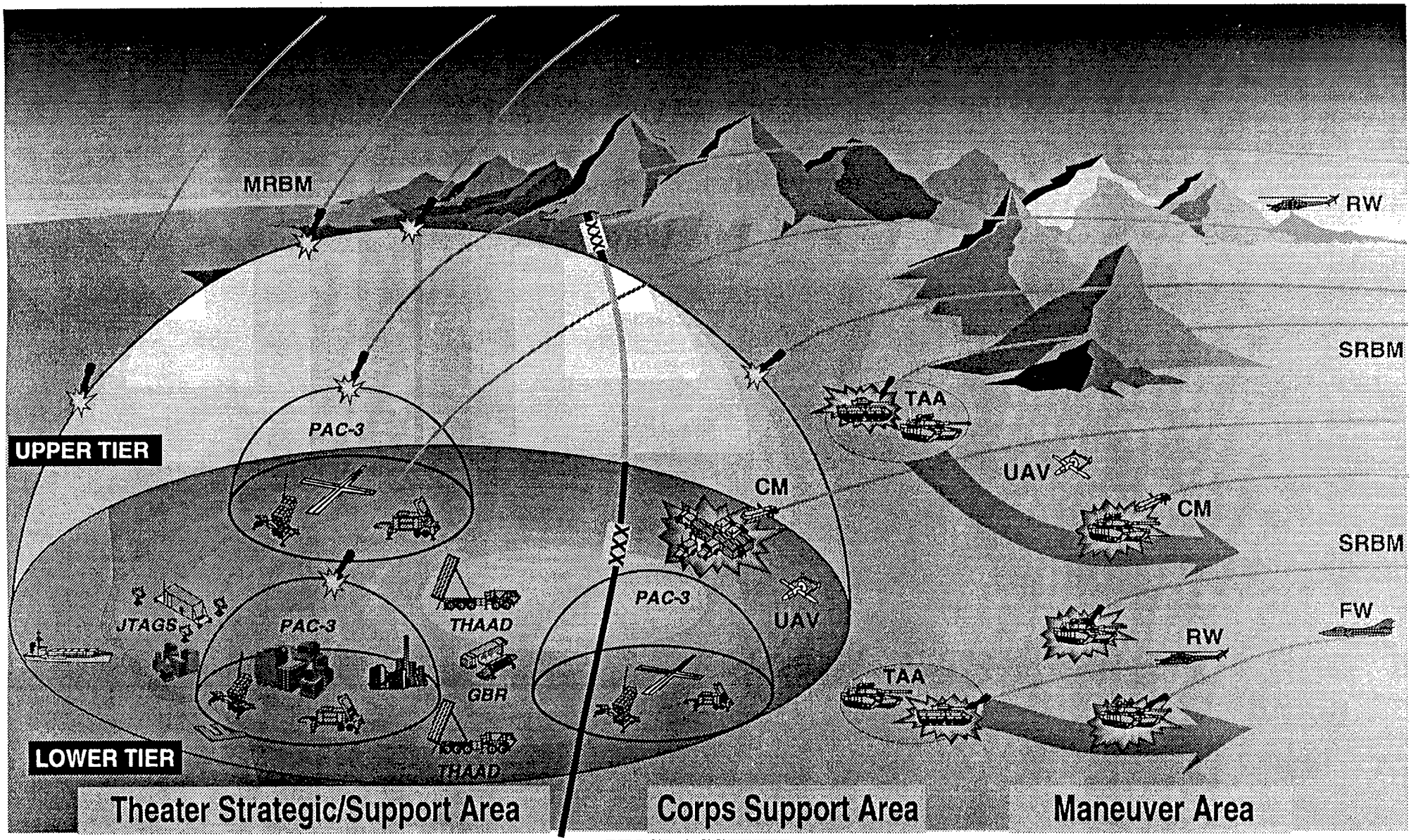
UNCLASSIFIED

MD0185Av3/111894Σ

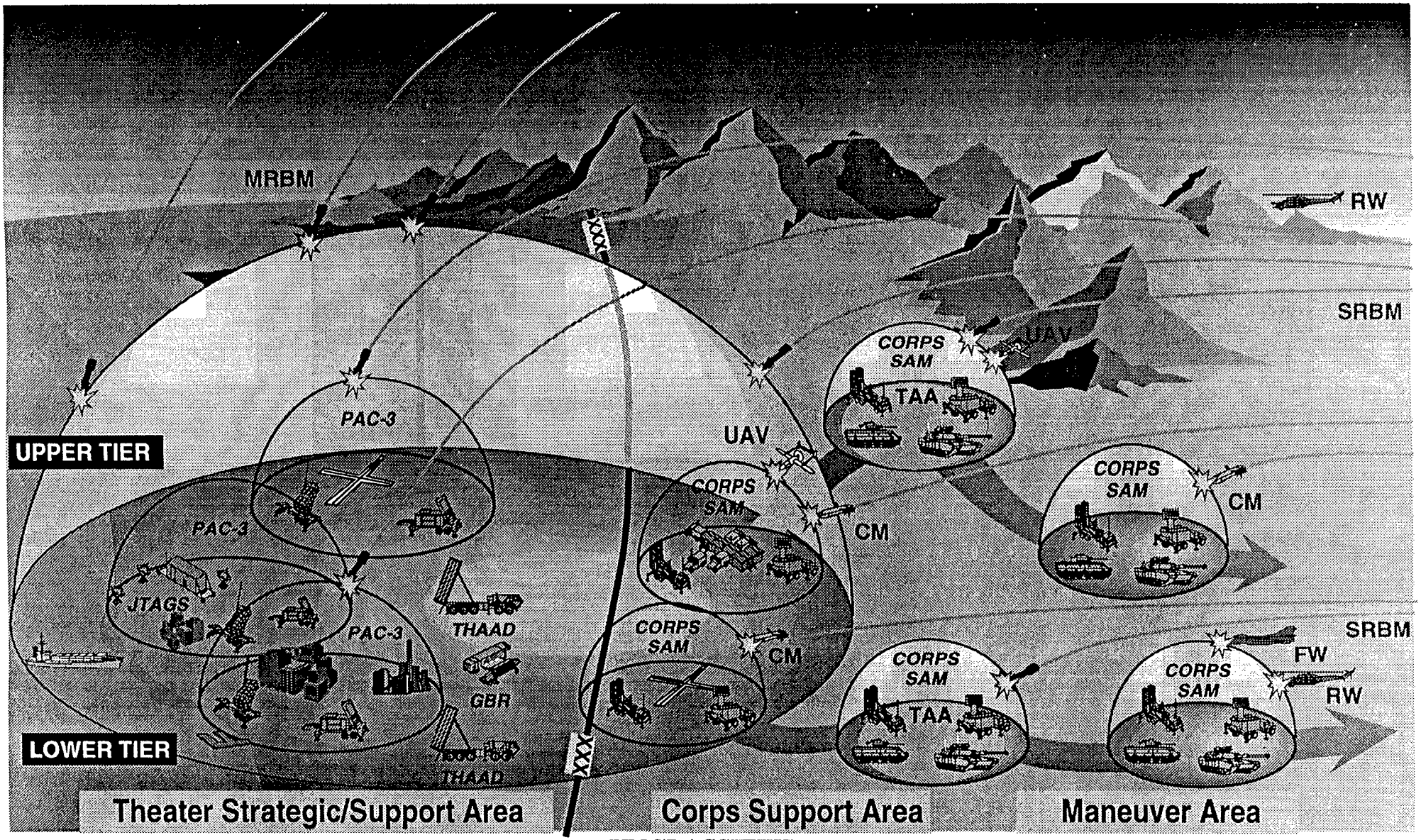
ARMY THEATER MISSILE DEFENSE NEAR TERM PHASE I



ARMY THEATER MISSILE DEFENSE NEAR TERM PHASE II



ARMY THEATER MISSILE DEFENSE OBJECTIVE



MD0188Av3/112194Σ

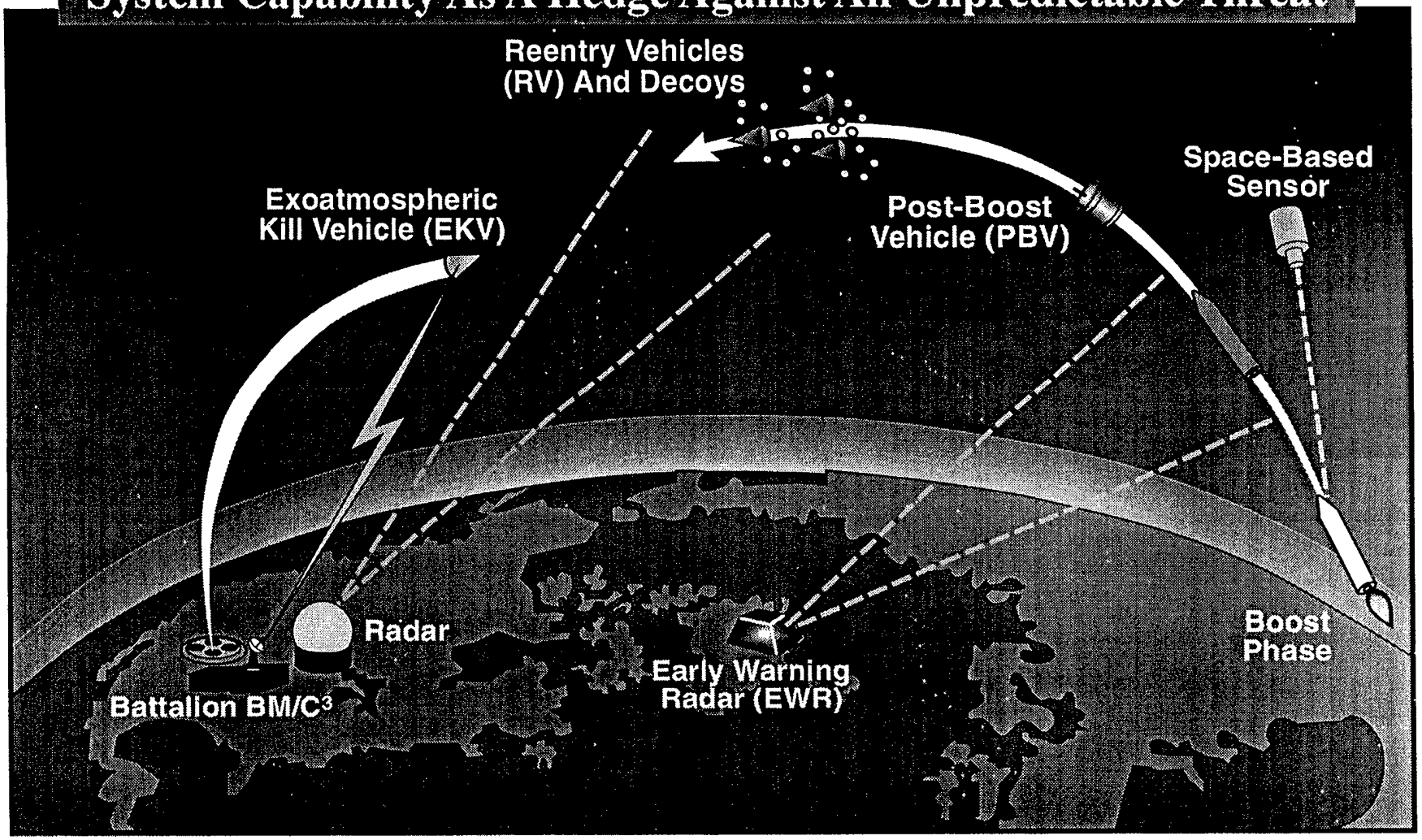
NATIONAL MISSILE DEFENSE A WISE COURSE OF ACTION

- No Capability To Protect The U.S. Against Strategic Ballistic Missile Attack Exists Or Is Otherwise In Development
- Uncertainty As To When Undeterrable Threat Will Appear And The Response Time Available For Deployment
- Only Moderate Investment Above TMD Is Required To Address Key Differences In TMD And NMD Threats, Mission Profiles, And Environments
- ABM Treaty Prohibits Giving Non-ABM Systems (e.g., TMD Systems) ABM Capability

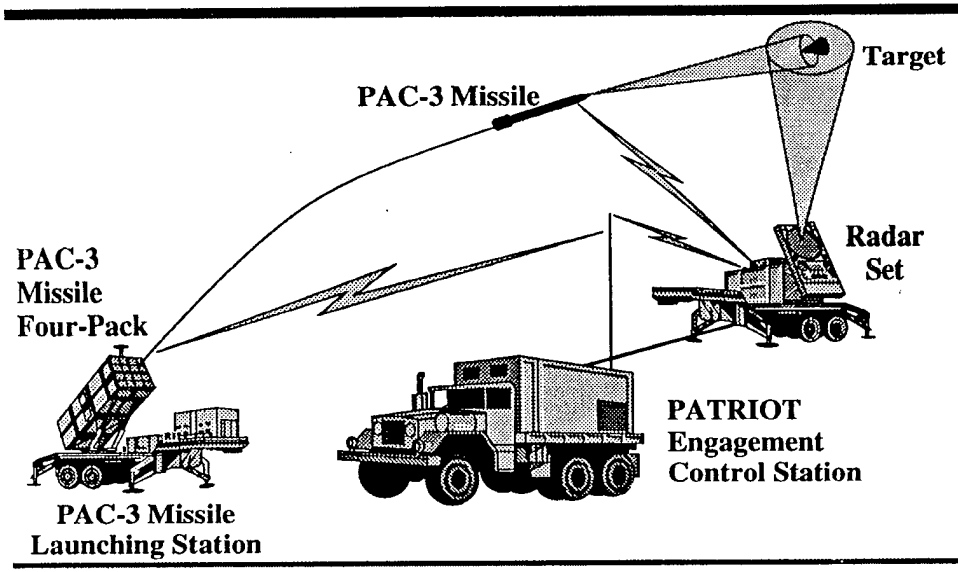
Must Continue NMD Technology Development - Unacceptable Consequences If Not Prepared

NMD SYSTEM CONCEPT

Reduce Leadtime To Achieve A Treaty Compliant, Single Site System Capability As A Hedge Against An Unpredictable Threat



PATRIOT (PAC-3)

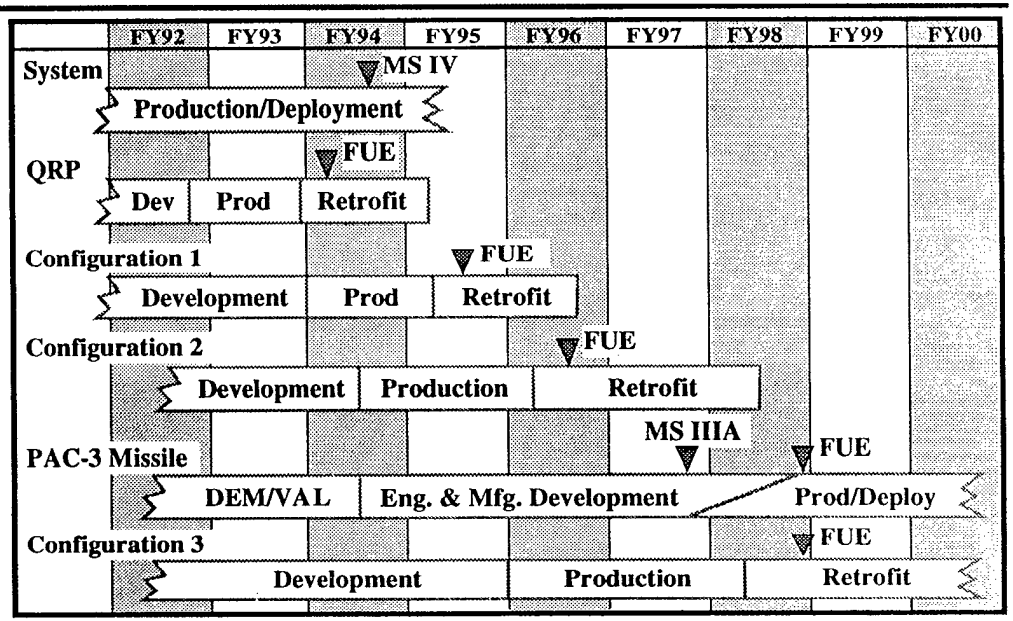


Objectives

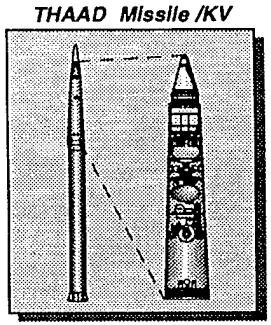
- Provide System Enhancements That Fully Respond To PAC-3 ORD Requirements And STAR Threat
- Incrementally Satisfy ORD Requirements Through Phased Fielding Of System Enhancements
- Demonstrate Improved Capability Against Air Breathing And Tactical Ballistic Missile Threats
- Initial Fielding Of PAC-3 In FY98

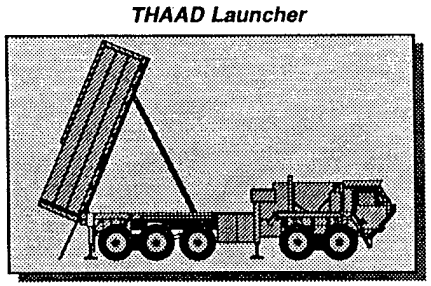
Status

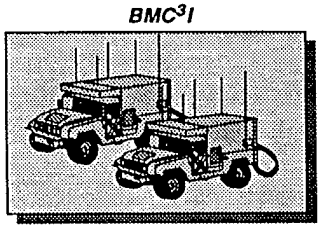
- Quick Response Program Being Fielded
- Guidance Enhanced Missile And Configuration 1 Production Approved
- Remaining PAC-3 Enhancements In Development
  - •• Radar
  - •• Computers And Peripherals
  - •• Communications
  - •• Software
- ERINT Project Office Merged With PATRIOT 15 July 94
- Contracts For PAC-3 Missile EMD (Loral) And Missile Integration (Raytheon) Were Awarded In Oct 94.

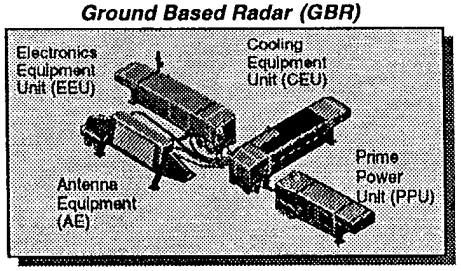


THEATER HIGH ALTITUDE AREA DEFENSE (THAAD)







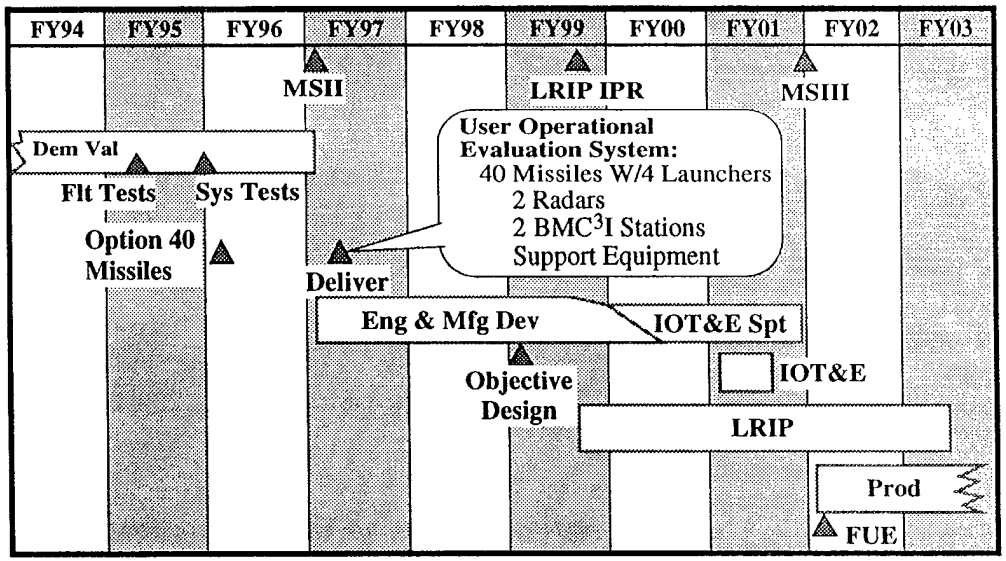


Objectives

- Defend Against TBM Threats Using Hit-To-Kill Technology
- Upper Tier Of Two Tiered Defense
- Capable Of Both Endo- And Exo-Atmospheric Intercepts
- Use GBR X-Band Radar

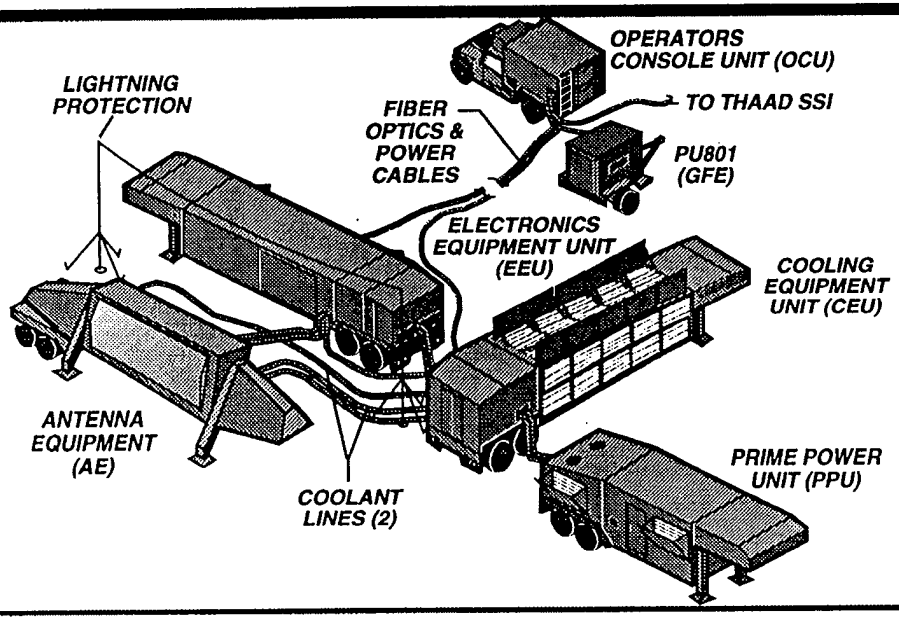
Status

- Significant Accomplishments
  - •• Initial And Final Design Reviews Completed
  - •• Development Tests Continuing
  - •• Technical Challenges Being Addressed
  - •• Delivery Of GTU #1 Hardware
- Current Focus On Fabrication And Integration Activities In Support Of First Flight And First Intercept (FTV-3)
- Initial Test Flight In 2QFY95



