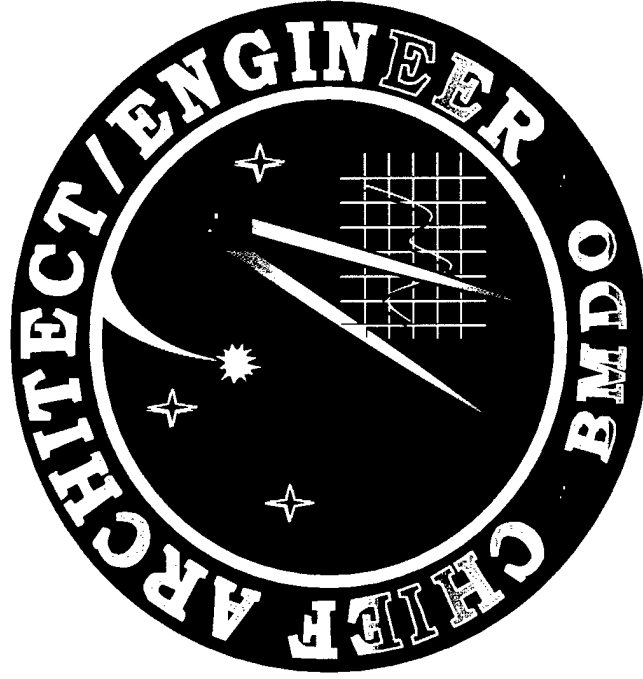
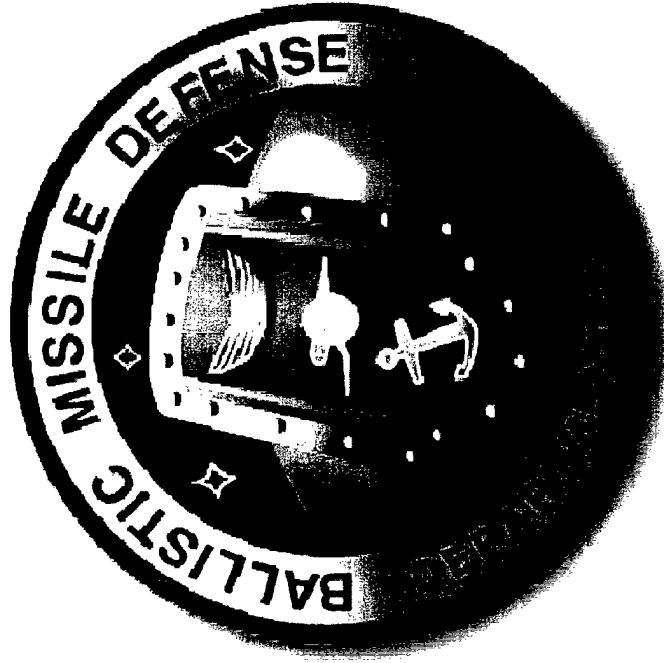


BMDO System Planning

Presentation to the
8th Annual AIAA/BMDO Technology Conference
Boston, Massachusetts



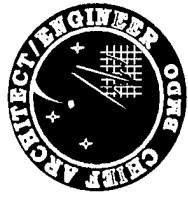
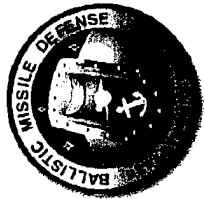
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FOR OPEN PUBLICATION
JUL 9 1999 3
DIRECTORATE FOR FREEDOM OF INFORMATION
AND SECURITY REVIEW
DEPARTMENT OF DEFENSE
Reference #: 99-S-2563
BMDO/SRE Case #: 99063001