MD0004K/021295Σ

GROUND BASED RADAR

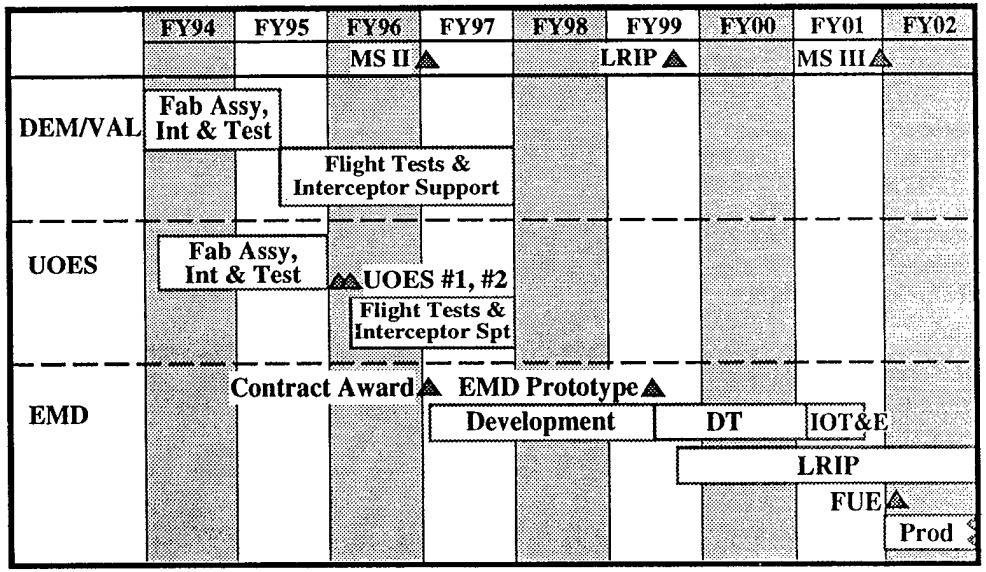


Objectives

- Provide Detection, Acquisition, Track, Discrimination, And Interceptor Guidance And Control For The THAAD System
- Meet Strategic And Tactical Mobility Requirements
- User Operational Evaluation System (UOES) Deployable FY97; Objective System FY01
- Provide A Robust Technology Base For Strategic Radar Development

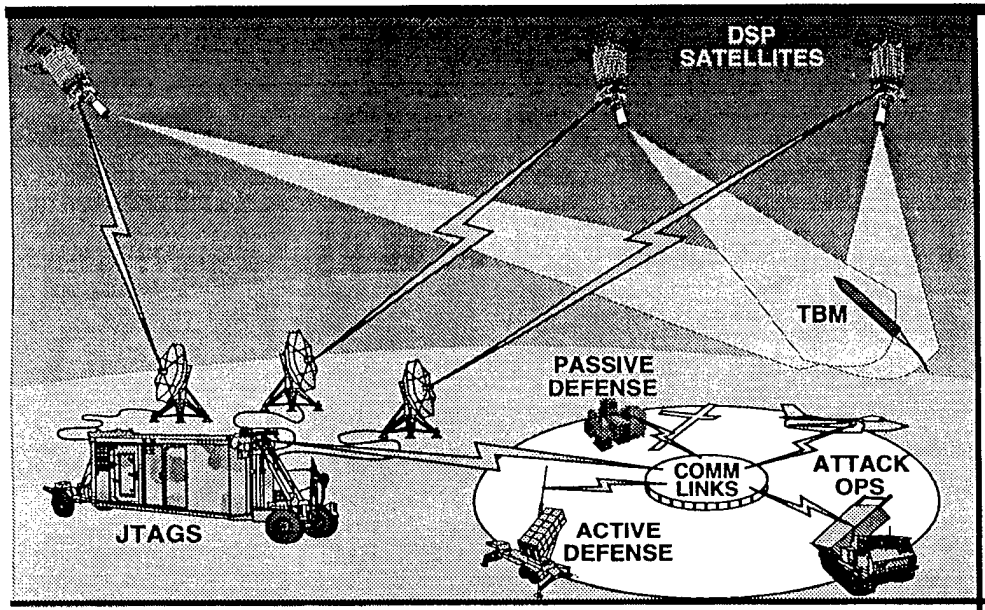
Status

- DEM/VAL Radar Assembly And In-Plant Testing Ongoing
- FT. Devens Testing To Be Conducted Mar - Oct 95
- UOES Radar Fabrication Ongoing
- Initial DEM/VAL Radar Full Power Test - Jan 95



MD0005G/121394Σ

JOINT TACTICAL GROUND STATION (JTAGS)

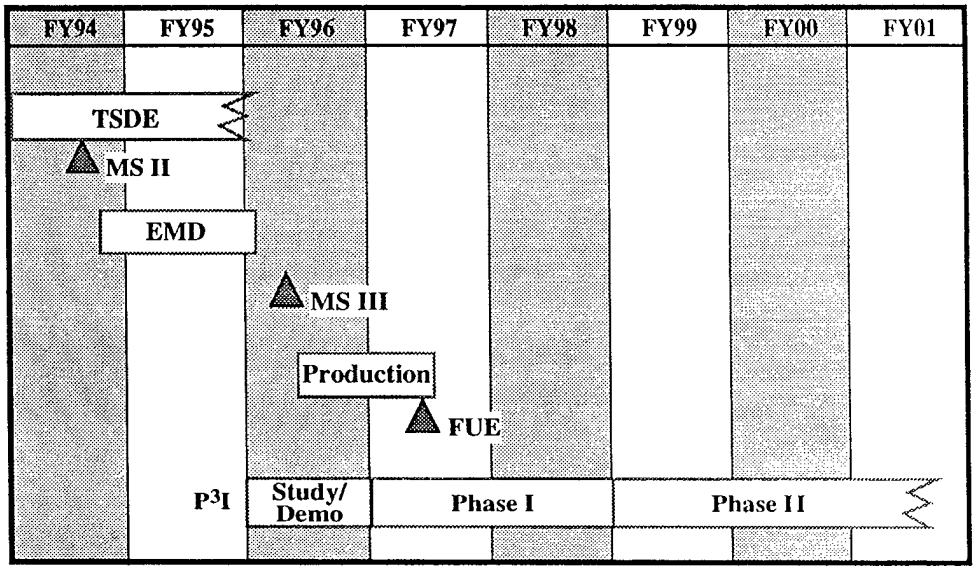


Objectives

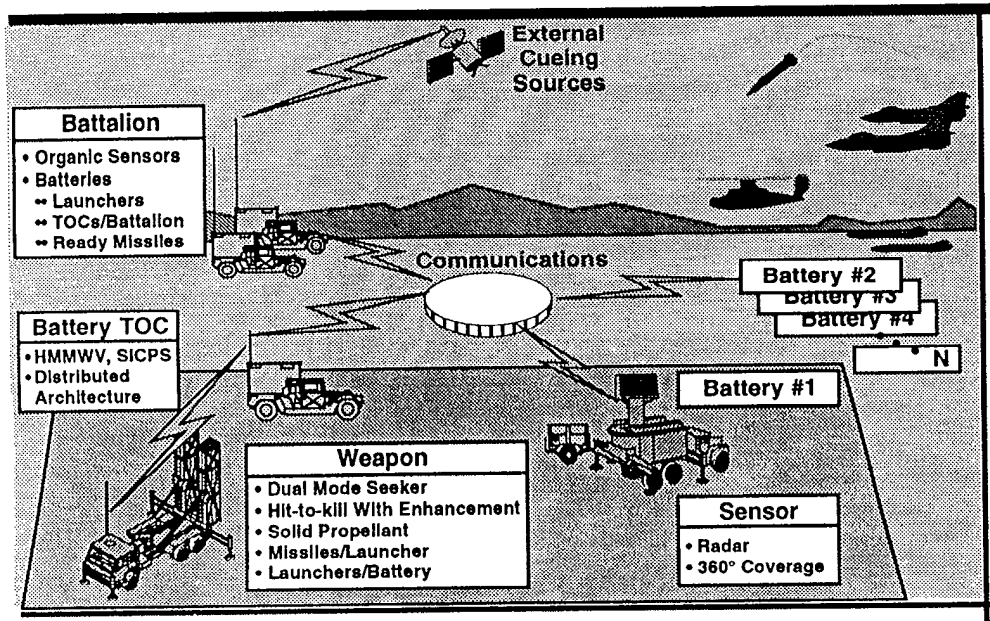
- Field Joint Tactical Ground Stations To Provide In-Theater Real Time Tactical Warning, Alerting And Cueing Information
- Use Direct Down-Link From DSP And Follow-On Space-Based Sensors

Status

- TSD Prototype In USAREUR - Currently Providing Contingency Support And Available For Exercises
- TSDE Transportable Prototype
  - Government Testing Completed January 1994
  - Currently Providing Contingency Support OCONUS
- Successful Milestone II Decision Review 6 May 1994
  - Contract Awarded 8 Jul 94 For EMD With Production Options
  - EMD Prototypes Undergoing Integration And Test
  - EMD Testing WSMR Apr - Sep 1995
  - Army Responding To Tactical Event System Implementation Plan



CORPS SAM

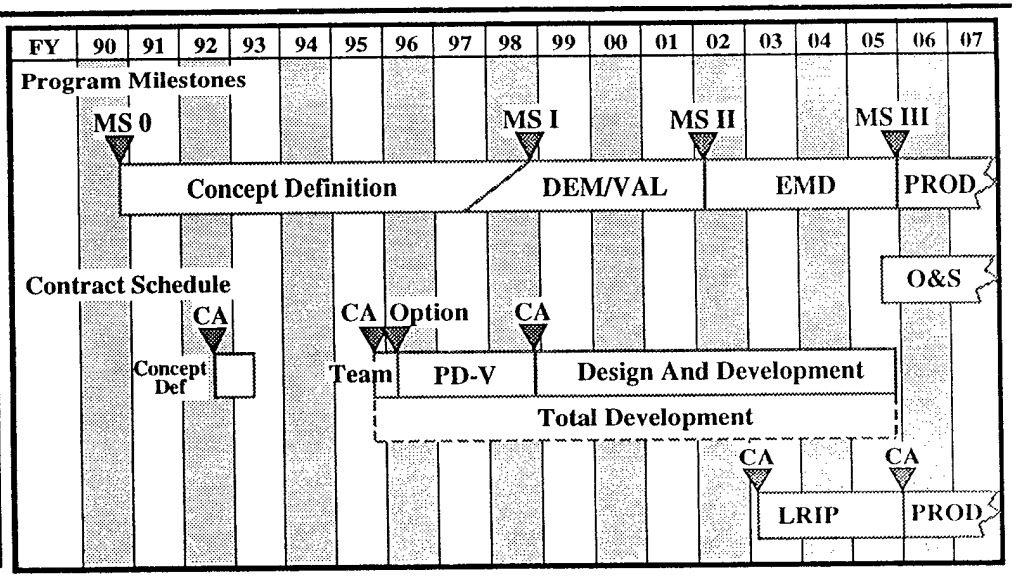


Objectives

- 360 Degrees Protection Against TBMs, CMs, And Other ABTs
- Transportability Consistent With Contingency Operations
- Mobility Consistent With Protection Of Maneuver Force
- Highly Survivable And Operationally Versatile Distributed Architecture
- High Firepower With Low Manpower And Low Airlift

Status

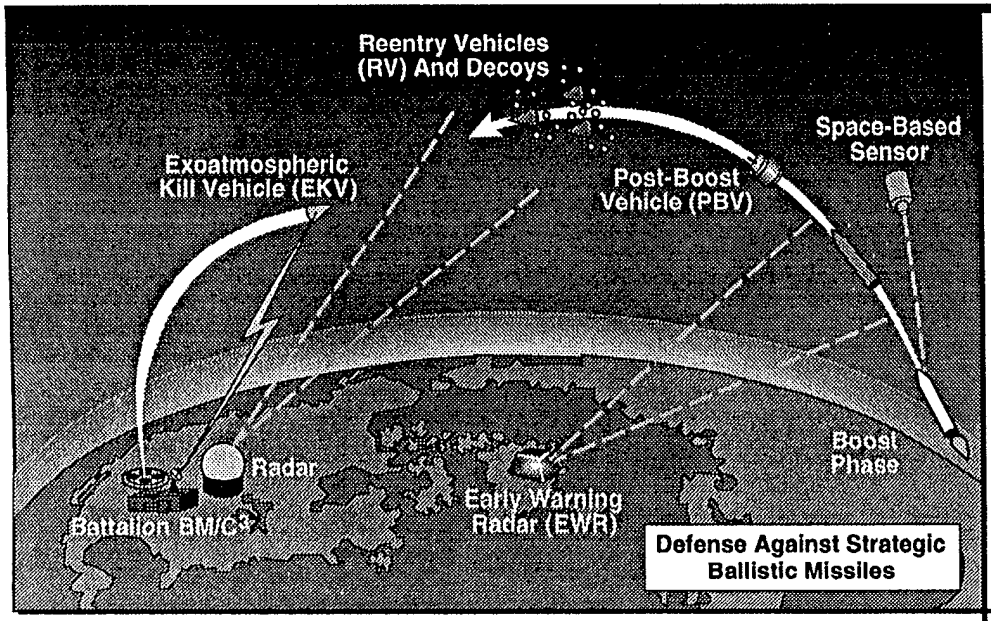
- ORD Approved October 93
- Statement Of Intent For International Program With U.S./GE/FR/IT Signed February 1995
  - •• Program Managed By A NATO Agency
  - •• U.S. Cost/Work Share = 50%
  - •• Program Name - MEADS (Medium Extended Air Defense System)
- U.S. Downselect Process Underway
  - •• Five Contractors To Two
  - •• Source Selection In September 1995
- International MOU And NATO Agency Charter Being Negotiated



UNCLASSIFIED

MD0006J/022795Σ

NMD PROGRAM

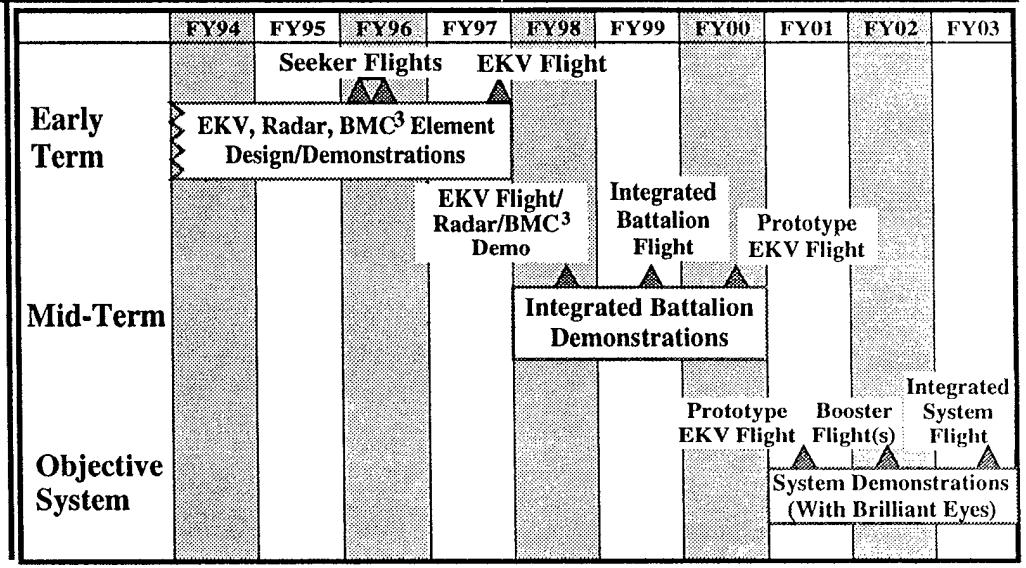


Objectives

- Leverage TMD Investments And Experience
- Incrementally Demonstrate Interceptor, Sensor, BMC^3 Technologies, And Integrated System Performance
- Resolve Key System Level Technical Challenges
- Develop Methodology For Reducing Acquisition Leadtimes
- Develop/Maintain Contingency Options With Minimum Deployment Leadtime

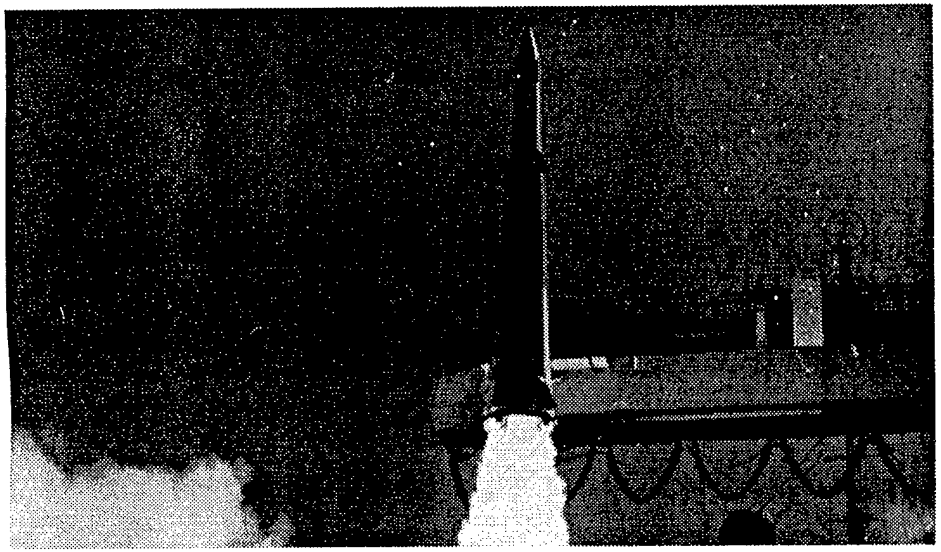
Status

- Program Restructured To Reflect Latest Congressional And OSD Direction
- Rockwell And Hughes Selected For EKV Demonstration
- Radar Contract Modification In Progress
- BMC^3 RFP Being Prepared



U.S. ARMY MISSILE DEFENSE PROGRAM EXECUTIVE OFFICE

ARROW/ACES

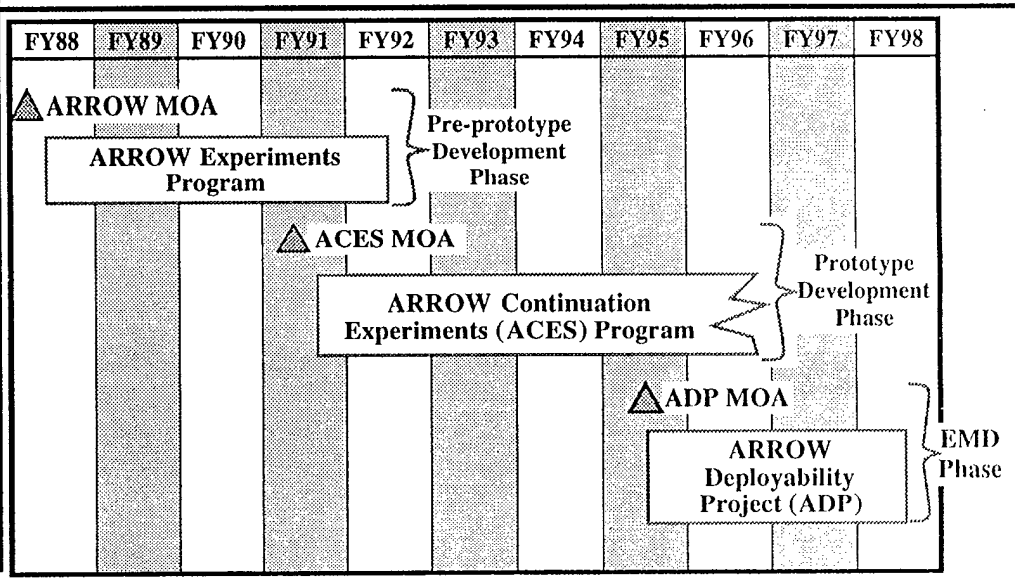


Objectives

- Develop Long Range Interceptor For Israeli TBM Defense
- Conduct Lethality Tests
- Show Capability Against Surrogate Targets
- Develop Transportable Launcher
- Enable Israeli Deployment Decision
- Initiate ARROW Deployability Project

Status

- Launcher Test #4 Completed
- Launcher Test #5 2QFY95
- System CDR 2QFY95
- First ARROW 2 Integration Test 2Q FY95
- Fire In The Hole #3 2QFY95
- Booster Test #5 2QFY95
- ARROW Deployability Project (ADP) MOA In Negotiation



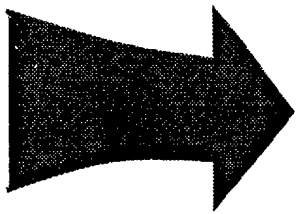
MD0002i/021095Σ

SUMMARY

The PEO Missile Defense Is Committed To:

- **Developing, Acquiring, And Fielding The Best Air And Missile Defense Systems Possible**
- **Reducing Cost And Lead-times**
- **Streamlining The Acquisition Process**
- **Developing A Robust Theater Missile Defense Program**

PATRIOT PAC-3
THAAD/GBR
CORPS SAM
JTAGS



Versatile
Lethal
Synergistic
Interoperable

- **Developing A National Missile Defense Deployment Capability**

Protect The Theater Of Operations And The United States From A Technologically Advanced And Diverse Missile Threat

Advance Planning Briefing For Industry, Arms Control And Missile Defense Overview



7-8 MAR 95

COL Vincent J. Faggioli, USA
Assistant General Counsel
Treaty Compliance And International Law
Ballistic Missile Defense Organization

mj-51076 / 021795

Briefing to be Presented by COL Vincent Faggioli, Treaty Attorney, BMDO March 7, 1995 at the Advance Planning Briefing for Industry.

Briefing is to be at the unclassified level.

Purpose of the briefing is to update attendees, inasmuch as that is possible, regarding missile defense and Arms Control.

Slide 1 - Outline Slide - self-explanatory

Slide 2 - Arms Control
Explain Background, benefit and effect of arms control

Slide 3 - Explain INF Treaty

What it did
How it is verified
First true success in eliminating an entire class of nuclear weapons

Slide 4 - Briefly explain START Treaties

History
Major provisions - limitations
Arms Reduction - where is it going? START III? Zero Option?

Slide 5 - Rhetorically asks what is responsible for these reductions? (nonjudgementally of course)

Slide 6 - The ABM Treaty is given much of the credit

-Begin discussion of ABM Treaty with review of history

-Discussion of philosophical underpinning - MAD (I have several quotes, which will not be read verbatim which states that MAD was in fact the policy of the parties including one from Secretary Perry: "MAD was the base of our security policy during the cold war."

-End discussion with vivid picture painted in words by Secretary Perry describing MAD.

-Purpose of slide is to get audience to actually consider both sides of MAD - stability and actual means to stability.

Slide 7 - The audience is asked again to consider the purported benefits of MAD

Slide 8 - Actual unclassified numbers of warheads at the time of signing of ABM Treaty, through cold war period to Arms Control success period. Let audience form own conclusion as to cause-effect

Slide 9 - Discusses articles I-IV (no focus yet on NMD or TMD)

Slide 10 - Discusses Articles V and VI (no focus on NMD or TMD)

Slide 11 - Characteristics of the Treaty not covered in Articles I-VI

Slide 12 - Discusses the four main prohibitions of the Treaty - will also add - no transfer provisions

-attempts to get audience thinking about ambiguities with bottom bullet.

Slide 13 - Introduces difficulties in interpreting the Treaty

- discusses how ambiguities are interpreted and explains interpretation aids.

Slide 14 - Purpose of slide is to show ABM Treaty DOES NOT prohibit all activities related to missile defense

-explains what we can do

Slide 15 - This is the transition into NMD discussion.

-The slide is a graphic representation of the single site ABM field allowed under the treaty

Slide 16 - Continues NMD discussion - reviews Arts I-III

- asks questions based on ambiguity - adjuncts? capability?

Slide 17 - Ends NMD discussion with Articles V and IX

Slide 18 - This is TMD Transition slide

- give quote from Kissinger: shows latent ambiguity of Treaty -used as springboard for assertion that Treaty needs clarification

Slide 19 - Flesh out ambiguity assertion with description of ambiguities - lead into Former Foster Box limitation - stay away from classified.

Slide 20- This slide develops evolution of TMD and strategic missiles - demonstrates "buffer" which will exist in 1995-2005 which is even larger than Foster Box Buffer of 1972.

Slide 21 - This slide presents the choice which the administration had: Clarify or forgo meaningful TMD.

Slide 22 - This is first of 2 slides showing how 2 newspapers

captured this choice - NY TIMES - argues for wooden interpretation

Slide 23 - Wash Post recognizes need to field TMD and clarify treaty

Slide 24 - This slide begins to describe clarification process using Bob Bell's original talking points and Ash Carter's Washington Post Talking Points.

- Inject here only a little implicit criticism of Postol for claiming the administration is proposing to violate the Treaty
- Here I will make the point that the Treaty is what the parties say it is - and move into next slide on THAAD testing

Slide 25 - Briefly discuss THAAD testing - drawn from Dr. Carter's talking points. Expand to briefly mention LEAP and SMTS concept tests as being treaty compliant - not relying on agreement or breakout.

Slide 26 - This slide continues clarification discussion

-gives brief synopsis - unclassified - as to "some" areas of progress, "some" areas of disagreement.

-introduces, nonjudgmentally, multilateralization.

Slide 27 - This slide introduces discussion of Treaty status of sensors

- Hopes to make the point that sensors, if they are too good, will offend the Treaty

Slide 28 - This is an issues slide - not to be fully discussed.

- self explanatory

Slide 29 - Summary Slide
-Self Explanatory

OUTLINE

- Treaties Generally
- INF
- START I / II
- ABM
  - History And Provisions
  - NMD
  - TMD
  - Sensors
- Summary

mj-51077 / 021795

ARMS CONTROL CREDO

- Treaties
  - Cold War
  - World Is / Was *Very* Dangerous Place
  - Fewer Arms = Safer Place
  - Defense By Other Means
  - Parties All See Benefits
- Effect → Agreement To Give Up Right To Obtain Benefits

A Treaty Is The Law Of The Land

mj-51078 / 022195

INF TREATY

- 1988 Agreement To
  - Ban Intermediate Range Ballistic Missiles >500<5,500 km Range
  - Interceptors Exempt
  - Constrains R&D Boosters - But Allows
    - R&D To Test Objects Other Than, Booster Itself
    - Test Sites Designated / Limited To 35
    - Canisters Must Be Fixed, Above Ground

- Verified By
  - Data Exchanges / Test Reporting
  - On-site Inspections
  - NTM

- First Major Arms Reduction Success

mj-51079 / 021795

START

- START
  - Entered Into Force December 1994
  - Eliminates Selected Sites And ICBMs (SOA)
  - Limits Test Site - Vandenberg
  - Encryption Ban
  - Decreases Nuclear SBMs To *6,000* Accountable Each
  - Our Lucky "STARS"
  - Removes Nuclear Missiles From All FSU But Russia

- START II
  - No MIRVed ICBMs
  - Reduces SBMs To *3,500* Each !
  - Presently Before Senate

- Clinton - Yeltsin Initiative

- START III ?

- Zero Option ?

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WHAT MADE ALL THESE REDUCTIONS POSSIBLE ?

- Political Reality ?
- Economic Reality ?
- Hard-nosed Negotiating ?
- Arms Control Process ?

mj-51081 / 021795

SOME SAY: THE ABM TREATY

- History - Before Arms Reduction Successes
  - Cold War
  - 1969 - 1972 Negotiations
  - Mutual Vulnerability - Offensive Deterrence
  - Stability
  - Offense-Defense Linkage ?
  - MAD - *The Base Of Our Security Policy*

Secretary Perry:

"MAD Has Been Compared To Two Men Standing 10 Feet Apart, Each Holding A Revolver Pointed At The Other's Head. The Revolver Is Loaded, Their Fingers Are On The Trigger, Quivering, And They Are Shouting Insults At Each Other. This Captures ... The Mutual Terror That Was At The Base Of Our Security Policy During The Cold War."

January 1995

mj-51082 / 021795

ABM TREATY: PURPOSE

- To Preserve Stability Of MAD

And

- Clear The Way For Arms Reductions
- Did It Work ?

mj-51083 / 021795

STRATEGIC ICBM / SLBM WARHEADS

Numbers Of Strategic Nuclear Weapons Systems
(Exclusive Of INF Range)

- 1972 - Total U.S. / USSR ≈ 5,000

- 1980 - Total U.S. / USSR ≈ 14,000

- 1990 - Total U.S. / USSR ≈ 18,000

START - 1996 - Total U.S. / Russia ≈ 12,000

START II - 2003 - Total U.S. / Russia ≈ 7,000

mj-51084 / 021795

ANTIBALLISTIC MISSILE TREATY (ABMT)

Major Provisions

Article I

- Limit ABM Systems - No Defense Of Territory From Missile Attack
  - Not Provide A "Base"
  - Not Deploy For Defense Of Region

Article II

- Defines An ABM System: "Currently Consisting Of" (1972)
  - ABM Interceptors, Deployed Or Tested In ABM Mode
  - ABM Launchers
  - ABM Radars

Article III

- ABM System Deployment Area - 100 Interceptors / Launchers
  - Powerful Radars

Article IV

- ABM Testing, Ranges, 15 Launchers Total

mj-38771 / 021795

ANTIBALLISTIC MISSILE TREATY (ABMT) (Cont'd)

Major Provisions (Cont'd)

Article V

- No Developing, Testing, Deployment Of ABM System Or *Components* Which Are Air, Sea, Or Space Based, Or Mobile Land Based
- No Multiple Launch Capability Or Rapid Reload

Article VI

- *May Not* Give Non-ABM Components Or Systems Capabilities To Counter Strategic Ballistic Missiles
- *May Not* Test Non-ABM Systems In ABM Mode
- May Only Deploy Future Radars For SBM Attack Warning On Periphery-oriented Outward

mj-38772 / 021795

OTHER PROVISIONS

- Bilateral (Was)
- Unlimited Duration
- Withdrawal - Supreme Interest
- It Is The Law Of Our Land

ABM TREATY PROHIBITIONS

Four Main Prohibitions

- No ABM Systems - Except 1, And It Can't Defend "Territory"
- No Mobile ABM Systems / Components (Space, Sea, Air, Mobile Land Based)
- No Testing Non-ABM Systems In ABM Mode
- No Giving Non-ABM Systems, ABM Capabilities (Substituting) Against SBMs

Problem: Few Definitions

GOOD NEWS AND BAD NEWS

- *Good* News: It Is Ambiguous

- *Bad* News: It Is Ambiguous

- How Is The Treaty To Be Interpreted ?

  - The Words
    - Articles, Agreed Statements,Common Understandings, Unilateral Statements

  - Practice Of The Parties

  - Statements Of The Parties
    - Negotiating Record
    - Ratification Record
    - SCC Records
    - D&S Talks
    - Compliance Reports

mj-51085 / 021795

ABM TREATY:
WHAT WE KNOW WE CAN DO

- We Can
  - Research
  - Field Test Non-ABM Systems / Components
  - Deploy Non-ABM Systems
  - Develop And Deploy One ABM Site

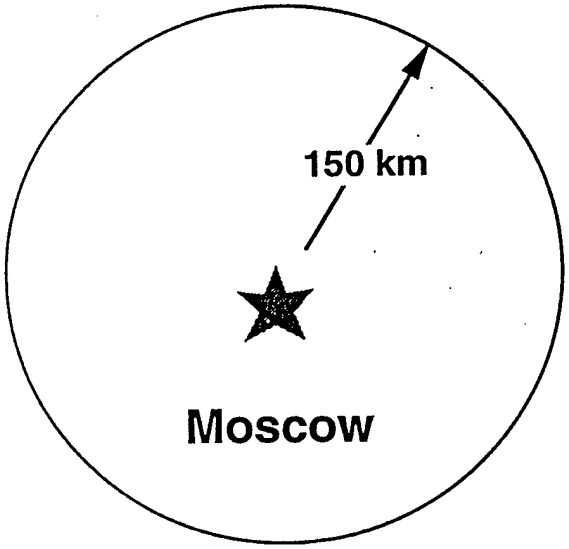
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NMD SINGLE SITE

Numerical / Locational Limits

- 1974 Protocol Limited Parties To 1 Site Each Vice 2 In Basic Treaty

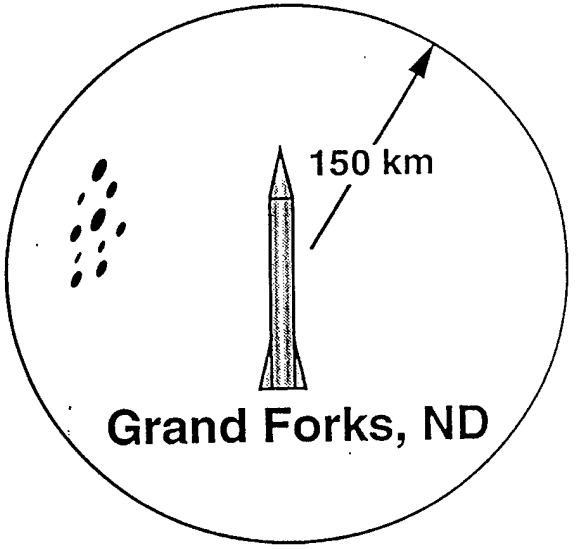
National Capital



- 100 Interceptors
- 100 Launchers
- 6 ABM Radar Complexes

- Each Party Allowed To Change Deployment Area Only Once
- Must Notify

ICBM Deployment Area



- 100 Interceptors
- 100 Launchers
- 2 LPARs
- 6 ABM Radar Complexes

mj-51087 / 021795

NMD SINGLE SITE (Cont'd)

Article I
- Prohibits ABM System For A Defense Of The Territory Of The Country
- Region
- Base For Breakout

Article II
- ABM System Defined (Sort Of)

Article III
- Deployment Area
- Adjuncts ?
- How Capable ? Defend Nation Against 2 Or 3 ?

NMD SINGLE SITE (Cont'd)

Article V

- Prohibits Development, Testing Or Deployment Of Sea-, Air-, Space-based Or Land Mobile ABM Systems
  - Develop ? Not Defined
  - Narrow / Broad
  - How Capable Can It Be, Against What ?

Article IX

- No Transfer Of ABM Systems Or Components

mj-51088 / 021795

TMD

- *Good* News
  - Word TMD Does Not Appear In Treaty

- *Bad* News
  - It Doesn't Have To In Order To Be Constrained

- Dr. Kissinger:

"In The Negotiations For The ABM Treaty, No Distinction Was Made Between Theater And Strategic Systems - The Concept Of Theater Ballistic Missiles Was Not Known At The Time."

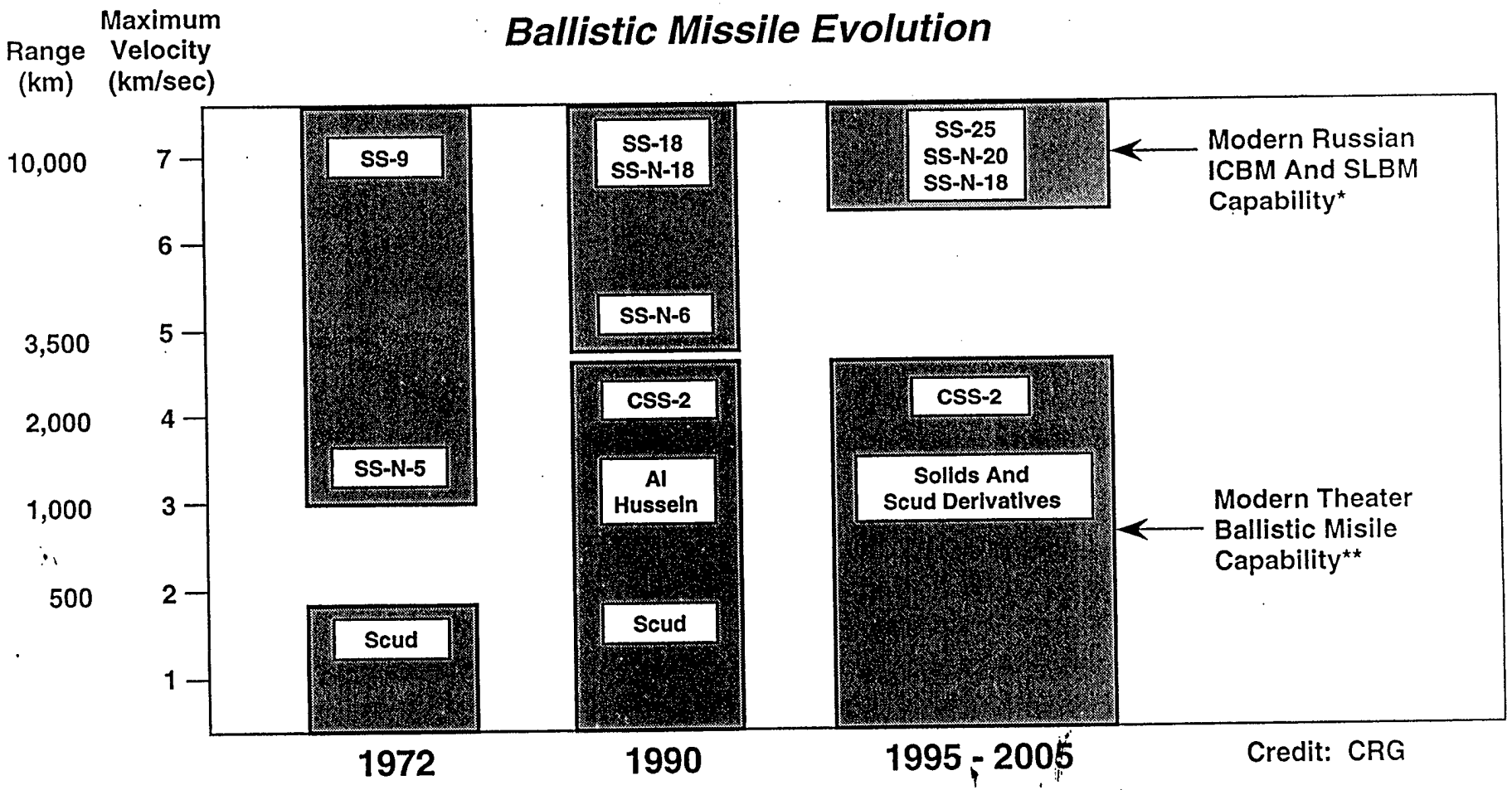
2 FEB 95
Before SASC

Treaty Needs Clarification

LIMITS ON ATBM

- May Not Give Non-ABM Components Capability To Counter SBM
- ABM "Capability"
- No Capability To Counter SBM Or SLBM
- What Is SBM ?
- What Is Capability ?
- Foster Box Et Seq (Historical Interest Only!)

WHY TMD RAISES ABM COMPLIANCE ISSUES



* Assumes SS-N-6 Retirement Completed

** INF Treaty Bans U.S. And USSR GLBMs In 500 - 5,500 km Range

mj-40504B / 022194

CHOICE ?

- Clarify The Threat And Allow Some Flexibility In ABMT To Meet Theater Threat – Any SAM Has Some "Capability"
- Wooden Interpretation Of Treaty Which Does Not Allow For Reasonable Clarification And Forbids Most TMD

WRONG DEFENSE, WRONG ENEMY

"The Strict Limits On Anti-missile Defenses Have Helped Make The Reductions In Nuclear Offenses Possible. The THAAD Would Breach Those Limits. Were The U.S. To Test It, Moscow's Likely Response Would Be To Resist Further Cuts In Warheads.

The THAAD Could Also Be Deployed Against Intercontinental-Range Missiles Launched From Submarines, The Core Of Most Nuclear Deterrents. This Intrigues The Republicans. But Imagine Their Reaction If The Russians Were To Test Their Own Version Of The THAAD To Defend Against American, British And French Missiles Launched From Submarines."

New York Times, 16 NOV 94

UPDATING MISSILE DEFENSE

"More Russian Than The Russians, ABM Treaty Purists Contend That Any Change In The ABM Treaty Would Open Up The Door For Strategic Rearmament On Both The American And Russian Sides. The Argument Evokes Its Own Nostalgia For The Brave Old World Of Strategic Arms Control, And It Has Its Own Congressional Following.

The Clinton Administration Remains Well Advised To Proceed With Its Plans For The New Sort Of Missile Defense System. These Plans Count On Consensus With The Russians, Exclude Rebirth Of A Space-based Star Wars Defense And Look To The Slow But Deliberate Deployment Of A Ground-based, Shorter-range ABM System Appropriate To New Times. This Is What American Defense Now Requires."

Washington Post, 30 OCT 94

U.S. POSITION ON TMD

- Develop Robust TMD
- Clarify Treaty To Ensure No Misunderstanding As To U.S. Intentions On TMD
  - 5 km / sec - 3,000 / 3,500 km Range
- Preserve The Treaty, It Is Still Valuable For Stability
- Response To Critics ?
  - PATRIOT Not Good Enough, THAAD Too Good ?
- Butter

mj-51093 / 022195

TESTING TMD

- Testing THAAD - Soon
  - U.S. Review Of Testing Regime To Ensure Compliance
  - THAAD Would Eventually Present Issues
  - Dem / Val Program Clearly Compliant / No Test In ABM Mode
- Testing LEAP
- Testing SMTS

mj-51094 / 021795

CLARIFICATION NEGOTIATIONS

- Began January 1994
- Some Agreement, Very Complex
- Classified
- U.S. Position
- Parties, Multilateralization
  - Russia
  - Muldova
  - Belarus
  - Ukraine
  - Kazakhstan
  - Georgia

mj-51095 / 021795

SENSORS

- Article III
  - Not In Grand Forks
- Article V
  - Mobile
- Article VI
  - Do Sensors "Give" Too Much Capability To TMD ?
- Agreed Statement D
  - Substitute For Radar ?
- Grandfathered ? DSP ?
- Bottom Line: If It Is Too Good, It Is Illegal !

mj-51096 / 022195

ISSUES ON THE HORIZON

- Congress
  - Advice And Consent On Clarification
  - Statutory Guidance
  - Compliance Reviews For NWA / SMTS
- Negotiations With FSU On Demarcation
- Long-range Missile Threat - Beyond Theater ?
- MTCR

mj-51097 / 021795

SUMMARY

- The ABM Treaty...
  - Contains Ambiguities, But Is Still The Law
  - Constrains Strategic Ballistic Missile Defenses
  - Does Not Limit TMD Systems Per Se, But Prohibits Parties From
    - Giving Non-ABM Systems "Capabilities To Counter Strategic Ballistic Missiles"
    - Testing Non-ABM Systems "In An ABM Mode"

- Key Issues (DoD Perspective)
  - Definition Of "Strategic" Ballistic Missile
  - Definition Of "Giving" ABM Capability To Non-ABM System
  - Interpretation / Application Of Treaty Obligations To Technologically Advanced Theater And Strategic Missile Defense Concepts And Programs

mj-42567 / 121294

National Missile Defense
Overview

23 JAN 95
DRAFT



7 MAR 95

Dr. Richard D. Bleach
Assistant Deputy For NMD Readiness (Acting)
Technology Readiness Deputate
Ballistic Missile Defense Organization

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nj-50276 / 012395

BACKGROUND

• 1984 - 1987	SDI Oriented To Address A Broad Variety Of Technical Issues Associated With Countering A Massive Attack From Former Soviet Union
• 1987 - 1989	Strategic Defense System Acquisition Program Conducts Dem / Val Activities To Counter Former Soviet Union Threat
• 1989 - 1992	Global Protection Against Limited Strikes Acquisition Program Address Threats Of Reduced Size
• 1992 - Present	NMD Technology Readiness Program To Address Rest Of World Capability And To Provide Option To Deploy

mj-44251/001404

BACKGROUND
(Narrative)

Our Program Has A Ten Year Legacy Of Providing The World's Best Technology Alternatives To Address Ballistic Missile Defense Options To A Changing Threat. We've Transitioned Over The Years From A Research Program To An Acquisition Program, To A Technology Readiness Program. Today Our Technology Readiness Program Is Focused On Activities Reducing The Time Needed To Deploy An Effective Defense When And If We're Given The Direction To Produce And Deploy.