19 July 1999

Dr. Richard Bleach
Deputy Chief Architect/Engineer

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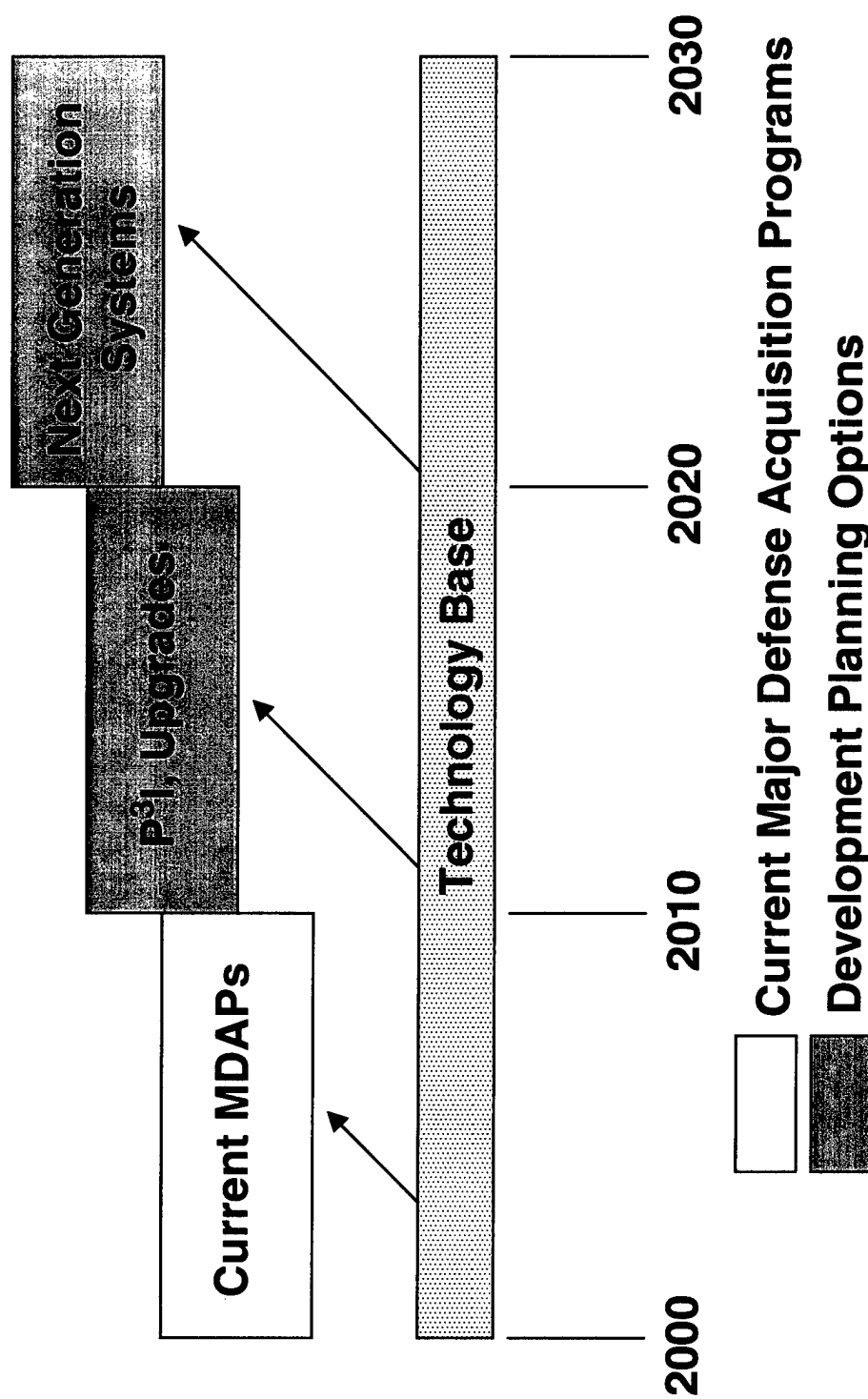


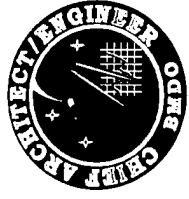
BMDO System Planning

Development of Options for System Evolution and System Needs to Support Options

System Evolution

System Needs





BMDO Planning for Technology Investment

The Development Planning process provides BMDO's system needs for technology and basis for investment