EXISTING AND POTENTIAL STRATEGIC SYSTEMS

	Large, Warm RV Low Yield	Large, Cool RV Low Yield	Small, Cool RV Higher Yield, ECM	Small, Cold RV Higher Yield, ECM, MIRVed
CIS Republics • Belarus • Kazakhstan • Ukraine • Russia	*Existing Systems*		SS-25 SS-18** SS-18** SS-25	SS-18 SS-18 SS-24, SS-19 SS-N-8, SS-N-18, SS-N-20, SS-N-23
• PRC	CSS-4 (High Yield)			
ROW • Libya • Iran • North Korea	"CSS-4" Like "CSS-4" Like "CSS-4" Like		*Potential Systems*	

** Single RV Configuration

mj-46327 / 100694

EXISTING AND POTENTIAL STRATEGIC SYSTEMS (First Chart) (Narrative)

A Spectrum Of Threat Systems From Single To Complex Currently Exists From Both The Former Soviet Union States And China. The Likelihood Of Their Use Today Is Low. Third World Countries, Or As We Call It The Rest Of The World (ROW), Pose A Potential Emerging Threat To The U.S. Although The Timing For Threats From These Other Countries Is Uncertain, It May Occur Sooner Rather Than Later. The Proliferation Of Ballistic Missile Technology, The Sale Of Complete Weapon Systems, And The Possibilities Of "Brain Drain" From The Former Soviet Union To Third World Belligerents All Give Us Cause For Concern. The NMD Technology Readiness Program Is Addressing This Complete Spectrum Of Threats.

EXISTING AND POTENTIAL STRATEGIC SYSTEMS

	ST 1 Low Complexity	ST 2 Low Complexity	ST 3 Moderate Complexity	ST 4 High Complexity
FSU Republics			SS-19 Variant SS-24 Variant SS-25	SS-18 SS-24, SS-19
• PRC			CSS-4	
ROW • Libya • Iran • North Korea	"CSS-4" Like "CSS-4" Like "CSS-4" Like			

Existing Potential

mj-46327B / 121294

EXISTING AND POTENTIAL STRATEGIC SYSTEMS (Second Chart) (Narrative)

The Range Of Complexity In The Threat Systems Which NMD Must Address Drives The Technology Solutions For The NMD Program. The Size Of The Radar Cross Section Affects Our Radar Acquisition Range And Tracking, And Thus The Battle Space Available For Intercepting. The temperature Of The Threat Warheads Affects The Design Requirements For Infrared Sensors. Potential Threat Countermeasures Can Affect Many System Design Parameters To Ensure Robustness Of the NMD System. As Shown On This Chart We Have Devised Four Categories Of Threats To Address. The Goal Of Our Program Is To Eventually Be In A Position To Counter All These Threat Categories. As You Can See, The Potential Third World Threat Which May Emerge Will Probably Be In The Simpler Class of Warheads.

THREAT SCENARIOS
PAST, PRESENT AND FUTURE

Threat	Complexity	Number Of Warheads	Likelihood For Use	Uncertainty
ST 1	Low	4	Possible	Timing Of Indigenous Development
ST 2	Low	4	Possible	Timing Of Indigenous Development
ST 3	High	4	Heightened Risk	Proliferation, Accident, Unauthorized
ST 4	High	20	Heightened Risk	Proliferation, Accident, Unauthorized
GPALS	Very High	200	Unlikely	Accidental Unauthorized
Original SDI	Very High	1,000+	Highly Unlikely	Deliberate Attack

mj-49420 / 010995

THREAT SCENARIOS PAST, PRESENTAND FUTURE
(Narrative)

Defending Against Deliberate Massive Attacks Of Highly Complex Ballistic Missile Threat Systems Was The Original Goal Of The Program Eleven Years Ago. The World Changed Significantly In 1991 With The Demise Of the Soviet Union And That Threat Changed With It. It Is Not A Likely Threat Today. In Addition, Accidental Or Unauthorized Launches Are Not Considered Likely Today. Basically, Those Countries That Own The Capability To Attack Us Today Are Not Judged To Have The Intent To Do So. The Converse Of This Is That Those Belligerent Countries That Potentially Have The Political Will To Attack The U.S. Do Not Currently Own The Capability To Do So. Our Immediate Concern, However, Is That These Countries Could Build, Buy, Steal, Or Otherwise Acquire Ballistic Missiles And Devasting Warheads With The Range To Threaten The U.S.

NMD GUIDANCE

- BUR Guidance
  - Technology Development, Not Acquisition
  - Funding Constrained, Not Threat Driven
- Congressional Guidance
  - Demonstrate UOES-Type Capability
  - Develop Increasingly Capable Deployment Options
- Compliance With The ABM Treaty Is Required
  - Restricts The Architecture And Effectiveness
- Program *Guided* By Requirements, But Progress *Driven* By Funding

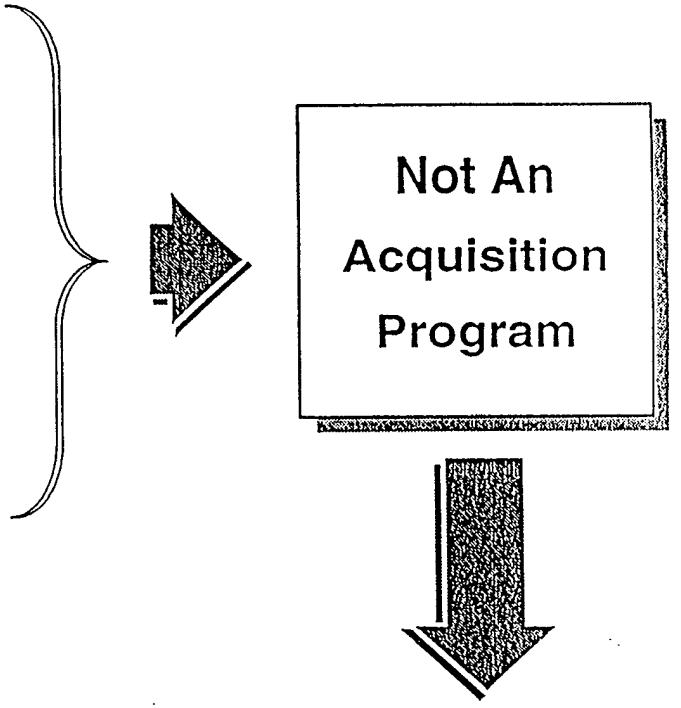
NMD GUIDANCE
(Narrative)

Our Guidance For The NMD Program Is Summarized Here. In Essence, We Are To Spend About $400M Per Year In Deploying The Technology And Doing The Contingency Planning To Be In A Posture To Build And Deploy An Effective System As Soon As Possible When And If We Are So Directed. We Believe Our Planning And Program Activities Of Technology Demonstrations, Prototypes, And Tests For The More Critical Elements Are In Line With Our Guidance.

THE NMD ENVIRONMENT

The NMD Program Is Not Business As Usual ...

- Uncertain Threat
  - OSD Direction (BUR)
    - Technology Development
    - Constrained Funding
      - Congressional Guidance
        - ABM Treaty



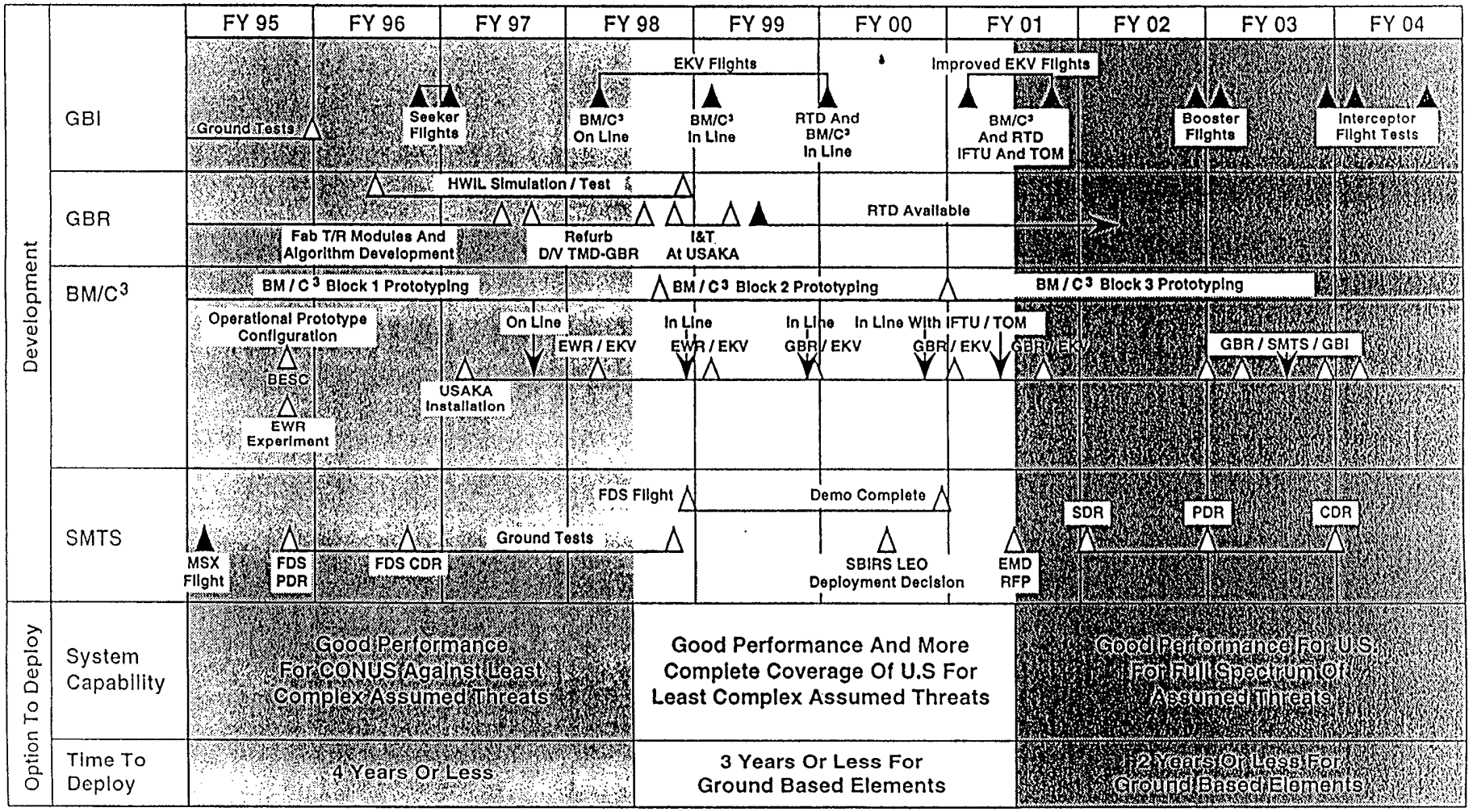
Technology Readiness Program That Develops And Maintains An Option To Deploy

mj-46313 / 091494

THE NMD ENVIRONMENT
(Narrative)

Our Current Technology Readiness Program Derives From The Program Strategy Contained In The Bottom Up Review. We're Marching To Those Orders. The New Congress, However, Will Have A Say As To Whether Our Current Orders Are Adequate. As Usual, The Environment Has Changed Again.

NATIONAL MISSILE DEFENSE TECHNOLOGY READINESS PROGRAM



NATIONAL MISSILE DEFENSE TECHNOLOGY READINESS PROGRAM (Narrative)

Key Events And Activities In Our Current Program Are Shown Here. We Have A Lot Of Effort Applied To The Hit-To-Kill Interceptor Vehicle, And Much Work Is Being Done To Prototype Our Battle Management Command, Control, An Communications Capability. The Ground-Based Radar (GBR) Work Is Being Leveraged Off The Theater Missile Defense GBR Development. The Space And Missile Tracking System (SMTS) Is Funded To Demonstrate This Technology At A Measured Pace. The Program Is Structured To Increase Performance And Coverage And Decease The Time Needed To Deploy.

NMD TIGER TEAM FINDINGS

- Uncertainty About The Pace Of Proliferation And Technology Transfer In The Third World Coupled With Concern About Intelligence Lead Time Creates An Appetite For A NMD Program

- A Defense Architecture Consisting Of Fewer Than 100 First Generation Kill Vehicles On Existing Boosters Based At Grand Forks Plus Existing Radar And Early Warning Assets Provides Good Defense Of The Entire U.S. Against Limited Threats

- Such A Defense Is Not Robust Against Threat Growth In Numbers Or Sophistication Or Against Existing Russian ICBMs And Will Require Additional Dedicated Defense Elements To Deal With These Threat Excursions

- Within Approximately Two Years, A Two Year Emergency Deployment Posture For A U.S. Defense Against A Limited Third World Threat Could Be Demonstrated, Given Appropriate Direction And Resources

mj-50168B / 012395

NMD TIGER TEAM FINDINGS
(Narrative)

A Group We Called The Tiger Team Recently Completed A Special Study To Determine What Could Be Done To Provide An Emergency Defense In The Minimum Time. The Results Of That Study Are Shown Here.

National Missile Defense Technology Readiness Program Advance Planning Briefing For Industry



7 MAR 95

COL Walter B. Grimes, USA
Director, NMD Readiness
Technology Readiness Deputate
Ballistic Missile Defense Organization

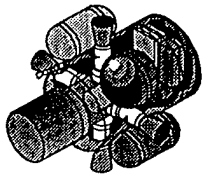
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PURPOSE

- To Explain The National Missile Defense (NMD) Technology Readiness Program

NMD SYSTEM DEFINITION

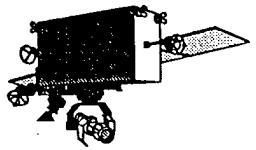
Exoatmospheric Kill Vehicle



Interceptor

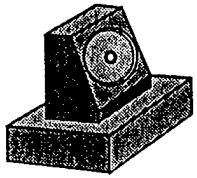


Integration



Passive Sensor

Early Warning Radar



Ground Based Radar



Integration

CINC's BM/C^3



BM/C^3

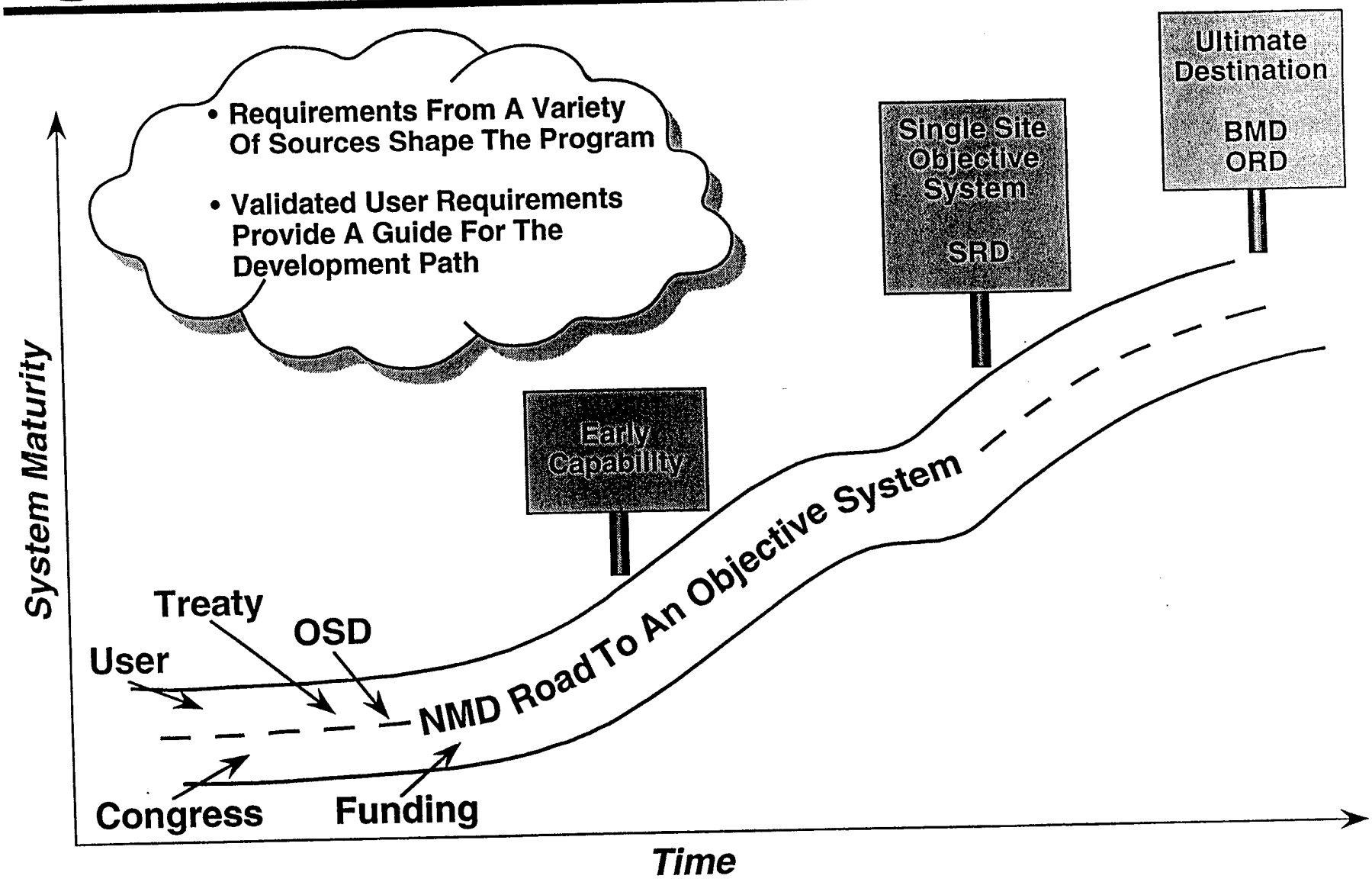


Site BM/C^3

The NMD Program Is Comprised Of Interceptor, Sensor And BM/C^3 With Systems Integration That Develop A Technology Readiness Option To Deploy

mj-46314 / 101494

NMD PROGRAM PATH



mj-48296 / 022295

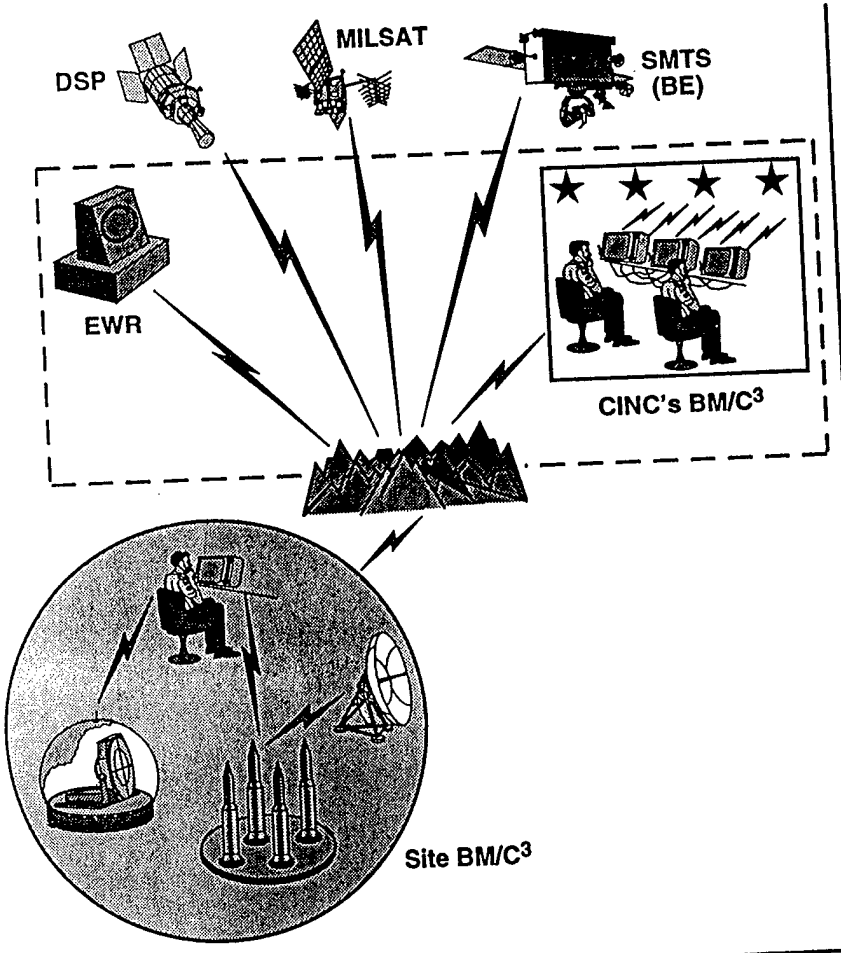
NMD PROGRAM EVOLUTION

- Initial Focus Is On Developing The Potential For Early Contingency Deployment
  - Responsive To Threat Evolution
  - Stays On Path To Required Capability (Capstone BMD ORD)
  - Retains Architectural Flexibility
- As The Program Evolves, Technical Progress Leads To Increasingly Capable Deployment Options
  - Technology Insertion Increases Element Performance
  - Incremental Development Brings New Capabilities Into Deployable Architecture

Objective Capability Guides Program Development

mj-46481 / 110894

BATTLE MANAGEMENT COMMAND, CONTROL, COMMUNICATIONS (BM/C^3)



- Develop And Evolve BM/C^3 Prototypes
- Develop EWR Software Interfaces For Cueing And Tracking
  - Early Midcourse Track Capability
- Develop And Evolve Targeting Algorithms
  - Real Time Calculation And Transmission
- Develop And Evolve Algorithms For Track / Discrimination / Kill Assessment
- Gain Early User Experience
  - Integrated Test And Exercises
  - Collateral Mission Support
- Provides NMD Integration

BM/C^3 Leverages Existing Strategic And TMD Assets And Integrates Joint Operators With NMD Assets And External Systems

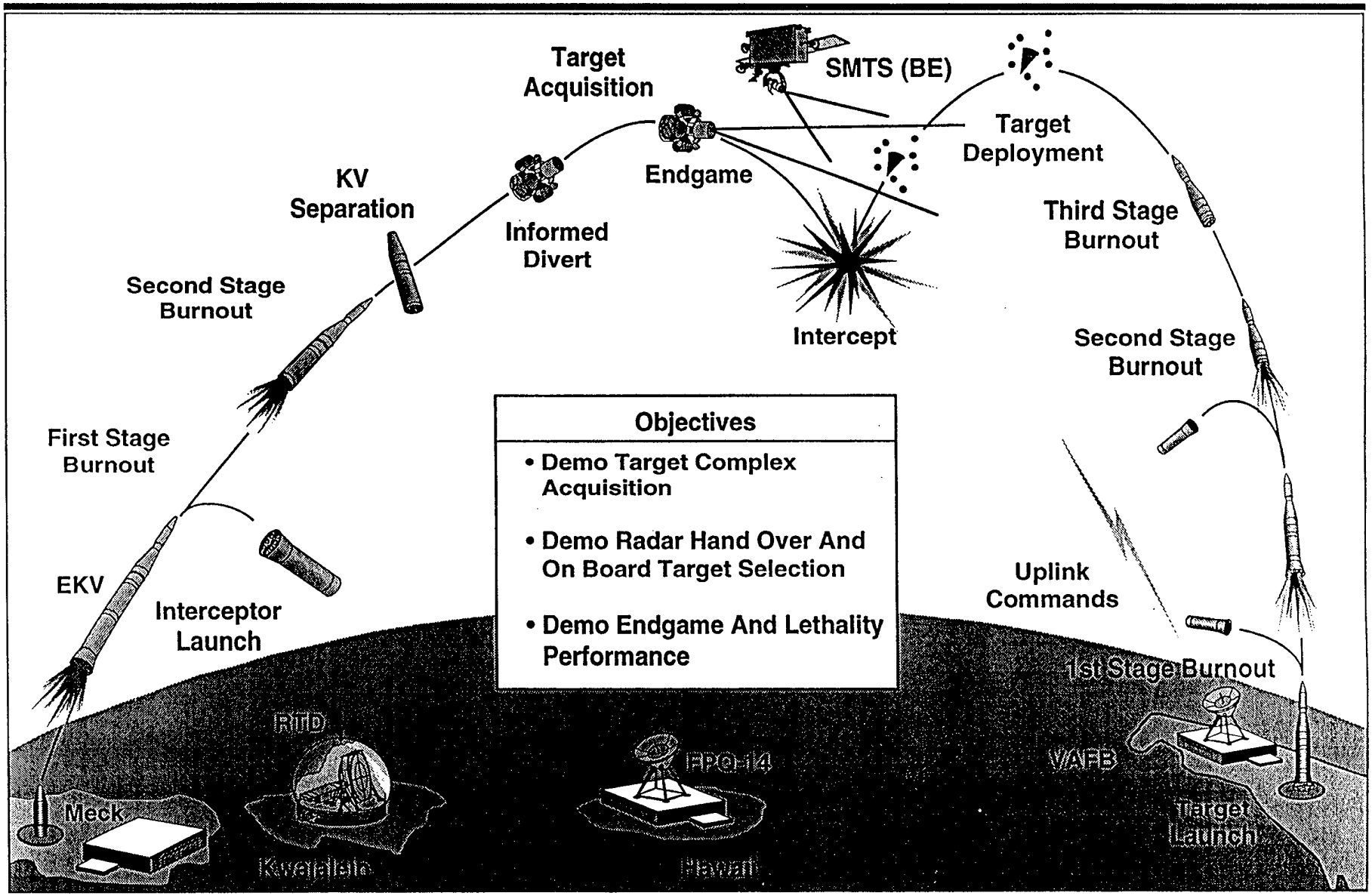
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BM/C^3 CONTRACTING PLAN
(INCLUDES SYSTEMS ENGINEERING AND INTEGRATION)

- FY 95 BMDO Contract Is Vehicle For System Integration And Cooperative BM/C^3 Development By Integrated Product Team
  - BMDO Leads Specification Of All Products To Be Developed
  - USA Leads Development Of Site-level Products
  - USAF Leads Development Of CINC-level Products

mj-46322B / 011395

INTEGRATED FLIGHT TESTING BEGINNING IN FY 1998



mj-46020A / 022294

GOAL OF NMD TESTING

- Provide Objective Evaluation Of Element And System Level Performance
  - Use The Test Design To Establish Confidence In The System Performance And Effectiveness Assessments

Done From A Technology Readiness Perspective

mj-47139 / 120294

FOCUS

- Development Testing At Element Level
- Roll Up To Evaluate System Capability
- Want User Involvement
  - War Games
  - BM/C^3 Development
  - Test Observation

There Is No Formal Operational Test Component To The NMD Test And Evaluation Program

mj-47140 / 100694

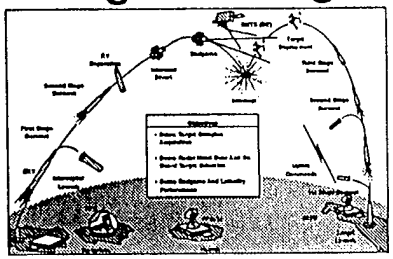
NMD TEST AND EVALUATION APPROACH

- Implement Test Program Within Guidance Of Bottom-Up Review, Congress, And Constraints Of ABM Treaty
- Use Services As Executing Agents To Conduct Tests And Evaluate Element Data
  - BMDO Develops System Level Test Requirements
- Leverage Element Test Programs To Gather Data For System Level Evaluations
- User Involvement (Though No Formal OT Program)
- Make Extensive Use Of Models, Simulations, And Hardware-In-The-Loop To Reduce Risk For Flight Tests And To Fill Out The Performance Envelope
- Make Common Use Of Limited Test Resources And Exploit Targets Of Opportunity (TOOs)
- T&E Planning For Contingency Deployment Option

mj-47142 / 022195

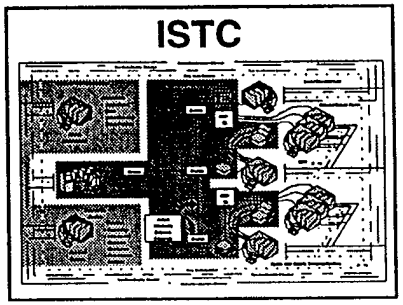
NMD TESTING METHODS

Flight Testing

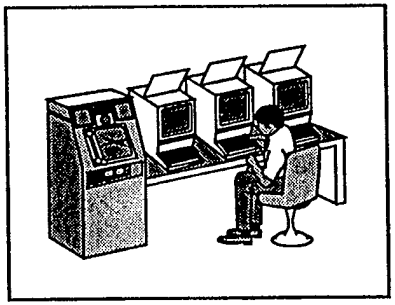


HWIL / SWIL

ISTC

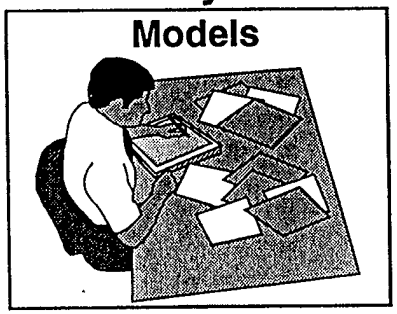


Simulation



Analysis

Models



Cost Per Test

Confidence

mj-46973 / 100394

MODELING AND SIMULATION ACTIVITIES

- Element Programs Develop Element Specific Models
- Hardware-In-The-Loop Facilities Are Used For Early Element Component Test (KHILS, KDEC, NHTF, etc.)
- Element Software-In-The-Loop And Hardware-In-The-Loop Are Incorporated Into The Integrated System Test Capability (ISTC) For NMD System Level Testing
- The ISTC Provides A Common Global Environment, Test And Control, And Interfaces Between Elements For System Level Evaluation
- Live Flight Test Results Are Fed Into ISTC For Validation Of Models And Simulations
- The ISTC Bridges The Gap Between Simulations And Flight Testing To Evaluate The Entire Performance Envelope Which Flight Testing Cannot Duplicate
- ISTC Architecture And Components Are Upgraded As The Elements Mature

mj-47145 / 100694

NMD FLIGHT TESTS

- Provide The Most Realistic Assessment Of Performance
- Are The Centerpiece Of The System Level Test Program
- Are Expensive And Provide Limited Opportunities In The NMD Fiscally Constrained Program
- Are Big, Complicated, Involve Many Players And Include Many Activities To Be Performed
- Are Made Complex To Make The Most Out Of These Limited Opportunities
- Require Multi-service Coordination And Multi-organization Coordination Within Each Service, Which Create Coordination And Integration Challenges

mj-49166 / 120294

CONTINGENCY DEPLOYMENT PLANNING

Objective

- Given ABM Capabilities Demonstrated In The NMD Technology Readiness Program, Develop A Contingency Plan To Exercise An Option To Deploy An Operationally Effective System In The Shortest Possible Time

mj-49337 / 120694

KEY CONTINGENCY DEPLOYMENT PLANNING PLAYERS

- BMDO - Lead Contingency Deployment Planning
- USSPACECOM (With Components) - Provide User Interface, Review, And Coordinate Plan
- USA NMD PEO - Develop GBI, GBR, And Site Annexes To The Contingency Deployment Plan And Coordinate Element Critical Path Analyses
- USASSDC - Provide Modeling / Simulation And Site Development Support
- USAADASCH - Review And Coordination Of The Contingency Deployment Plan
- USAF/ESC - Develop CINC BM/C^3 And UEWR Annexes To The Contingency Deployment Plan And Coordinate Element Critical Path Analyses

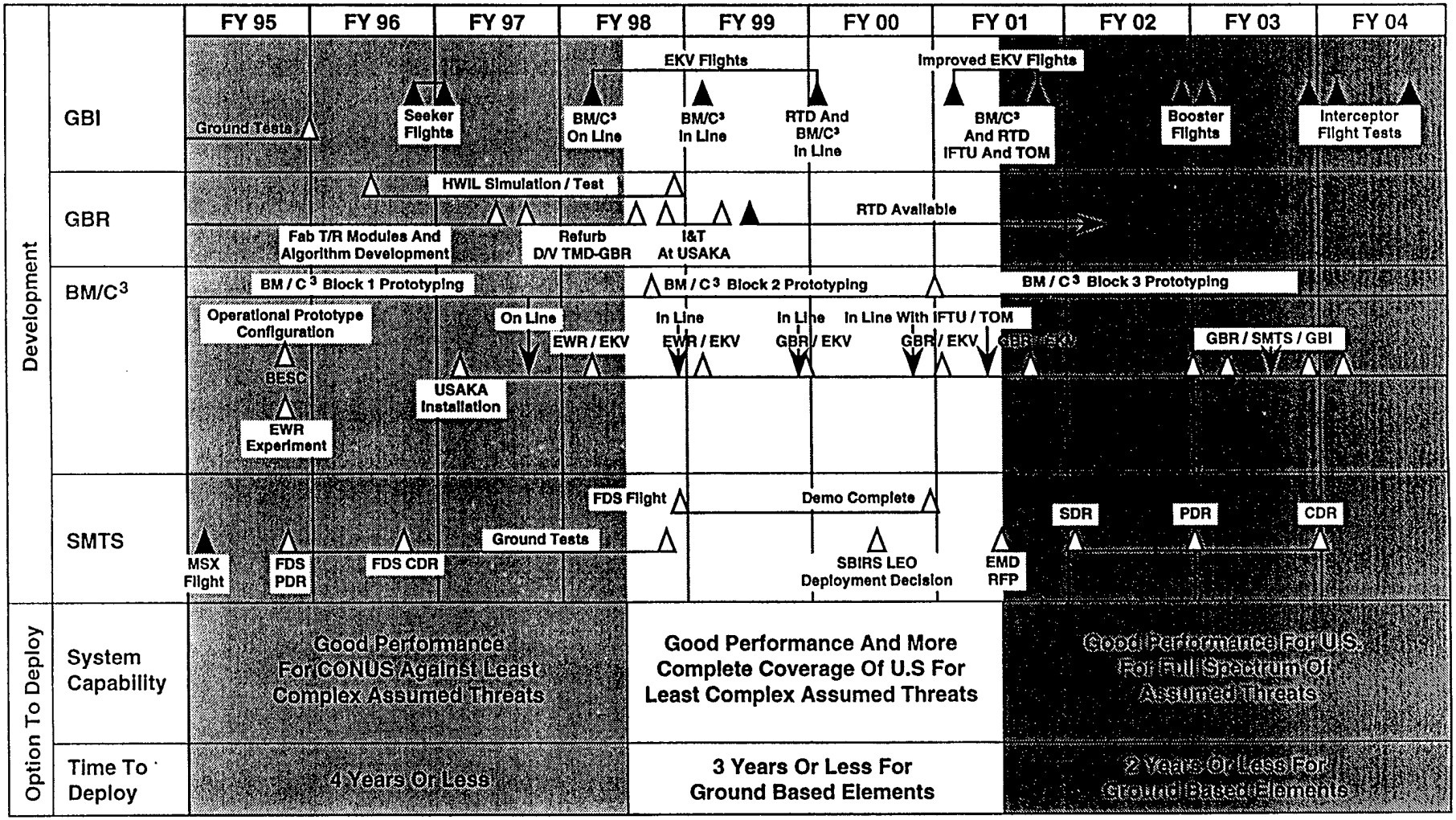
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CONTINUING CONTINGENCY DEPLOYMENT ACTIVITIES

- Periodically Update The Contingency Deployment Plan To Reflect Deployment Option Architectures
- Prepare NMD Contingency Deployment Reports
- Develop And Refine The Contingency Deployment Options Tool
- Conduct Critical Path Analyses For System Integration And Element Development And Deployment
  - Identify Long Poles On Critical Path
  - Develop Mitigation Strategies To Shorten Deployment
  - Conduct "What If" Analyses For Deployment Options
- Identify And Recommend Resolution Of Contingency Deployment Issues
- Form An Integrated Product And Process Development Team
- Establish A Senior Advisory Group

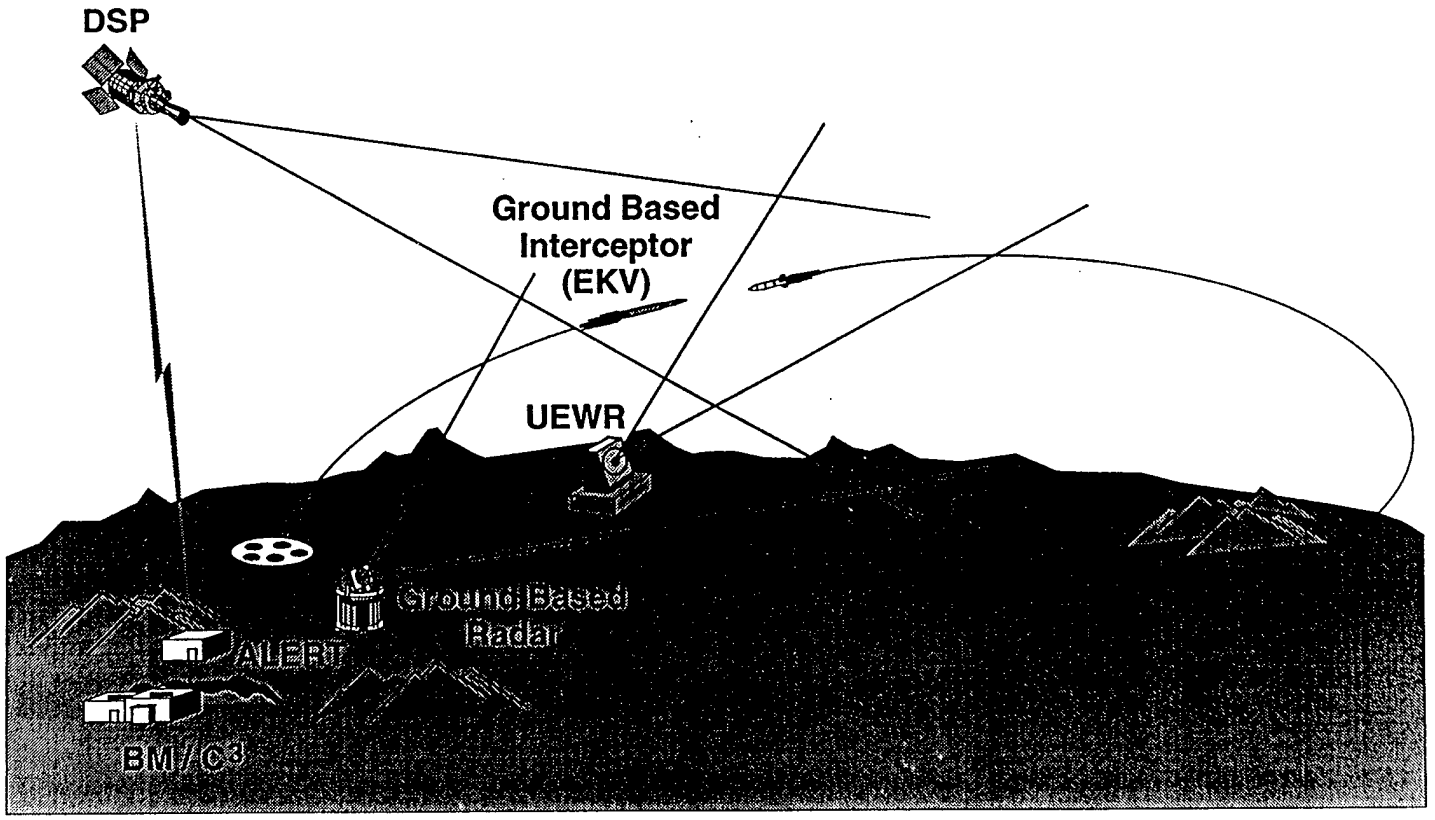
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NATIONAL MISSILE DEFENSE TECHNOLOGY READINESS PROGRAM



mj-47725 / 011095

NMD EARLY DEPLOYMENT OPTION

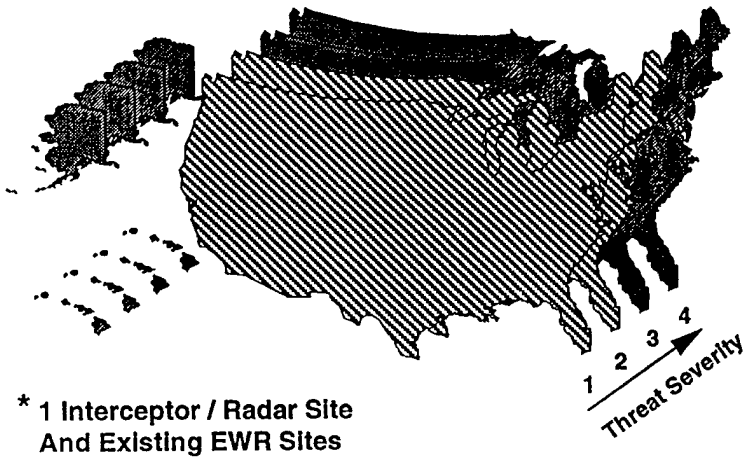


Provides Limited Capability

EARLY DEPLOYMENT CAPABILITY

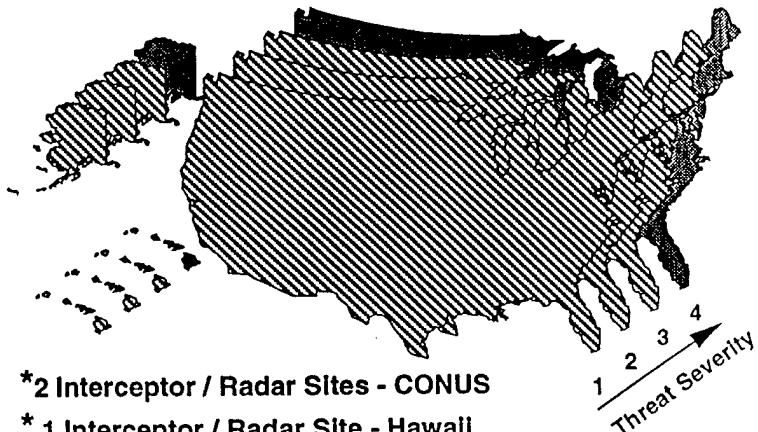
System Defense Capability Against A Few RVs

Single Site* - Treaty Compliant



* 1 Interceptor / Radar Site
And Existing EWR Sites

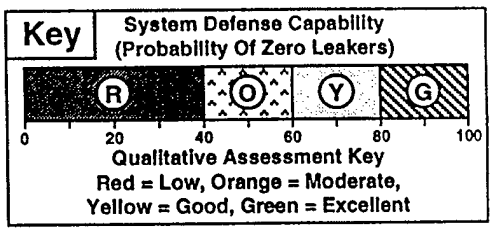
Multisites* - Treaty Noncompliant



*2 Interceptor / Radar Sites - CONUS
* 1 Interceptor / Radar Site - Hawaii

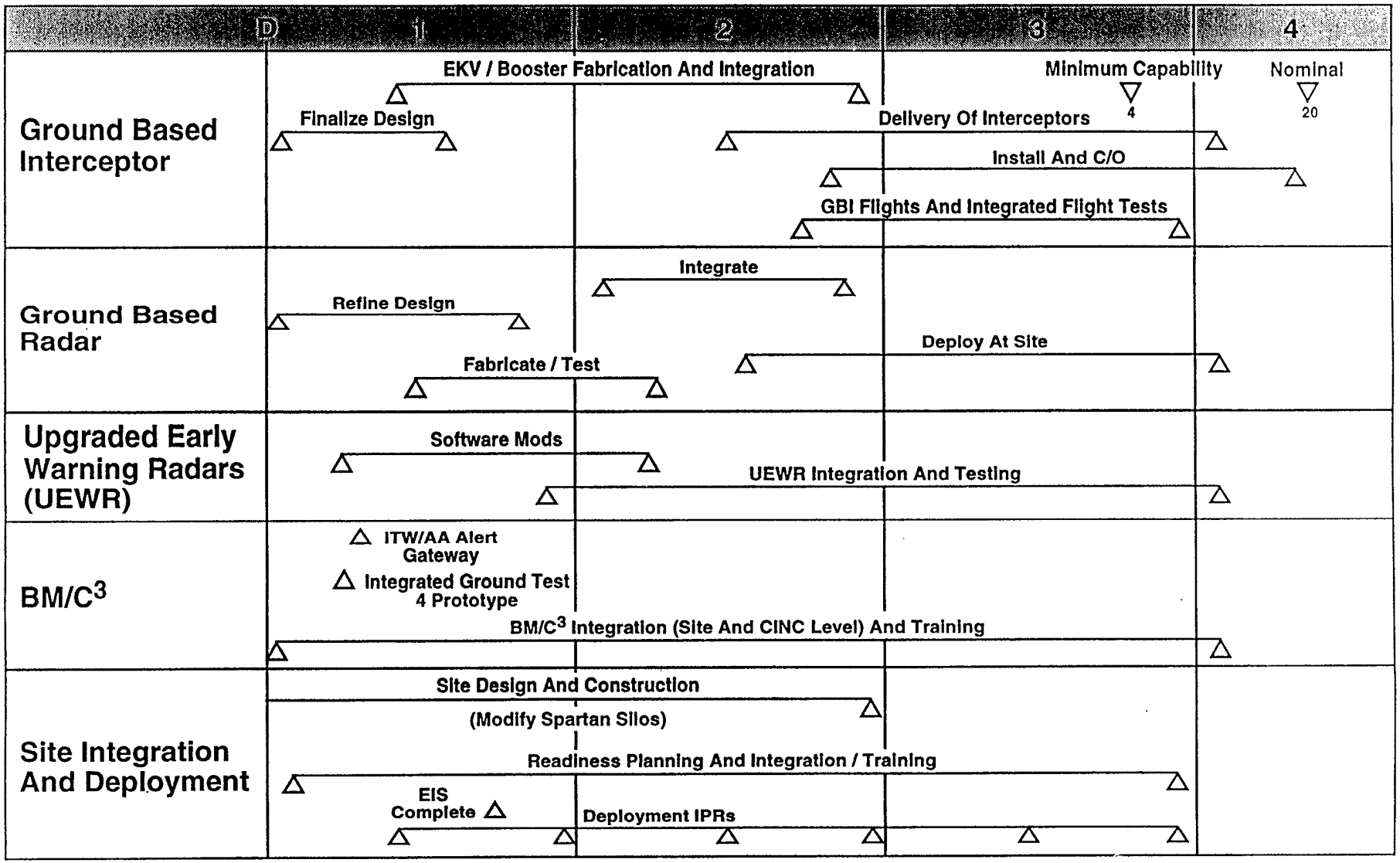
Deployable Elements

Early Warning Surveillance	Active Sensor	Inter-ceptor	BM/C^3
DSP	GBR + UEWR	EKV	Block 1



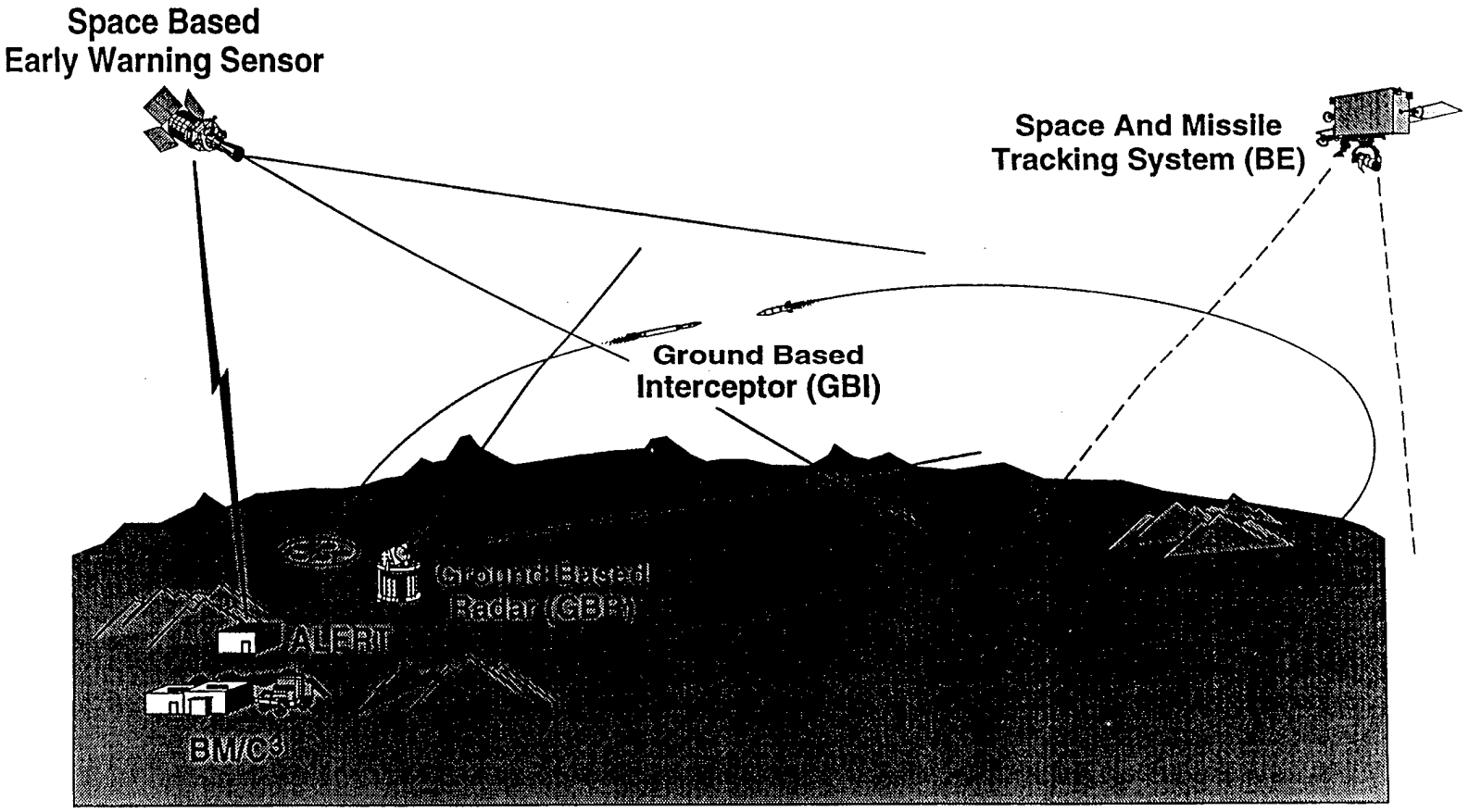
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DEPLOYMENT OF EARLY OPERATIONAL CAPABILITY



mj-49303 / 010595

NMD OBJECTIVE DEPLOYMENT OPTION

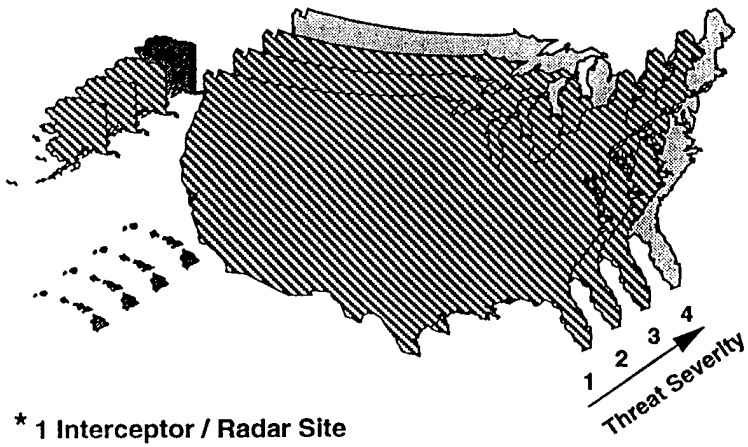


Provides Capability Over The Range Of Existing And Potential Threats

OBJECTIVE SYSTEM DEPLOYMENT CAPABILITY

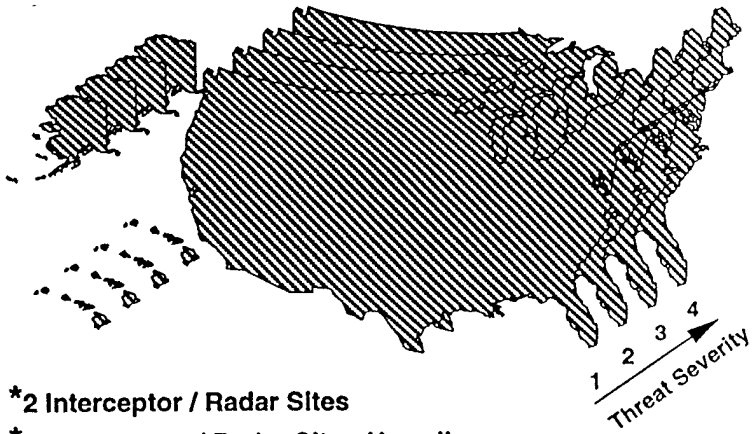
System Defense Capability Against A Few RVs

Single Site* - Treaty Compliant



* 1 Interceptor / Radar Site

Multisites* - Treaty Noncompliant

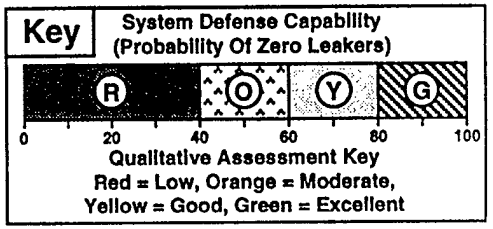


*2 Interceptor / Radar Sites

* 1 Interceptor / Radar Site - Hawaii

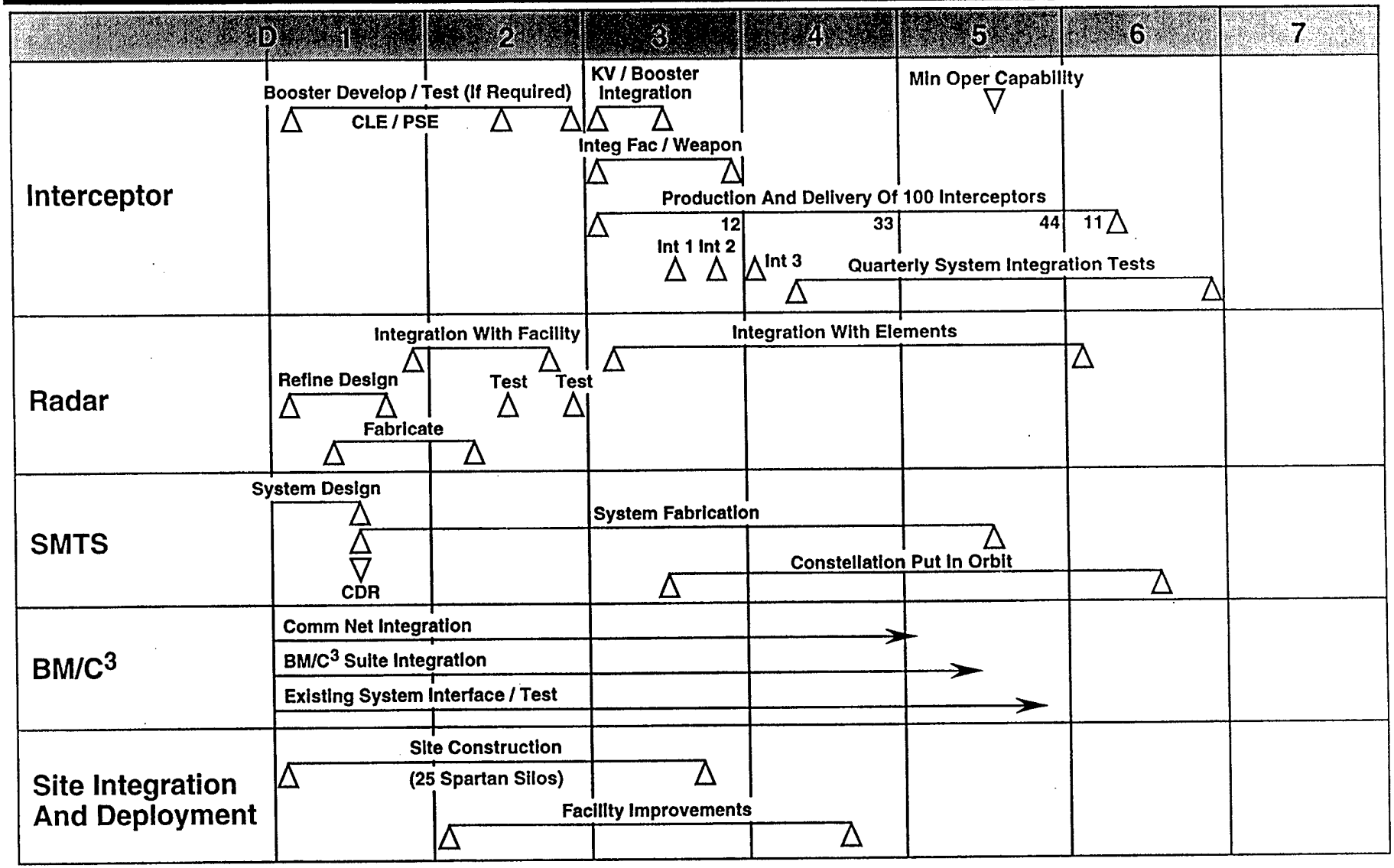
Deployed Elements

Early Warning Surveillance	Active Sensor	Inter-ceptor	BM/C^3	Passive Sensor
DSP Follow-on	GBR	GBI	Block 3	SMTS



mj-49307 / 120694

DEPLOYMENT OF OBJECTIVE CAPABILITY



D = Notional Deployment Decision

mj-49303A / 022495

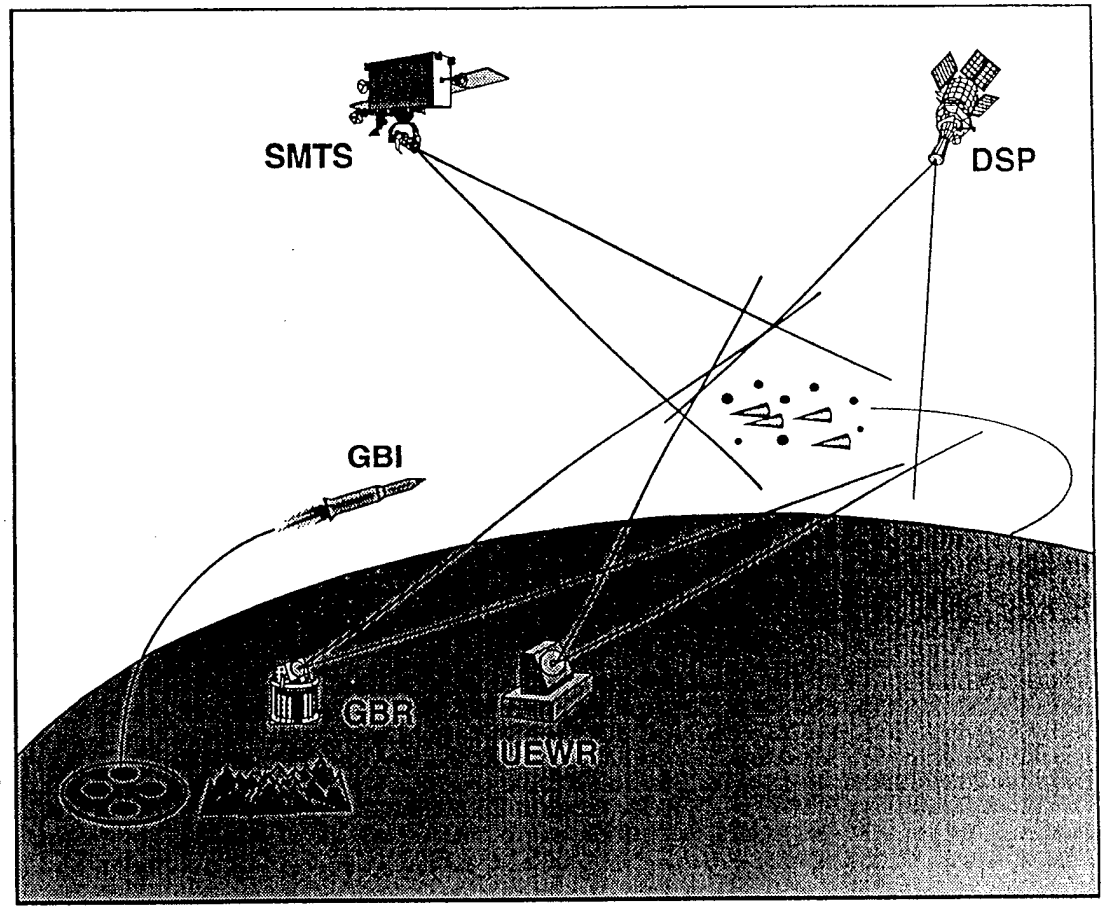
JOINT BMDO / SERVICE PROGRAM

BMDO
- BM/C^3 Lead
- Integration
- System Engineering

USA
- NMD Site
  - Ground Based Interceptor (GBI)
  - Ground Based Radar (GBR)
  - Site BM/C^3
- Targets

USAF
- DSP
- Early Warning Radar (EWR) Upgrade
- Space And Missile Tracking System (SMTS)
- CINC's BM/C^3
- Launch Vehicle
- Midcourse Space Experiment (MSX)

USN
- MSX Integration
- Software IV&V



mj-46315 / 121494

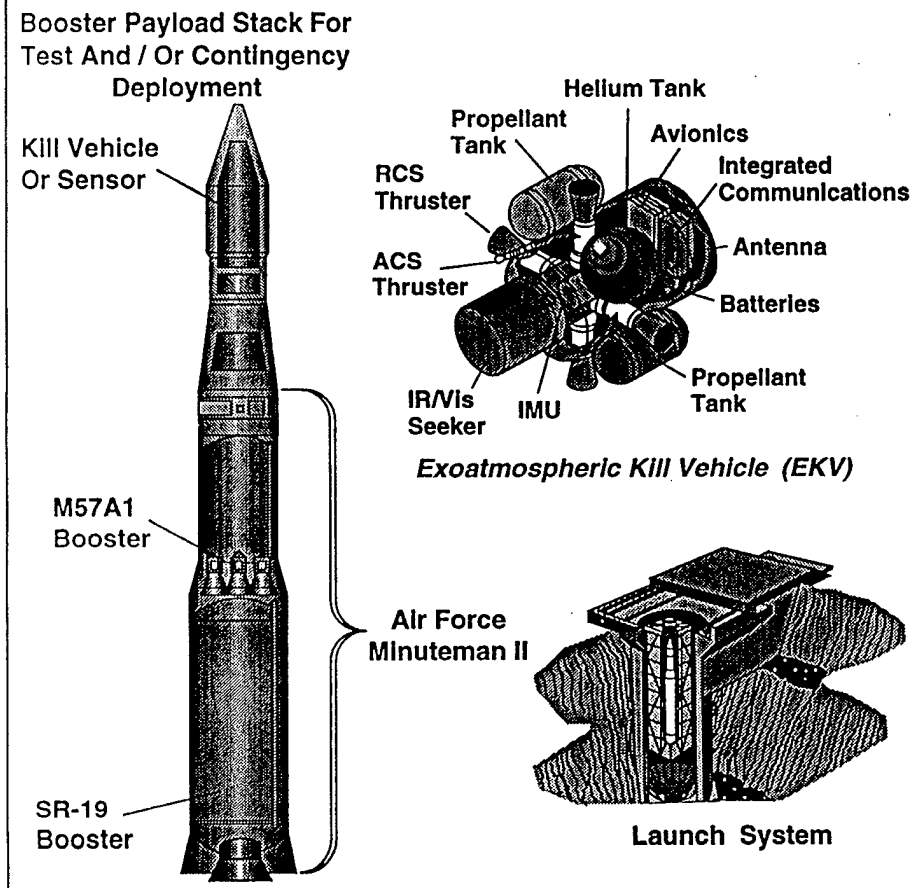
NMD LEVERAGES FROM TMD INVESTMENTS

- NMD Radar Grows Directly From TMD-GBR
  - Solid-state T / R Modules
  - Data Processing Hardware
  - Discrimination And Kill Assessment Algorithms And Software
  - Beam Control / Tasking Algorithms And Software
- NMD BM/C^3 Is Functionally Similar To TMD BM/C^3
  - Information Architecture (Common Functions)
  - Situational Assessment
  - Battalion Level Engagement Operations
  - Distributed Command System
- NMD Exo-Kill Vehicle Leverages Off Component Level Technologies
  - Guidance And Navigation Control Technology
    - IMU Components
    - GN&C Algorithms
  - Data Processing Hardware

mj-41980 / 101194

GROUND BASED INTERCEPTOR

System Components



Description

EKV

- Exoatmospheric, Nonnuclear, Hit-To-Kill
- Long-range Multi-wave Band Infrared Sensor
- High Performance Bipropellant Reaction Divert And Attitude Control
- Low Drift Rate Inertial Measurement Navigation
- On Board Threat Selection Software
- 20 / 44 GHz Communication And Shout Back
- Lightweight, Producible, Hardened

Booster

- Low Life Cycle Cost, Dormant Round
- 2 Stage, High Burnout Velocity

Launch System

- Treaty Compliant (Immobile)
- Launch And Ground Support Equipment
- Command Launch Equipment With Site BM/C^3 Interface

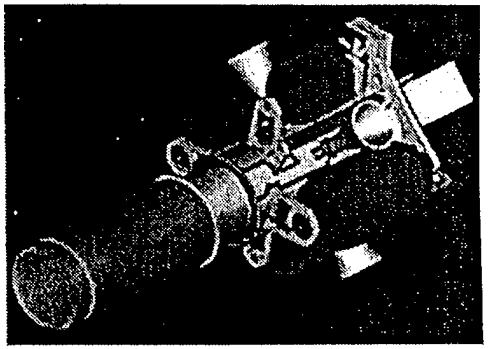
Developing The Interceptor Is Top Priority

mj-46317 / 110894

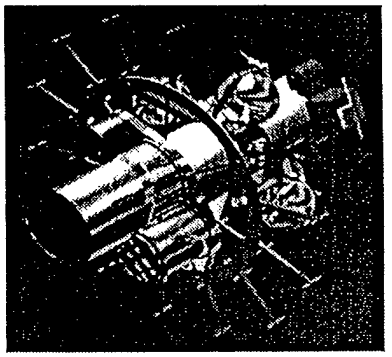
EKV CONTRACTING PLAN

- Program Builds On Past Successes
- Existing Competitive Contract Vehicles Support Early Milestones
  - EKV Contracts Started In FY 91 To Provide KV Improvements Over ERIS
  - Rockwell And Hughes Teams Recently Selected For EKV Based On Progress To Date
  - Seekers Will Be Flown In FY 96 And FY 97; Single Contractor Will Fly EKV In FY 98
- Payload Launch Vehicle
  - Lockheed Selected For Launch Vehicle And Integration Based On ERIS Success
- New Competition Following FY 98 Flight Test

Hughes Aircraft Co.
Tucson, AZ



Rockwell International
Downey, CA



mj-46318A / 111494

EKV PRODUCTS

Early Time Frame

- Flight Tested Seekers
- EKV Based On Passive LWIR Seeker Technology
  - Demonstrated Intercept Capability
- Limited BM/C^3 Interoperability

Mid Term Time Frame

- Second Generation EKV
  - Advanced Seeker Technology
  - Demonstrated Increased KV Intercept Effectiveness And Reliability
- RTD / BM/C^3 Interoperability

Objective System Time Frame

- GBI Class Interceptor
  - Dedicated Booster, Ground Support Equipment, And Interfaces
  - Demonstrated KV Intercept Capability Against Responsive Threats
- Interoperability With Advanced Sensors

Relevance

- Affordably Works Technology Long Poles
- Incrementally Increases Capability With Low Risk
- Gradually Reduces Deployment Time Lines

mj-41876 / 101894

FAMILY OF RADARS

TMD-GBR Dem / Val

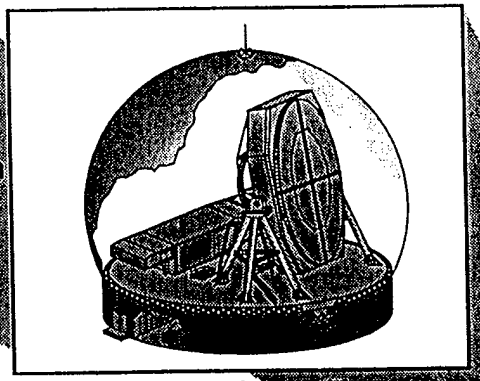


Original Family Concept

- TMD Solid-state
- NMD TWT
- 80-85% Commonality

Discrimination, Target Object Map, Kill Assessment, Mechanical Scan Enhancements

NMD Radar Technology Demonstrator



NMD Evolves From TMD

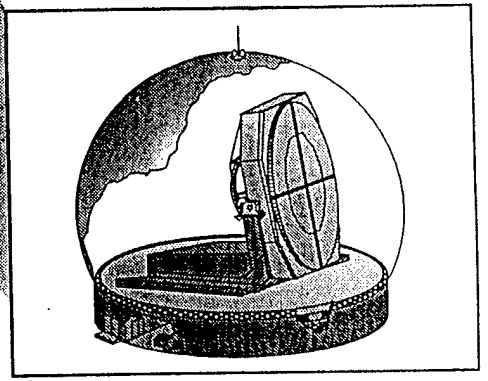
- TMD Solid-state
- NMD Solid-state
- 90-95% Commonality Within The Family
- TMD Dem / Val Radar 1995 - 1997
  - 12,500 T / R Modules
- Evolves To RTD / NMD In 1998 / 1999
  - 17,500 T / R Modules

Advancement To Objective Capability

Technology Leveraging

- Solid-state T/R Modules
- Data Processing
- Discrimination Algorithms
- Kill Assessment Algorithms
- Resource Management And Scheduling

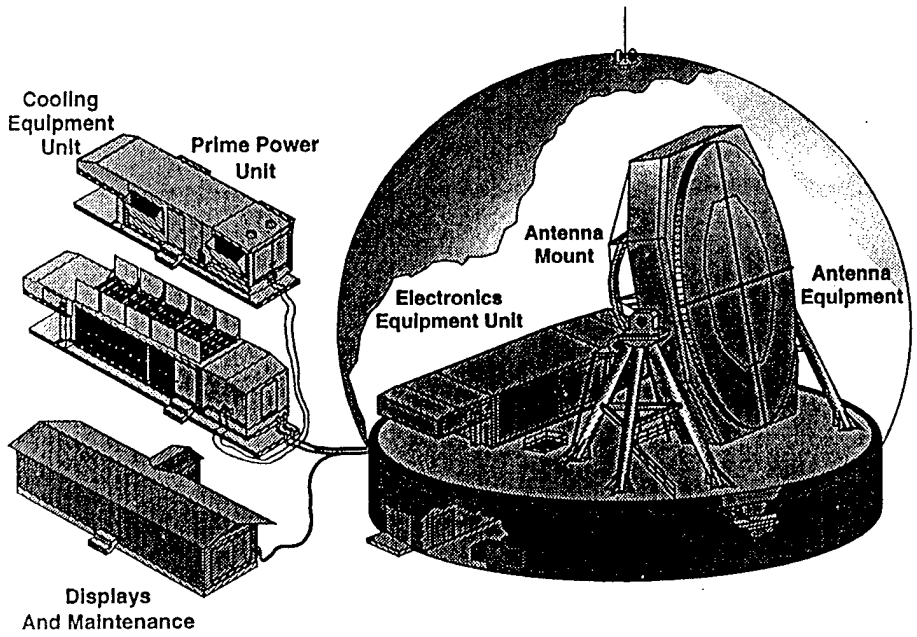
NMD Deployment System



mj-41638B / 091494

NMD RADAR TECHNOLOGY DEMONSTRATOR

Radar



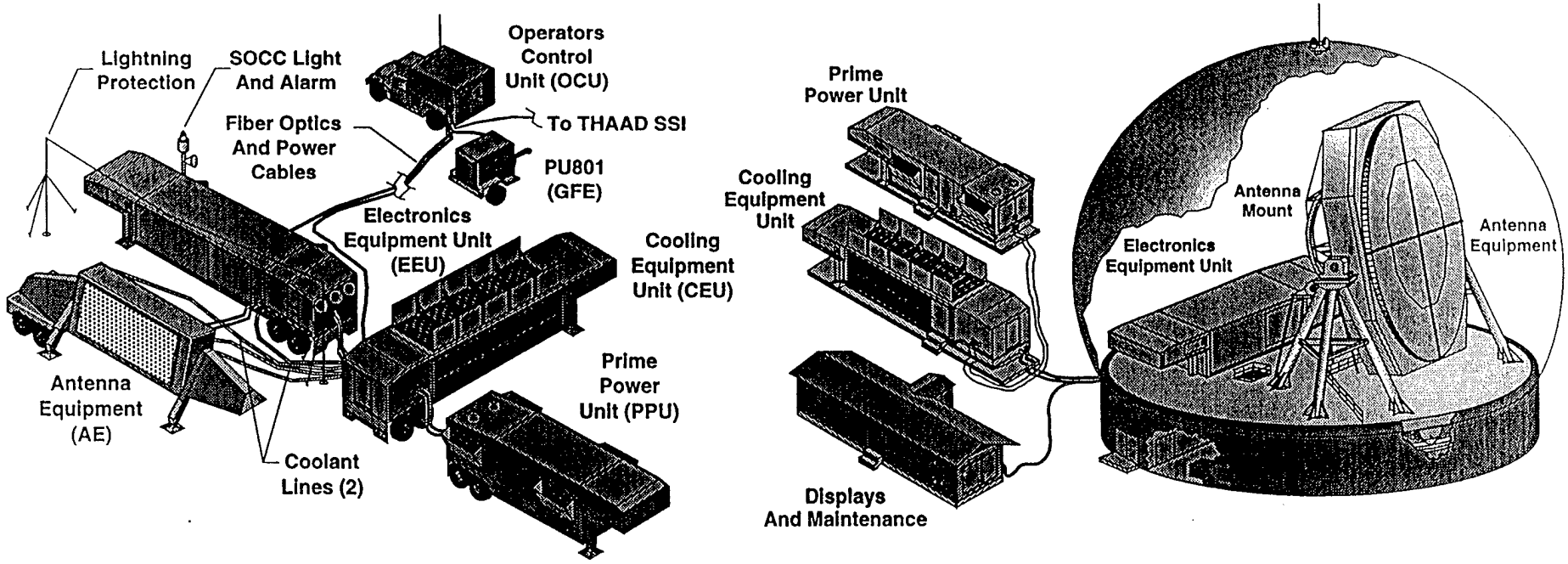
Description

- GBR Characteristics
  - Band — X
  - Aperture — 105 m^2
  - Field Of View — 25° Circular
  - Prime Power
  - Reference Range
  - Solid-state (T / R) Modules — 17,500
- Major NMD Focus
  - Discrimination
  - Target Object Map
  - Kill Assessment
  - Mechanical Scan Enhancements
- Technology Leveraging
  - Solid-state T / R Modules
  - Data Processing
  - Discrimination Algorithms
  - Kill Assessment Algorithms
  - Resource Management And Scheduling

TMD-GBR Is The Cornerstone For NMD Radar Development

RADAR TECHNOLOGY DEMONSTRATOR CONTRACTING PLAN

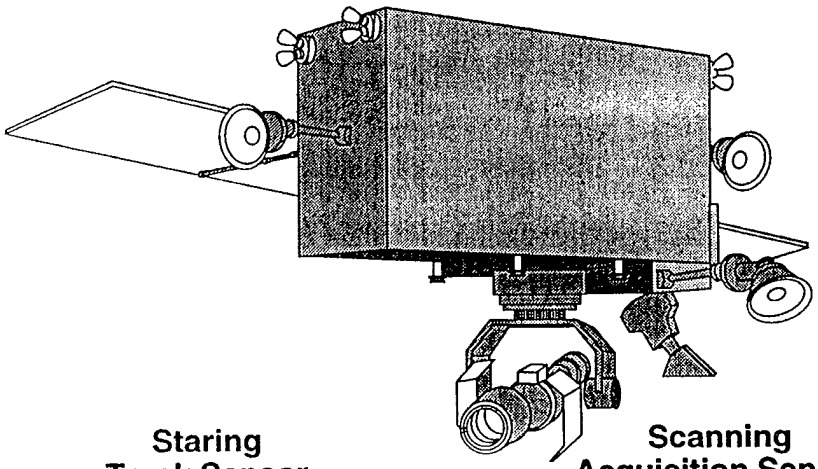
- Modify Competitively Won Family Of Radars Contract With Raytheon
  - Develop NMD Unique Operating Software
  - Reconfigure TMD Dem / Val Radar Into NMD Radar Technology Demonstrator At KMR



mj-46319A / 103194

SPACE AND MISSILE TRACKING SYSTEM (BRILLIANT EYES)

Spacecraft



Staring Track Sensor

- Short Wave Infrared
- Medium Wave Infrared
- Medium-long Wave Infrared
- Long Wave Infrared (P^3I)
- Visible

Scanning Acquisition Sensor

- Short Wave Infrared

Description

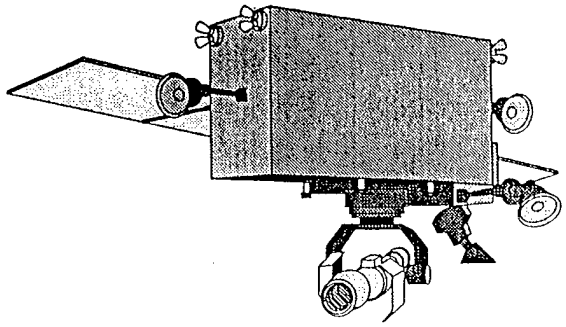
- Distributed Constellation In Multiple Rings
- Low Altitude, Inclined Orbits
- Small, Lightweight Spacecraft (≈600 kg)
- Wide Field Of Regard Acquisition Sensor
  - Horizon-To-Horizon Surveillance To Acquire And Track Boosters
- Narrow Field Of View Track Sensor
  - Above And Below-The-Horizon Tracking Of Boosters And Warheads
- Provides Passive Sensor Technology For Contingency Architectural Options

Space And Missile Tracking System Essential For Optimum Coverage

mj-46320 / 022195

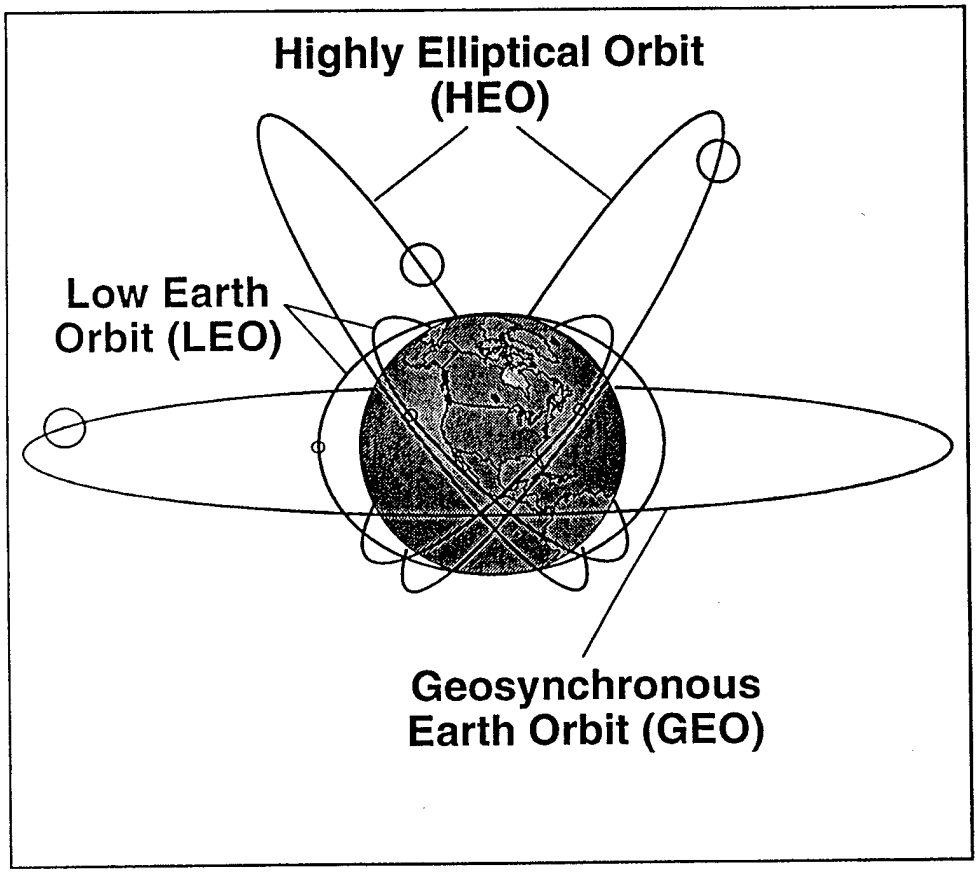
SMTS (BE) CONTRACTING PLAN

- Existing Competitive Contract Vehicles Support Early Milestones And Deployment Decisions
  - SMTS (BE) Contracts Awarded To Rockwell And TRW Teams In FY 93 To Develop Dem / Val Flight Demonstration Systems
    - Demonstrate Performance, Operations And Technology And Validate Designs And Cost
  - Earlier Funding Reductions Led To Planned Down Select To A Single Flying Contractor With Non-flying Contractor Continued For Risk Reduction
    - Down Select Decision Scheduled For March 1995
- SBIR Decision Transferred Resources For SMTS (BE) To USAF But Retained Flight Demonstration Approach



mj-46321D / 022295

SBIR ARCHITECTURE
HIGH NOW + LOW LATER

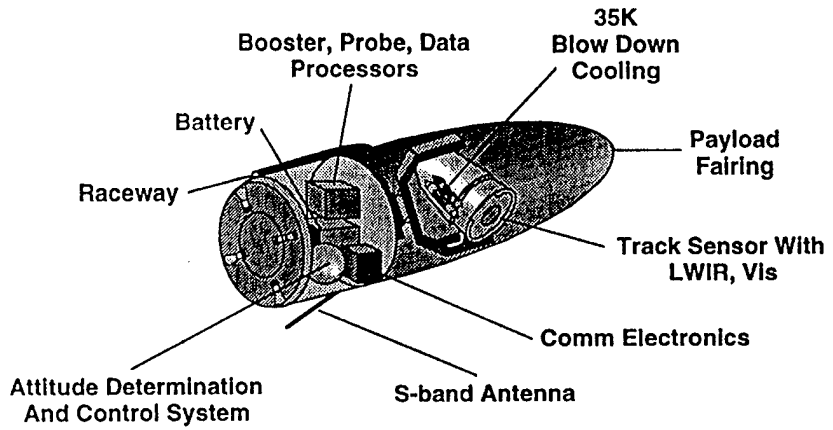


- Deploy High Altitude Constellation Now
- Evolve To Mixed High / Low Constellation In Future After Successful Flight Demo And Issue Resolution
- Optimize High And Low Mix To Meet Evolving National Needs
- Ensure Cost-effective Integration Of LEO Component

mj-46733B / 111494

BRILLIANT EYES (BE) PROBE

BE Probe (BEP)



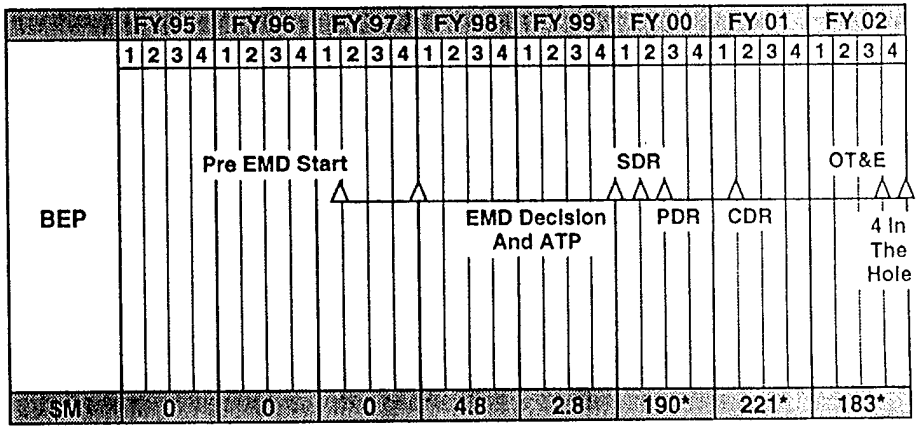
System Description

- BEP Design Leveraged Off BE FDS Design
  - Baseline FDS Track Sensor With LWIR Insertion
  - Baseline FDS ADACS, Propulsion, Communication, Processing, Space Segment Software With Minor Modifications
  - New Cooling - FPA Blow Down, Optics Crystat
  - New Structure, Power System And Additional Ground Segment Software
- BEP Booster Is MM II Stage 1 And 2
- BEP Ground Segment Interfaces With NMD BM/C^3 Element At BMD Site
- Deployment At BMD Site Includes 5 BEPs (4 In Hole And 1 Spare)

Development Plan

- BEP Pre-EMD Programmatics And 2 Year Study Starts In FY 98
  - Leads To A-Spec Development
- BEP Deployment Decision By End Of 4Q FY 99
- OT&E By End Of 3Q FY 02
- 4 In Hole With Spare By End Of 4Q FY 02
- No Plans To Actually Develop And Test

Schedule



* Funds Required For Post Deployment Decision Development

mj-49306 / 120694

SUMMARY AND CONCLUSIONS

- BMDO Has Formulated An Innovative And Highly Focused NMD Technology Readiness Program
  - Addresses Post Cold War Uncertainty
  - Leverages TMD And Past Investments
  - Develops Deployment Options That Emphasize
    - Ever Increasing Capability
    - Deployment Planning
    - Decreasing Contingency Deployment Time Lines

NMD Is Responsive To The Need To Provide An Early Contingency Capability While Maintaining A Path To The Objective System

Advance Planning Briefing For Industry
FY 96 Technology Program



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7-8 MAR 95

Col Alan Kirschbaum, USAF
Associate Deputy For Technology
Ballistic Missile Defense Organization

BMD ADVANCED TECHNOLOGY PROGRAM

Why ?

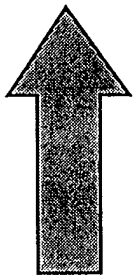
- Direct Applicability To Future TMD And NMD Options
- Focuses On Critical Technologies For Improvements In Capability And Affordability
- Needed To Prepare Future Responses To Straightforward Countermeasures

Essential To Maintain Viable Architecture For Future Mission Needs

TECHNOLOGY PROGRAM GOALS

Threats And Technology Do Not Stand Still, Therefore

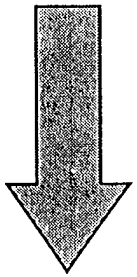
- Support TMD And NMD With *Component Technology Improvement*



Increase

- Range
- Lethality
- Accuracy
- Effectiveness

And



Decrease

- Size
- Weight
- Cost

- Pursue *Advanced Concepts* For Future Responses To An Evolving Threat
  - New Kill Mechanisms
  - High Payoff (Boost Phase Intercept)

TECHNOLOGY PRODUCTS

- Component Technologies
  - NMD Readiness
  - Next Generation TMD
- KE Boost Phase Intercept
  - Interceptor KV And Kick Stage
  - Off Board Sensor
- DE Ballistic Missile Defense
  - High Energy Laser
  - Integration Of Laser And Optics
  - Demonstration Of ATP

RESEARCH / EXPLORATORY DEVELOPMENT

- Innovative Science And Technology
  - Research And Exploratory Development Targeting Breakthrough Technologies For Ballistic Missile Defense
  - Core R&D Program In Sensing, Directed / Kinetic Energy, Materials, Propulsion, Power, And Information Processing
  - $50M / Year FY 96-01; Approximately 300 Small Contracts
- Small Business Innovative Research (SBIR)
  - Mandated Percentage Of Extramural R&D
  - Approximately $50M / Year FY 96-01
  - Results: 30% Commercialized By Phase II Completion, 75% Useful BMD Products
- Technical Applications: Robust Tech Transfer / Commercialization Program

COMPONENT TECHNOLOGY

- Sensors
  - Focal Plane Arrays - Sensitivity; Low Noise
  - Cryocoolers - Low Vibration; 10 Year Life
  - Optics - Rad Tolerant; Contamination Control
  - Signal Processing - A / D Converters; Neural Net
  - Laser Radar - Accuracy; Discrimination
  - RF Radars - Lightweight; Adaptive Array

- Interceptors
  - Seeker - LWIR For Cold Targets
  - Laser Radar - Lightweight; Discrimination
  - Solid And Gel Propellants - Munitions Insensitive

COMPONENT TECHNOLOGY (Cont'd)

- Phenomenology And Discrimination
  - MSX - 0.1 - 26 μ
    - Cold Body Signatures
    - Warm Body Tracking BTH
    - Space, Atmosphere And Earth Backgrounds
  - X-band Signatures
  - HALO And SLBD - MWIR Signatures
  - Algorithms And Codes
- Command, Control And Communications
  - Sensor Cueing And Hand Over Experiments
  - Communication Connectivity Experiments

BOOST PHASE INTERCEPT

- Air Launched KE Boost Phase Intercept
  - 1999 Demonstration - Integrated Endoatmospheric Kill Vehicle
  - Interceptor - USN And USAF Aircraft Compatible
  - Off Board Sensor - Optical / Radar
  - Operations Analysis - USAF And USN

DIRECTED ENERGY

- Chemical Laser
  - Alpha LAMP Integration
- Acquisition, Tracking, And Pointing
  - Plume / Hard Body Hand Over
  - High Altitude Balloon Experiment - Synergy With TMD And KE BPI

VISION FOR THE FUTURE

- Long-term Mission Success Requires Transforming Science And Technology Into Warfighting Capability
- Aggressive Technology Development And Demonstration Ensure Credible Missile Defense

ADVANCED PLANNING BRIEFING TO INDUSTRY

BMDO TECHNOLOGY APPLICATIONS

"COMMERCIALIZING MISSILE DEFENSE TECHNOLOGY"

DWIGHT DUSTON
MARCH 7, 1995

BALLISTIC MISSILE DEFENSE ORGANIZATION

ALL IST TECHNOLOGY IS DUAL - USE

Area	Defense Technology	Commercial Application
• Communications	• Terahertz Devices • Superconducting Digital Electronics • Spread Spectrum CDMA • Satellite Laser Communications	• Ultrahigh Frequency Bands • Iridium • Wideband Global Cellular • ISDN
• Imaging And Sensing	• Large Format Sensors • Digital Signal Processors • Artificial Neural Networks • Refractory Semiconductors • Lasers And Particle Beams	• Nondestructive Evaluation • Medical Imaging • Environmental Monitoring • Automotive Diagnostics • Noninvasive Surgery

pj-34048 / 052793

ADPA Briefing

ALL IST TECHNOLOGY IS DUAL-USE

Shown are two of the six Innovative Science & Technology (IS&T) areas that BMDO currently research advancements The other four are: power, interceptors, materials, and advanced propellants. The primary objective is to nurture scientific research, foster breakthroughs and accelerate the most promising ideas to applications that meet BMDO needs. As you can see, these are dual-use technologies by nature and have application to products in the commercial sector.

BALLISTIC MISSILE DEFENSE ORGANIZATION

... EVEN WHEN IT'S NOT OBVIOUS

Area	Commercial Applications
• Precision Tracking And Pointing	• Eye Surgery
• Cubane Rocket Propellant	• Pharmaceutical Precursors
• Electron Beam Accelerators	• Medical Waste Sterilization • Food Preservation
• Weapon / Target Assignment	• Truck Routing And Delivery
• Rocket Plume Spectroscopy	• Blood Sugar Monitoring
• Electromagnetic Rail Guns	• High Voltage Insulators • Auto Spark Plugs
• X-ray Lasers	• Cellular Microscopy • Plasma Processing
• Laser Beam Steering	• Optical Computing

pj-34049 / 052693

EVEN WHEN IT'S NOT OBVIOUS

One's initial projections of technology spinoffs might not readily lead to the match-ups shown here, but each of these success stories have been confirmed, reported and discussed in either the BMDO annual Technology Applications report or the quarterly Update publication. Men and women in small and large companies continue to apply their technical expertise, innovative foresight and entrepreneurial skills to transition these defense technologies to the commercial market place.

BALLISTIC MISSILE DEFENSE ORGANIZATION

WHAT'S THE SECRET TO TECH TRANSFER?

Proactive And Action Oriented

- Focused Technical Reviews ⇨ Marketing Assistance
- Publicity & Visibility ⇨ Widespread Acceptance
- Demonstration Projects ⇨ Successful Models
- Professional / Trade Organization ⇨ Networking
- Leverage Other Federal Efforts ⇨ Synergy
- Interactive Database With Follow-up ⇨ Accessibility

pj-33868 / 052693

WHAT'S THE SECRET TO TECH TRANSFER

There is no single, fixed set of rules that guarantees successful technology transfer for each private company and federal technology developing agency and laboratory. Since its inception, BMDO, and previously as SDIO, has developed, validated and continued to refine and expand a multi-faceted technology transfer model that has proven successful for us. Our approach is based on a proactive and action oriented program. We concentrate on interacting with our technology developers and potential applications base, using a broad and diverse network to publicize the technologies availability, and maximizing the capabilities of other DOD and federal agency laboratories.

Media List–IS&T/SBIR

Story:_____

Date: _____

- ☐ Aerospace America [?]
- ☐ Aerospace Daily [D]
- ☐ Aviation Week & Space Technology [W]
- ☐ Business Week [W]
- ☐ Defense Electronics [M]
- ☐ Defense News [W]
- ☐ Design News [2 x M]
- ☐ EDN Magazine [2 x M]
- ☐ EDN News [2 x M]
- ☐ Electrical Engineering Times [W]
- ☐ Electronic Business [M]
- ☐ Electronics [M]
- ☐ IEEE Spectrum [M]
- ☐ Journal of Electronic Defense [M]
- ☐ Lasers & Optronics [M]
- ☐ Laser Focus World [M]
- ☐ Military and Aerospace Electronics [M]
- ☐ New Technology Week [W]
- ☐ New York Times [D]
- ☐ OE/NI [M]
- ☐ Photonics Spectra [M]
- ☐ Physics Today [M]
- ☐ Science [W]
- ☐ Science News [W]
- ☐ SDI Monitor [Bi-W]
- ☐ Semiconductor Int'l [M]
- ☐ Sensors [M]
- ☐ Solid State Technology [M]
- ☐ Space News [W]
- ☐ Semiconductor Industry [Qrtly]
- ☐ R & D [M]
- ☐ Technology Review [8 x yrly]
- ☐ Wall Street Journal [D]
- ☐ Washington Post [D]
- ☐ Washington Technology [Bi-W]
- ☐ Washington Times [D]

Other Publications:

3/5/92

MEDIA LIST

Our outreach program has found that the media offers an unlimited resource for attracting and generating interest of potential users in BMDO-developed technologies. Furthermore, the more diverse the audience, the greater the technology exposure. This sample list includes national and local newspapers, weekly to monthly periodicals, to trade-related and technology-specific publications.

SDI Technology Applications Program

TECHNOLOGY TRANSFER/COMMERCIALIZATION ADVISORS
(Partial Listing)

Mr. John Preston
Director
Technology Licensing Office
Massachusetts Institute of Technology
Cambridge, MA

Dr. Milton Chang
President & CEO
New Focus, Inc.
Mountain View, CA

Dr. R. G. Colclaser
Westinghouse Science & Technology Ctr
Westinghouse Corporation
Pittsburgh, PA

Mr. Deen Edgar
Strategic Investment Program
Electronic Data Systems Corporation
Troy, MI

Dr. Peter F. Gerity
Associate Dean
College of Engineering
University of Utah
Salt Lake City, UT

Dr. Arthur H. Guenther
Science Advisor
State of New Mexico
also Sandia National Laboratory
Albuquerque, NM

Dr. Tom Hartwick
Chief Scientist
TRW, Inc.
One Space Park
Building R-10, Room 2830
Redondo Beach, CA 90278

Dr. Keith McKee
Director
Manufacturing Productivity Center
Illinois Institute of Technology
Chicago, IL

Dr. George McKinney
Managing Director
Beacon Venture Fund
Waltham, MA

Mr. Harvey M. Pollicove
Director
Center for Optics Manufacturing
University of Rochester
Rochester, NY

Mr. Thomas Schneider
Electric Power Research Institute
Palo Alto, CA

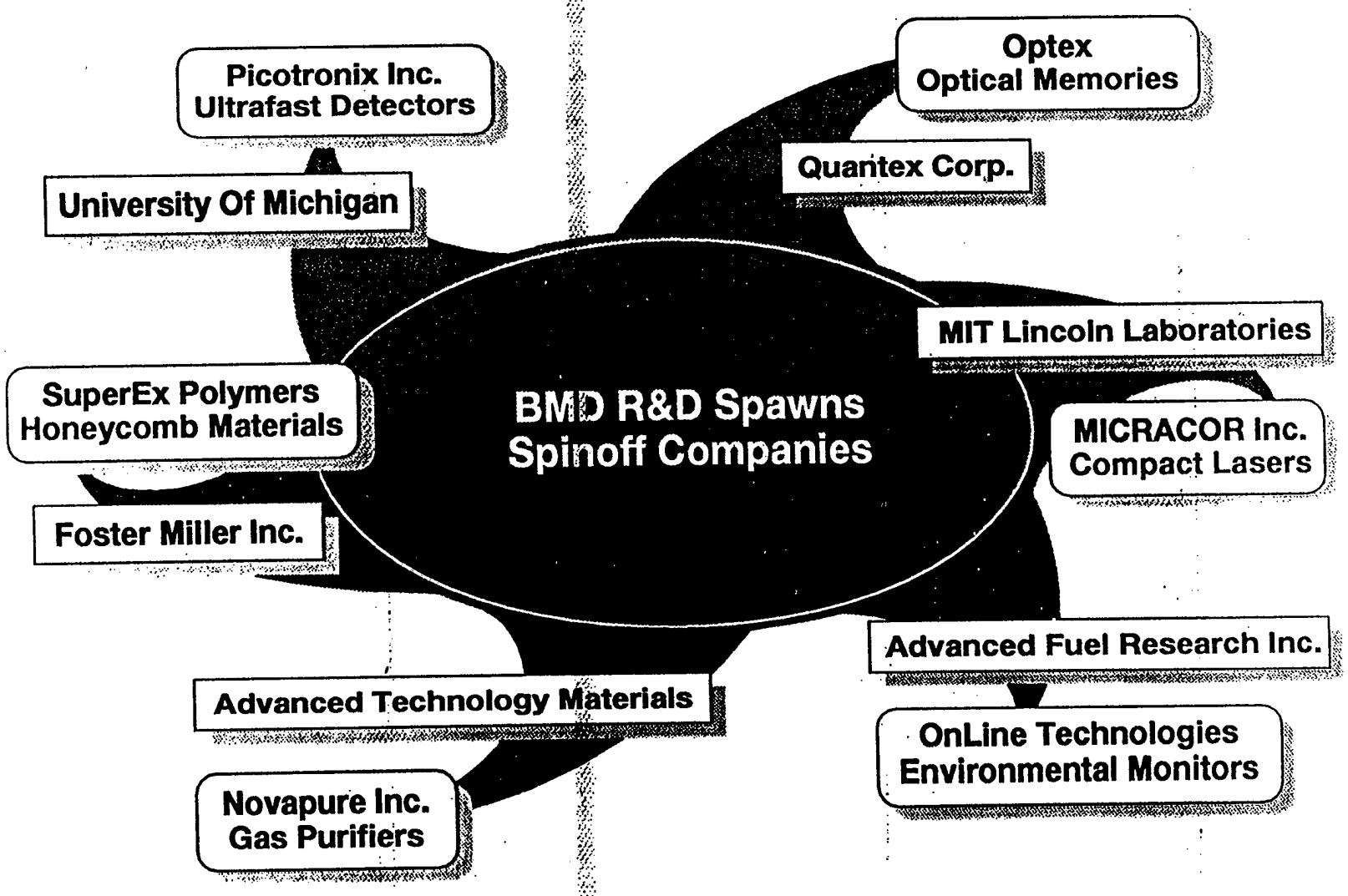
Mr. J. Thomas Walker
Special Assistant to the Director
National Technical Information Service
Springfield, VA

TECHNOLOGY TRANSFER ADVISORS

Over the years we have evolved and refined Technology Application reviews, a unique technology transfer tool to help guide the BMDO-funded researchers and technology developers in the process to commercialize their technologies. These periodic reviews examine either a specific class of technology or application field, and focus on assessing the researcher's commercialization strategy. Since the roadmap to profitably take a product to the marketplace is dependent upon the successful blending of many interdependent factors, our panels include a diverse representation of high-level experts from industry, venture capital, marketing, academia and government agencies. As you can see, this partial listing confirms the stature of the resource at our disposal.

BALLISTIC MISSILE DEFENSE ORGANIZATION

SPINOFF COMPANIES GENERATE NEW PRODUCTS FOR THE MARKETPLACE



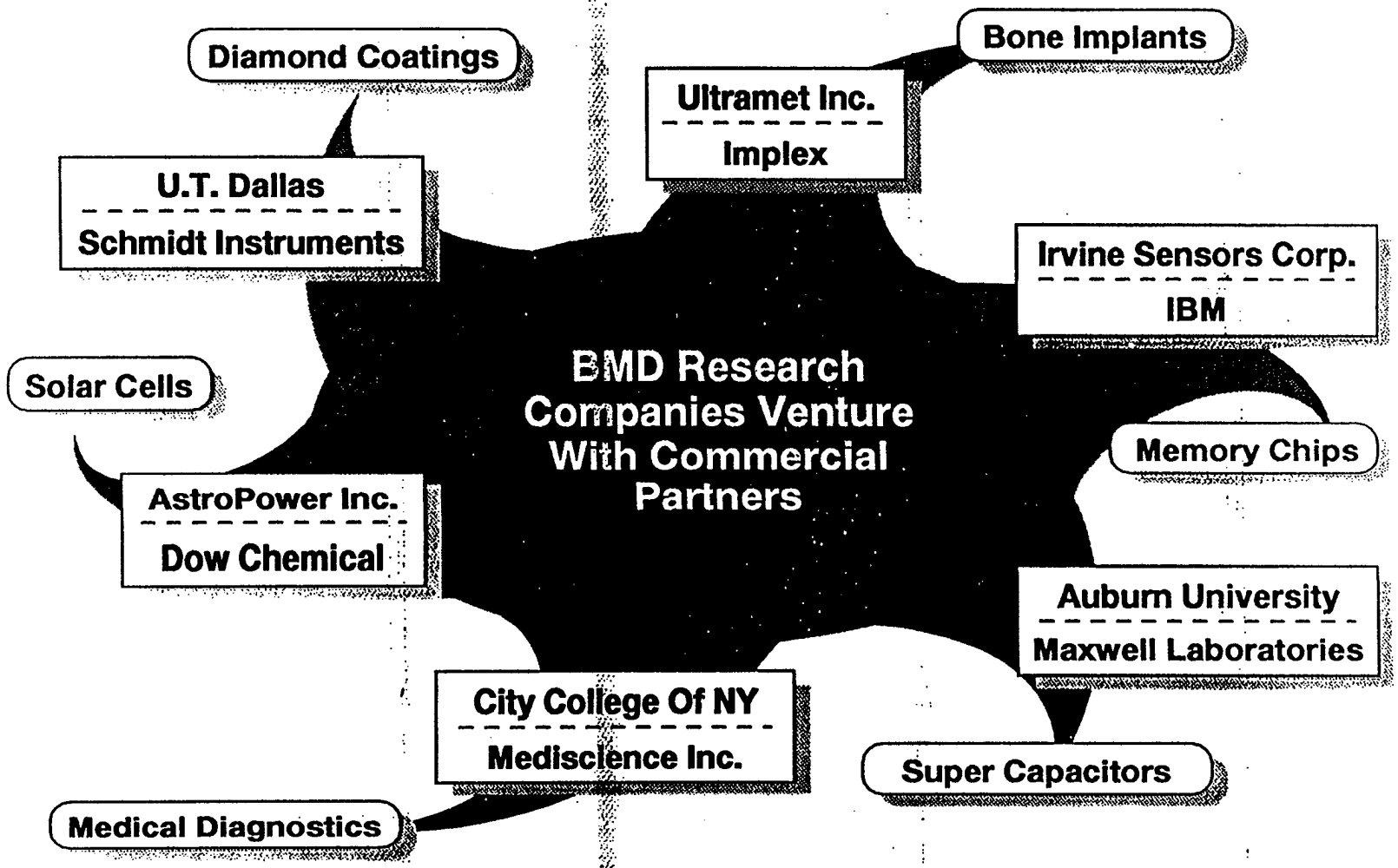
pj-33873 / 052693

SPINOFF COMPANIES GENERATE NEW PRODUCTS FOR THE MARKETPLACE

BMDO technologies, from both our Innovative Science and Technology program as well as our Small Business Innovation Research program, have found their way to the marketplace via new companies that have spunoff from their parents. For example, from universities such as MIT and Michigan, and a number of successful and growing small businesses.

BALLISTIC MISSILE DEFENSE ORGANIZATION

BMD CATALYZES FORMATION OF ALLIANCES AND PARTNERSHIPS



pj-33872 / 052693

BMD CATALYZES FORMATION OF ALLIANCES AND PARTNERSHIPS

There are many roads that lead to the commercial marketplace, and the BMDO technology transfer process has been successfully applied on a number of these. Alliances and partnerships, when structured to maximize the contributions of each participant, provide the right match of capabilities and resources necessary to design, finance, produce and market a successful commercial product. Again, this chart depicts a broad cross-section of participants from academia to small businesses to industrial giants in their respective fields. This only reaffirms there are endless possibilities for market-smart entrepreneurs willing to pursue their goals.

BALLISTIC MISSILE DEFENSE ORGANIZATION

BMD R&D SCORES BIG IN COMMERCIAL DEVELOPMENT COMPETITION

Department Of Commerce Advanced Technology Program Winners

• AstroPower	Ultrabright LED Production
• Cree Research Inc.	Nonvolatile Memories
• Conductus Inc., And Partners	Superconducting Digital Electronics
• Illinois Superconducting Corp.	RF Communications Components
• Geltech Inc.	Pure Silica Micro-optics
• Eagle-Picher / NCSU	Blue-green Lasers
• Optex Corp.	Electron-trapping Optical Memory
• Spire Corp.	Metalorganic CVD

pj-33870 / 052793

BMD R&D SCORES BIG IN COMMERCIAL DEVELOPMENT COMPETITION

The Department of Commerce's Advanced Technology Program (ATP) is a competitive, cost-shared program to further developed those technology with a commercial orientation. The ATP is open to individual companies, partnerships or consortia, and the focus is on reducing the risks leading to a production decision, and therefore, it has a manufacturing flavor.

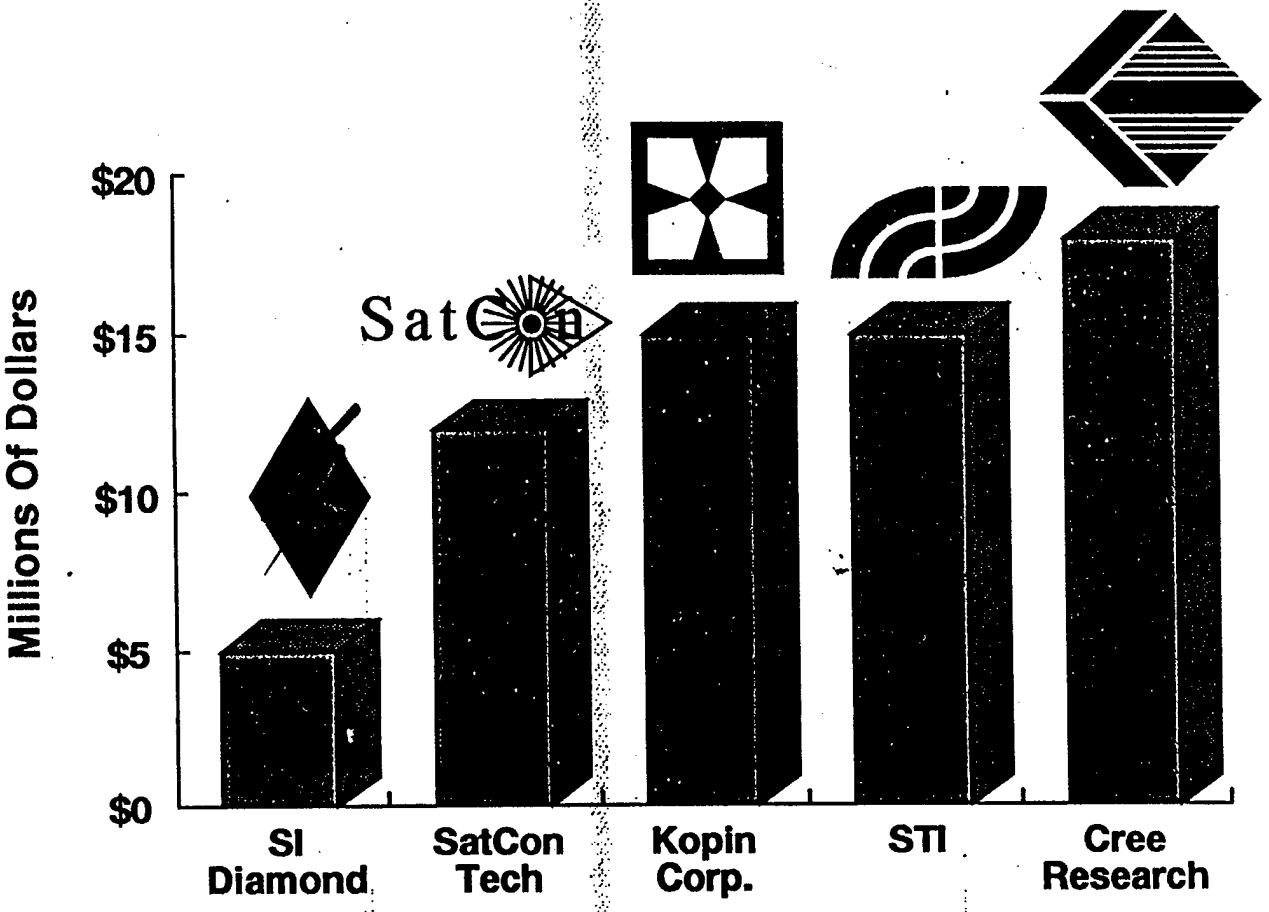
A number of companies who have either won or competed for ATP projects have stated that their participation in the BMDO SBIR program laid the groundwork in technology development and commercialization strategies which enabled them to be in a competitive position for an ATP award, which is one more step towards a commercial reward,

Shown here is a partial listing of ATP winners, the companies and their respective technologies that have received BMDO SBIR Phase I and II funding.

BALLISTIC MISSILE DEFENSE ORGANIZATION

THE PUBLIC MARKET LEVERAGES BMD R&D INVESTMENTS

Initial Public Stock Offerings



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THE PUBLIC MARKET LEVERAGES BMD R&D INVESTMENTS

One measure of a company's growth potential as judged by the financial market is its ability the attract investment capital in the free market. The initial public stock offering or IPO is one vehicle for a company to obtain necessary growth funds, gain exposure in the investment community, and place it name before the public at large. These companies, which selected the IPO route, have taken advantage of their participation in BMDO's SBIR programs to progress to the point that places them in position to attract the capital shown.

BALLISTIC MISSILE DEFENSE ORGANIZATION

INDUSTRY ROLE IN GUIDING BMD COMMERCIAL STRATEGY

Representative BMDO Technology Transfer Network

- American Bearing Manufacturers Transfer Network (ABMA)
- American Defense Preparedness Association (ADPA)
- American Society Of Metals International (ASM Int'l)
- Armed Forces Communications & Electronics Association (AFCEA)
- Electronic Industries Association (EIA)
- Industrial Research Institute (IRI)
- Institute Of Electrical And Electronics Engineers (IEEE)
- Manufacturers Alliance For Productivity And Innovation (MAPI)
- National Business Incubators Association (NBIA)
- National Coalition For Advanced Manufacturing (NACFAM)
- National Center For Advanced Technologies (NCAT)
- National Center For Manufacturing Sciences (NCMS)
- National Electrical Manufacturers Association (NEMA)
- National Tooling And Machining Association (NTMA)

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INDUSTRY ROLE IN GUIDING BMD COMMERCIAL STRATEGY

We have developed an excellent network with industry and communicate with more than 50 professional societies and trade associations. This has proven to be beneficial for both parties. Through this interaction we make industry aware of our emerging and maturing technologies while learning of their special needs. Such exchanges provide direction for our technology transfer initiatives, and contribute to focusing our Technology Application Reviews. This list provides only a sampling of the 50 organizations with which we interface.

Number of spinoff companies : ~~28~~ 33

Number of products on the market: ~~168~~ 183

Number of patents pending: ~~149~~ 164

Number of patents granted: ~~204~~ 274

Number of ventures: ~~231~~ 272

Number of CRADAs: ~~15~~ 19

as of Jan 5, 1995