Development Plan

- Evolving Threat
- User Needs
- Architecture and Systems Engineering Analyses
- System Concepts
- System Needs
- Priorities

Technology Master Plan

- Technology Solutions
- Road Maps
- Investment Strategy
- Priorities
- Implementation strategy
- POM Input
- Cost and Effectiveness Analyses

Architecture,
Technical and
Cost Analyses

The Technology Master Plan defines BMDO's investment and approach to obtaining the "needed" technology



BMDO Development Plan

(3 December 1998)



- **Development Planning Process**
- **Theater Missile Defense (TMD) - Threat, Mission Needs and Operational Requirements, Architectures, and System Needs for Technology**
- **Attack Operations - Functions and Priorities, Counter Countermeasures (CCMs), Sensor-to-Shooter Timeline, and Battle Damage Assessment (BDA)**
- **National Missile Defense (NMD) - Threat, Mission Needs and Operational Requirements, Architectures, and System Needs for Technology**
- **Test and Evaluation Needs for Technology**
- **Affordability Considerations**
- **Prioritization of System Needs for Technology**



Reference Documents (3 December 1998 BMDO Development Plan)



- **110 source documents were used including**
 - **System Threat Assessment Reports (STARs)**
 - **Capstone Requirements Documents (CRDs)**
 - **Operational Requirements Documents (ORDs)**
 - **Concept of Operations (CONOPs) documents**
 - **Technology Area Plans (TAPs)**
 - **Service Technology Master Plans**
 - **Mission Area Plans (MAPs)**
 - **Sub-Mission Area Development Plans**
 - **Technical Requirements Documents (TRDs)**
 - **System Requirements Documents (SRDs)**
 - **Cost Analysis Requirements Descriptions (CARDS)**
 - **Reports from studies including: Risk Management, Threat Risk, Red/Blue studies, Cost studies**



Categories of NMD System Needs for Technology

(3 December 1998 BMDO Development Plan)

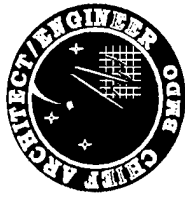


System and Elements	Functions
System Level	Discrimination Kill Assessment Survivability Reliability, availability, maintainability Affordability
Sensors	Search Surveillance and Tracking in a Nuclear Environment Target Detection and Clutter Rejection Track and Track Accuracy
BMC3	Tracking with Multiple Sensors (Sensor Fusion) Engagement Planning Real-time Distributed Database Management Survivable Communication Network
Interceptors	Performance in a Nuclear Environment TOM Utilization (handover, association, and endgame) Lethality



High Priority TMD System Needs

(3 December 1998 BMDO Development Plan)

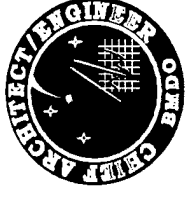


Radar Surveillance, Acquisition, Tracking, and Discrimination
Space-Based Electro-Optic Infrared Surveillance, Acquisition, Tracking, and Discrimination
Upper Tier Interceptor Discrimination (beyond 2005)
Lower Tier TMD Interceptor Agility (i.e., maneuver acceleration and time constant)
BMC4I Situation Awareness (Combat Identification), Interoperability and Kill Assessment
Lethality
Interceptor Avionics, IR and RF Seeker and T/R Modules Producibility and Affordability



High Priority NMD System Needs

(3 December 1998 BMDO Development Plan)

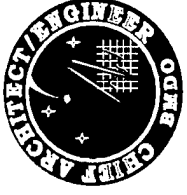


Tracking and Discrimination	System Level and BMC3 Discrimination SBIRS IR Track and Track Accuracy XBR Discrimination in Presence of Chaff and Jammers GBI Discrimination GBI Target Map Utilization - Target Selection BMC3 TOM Generation
Kill Assessment	Kill Assessment (System, XBR, and BMC3)
Lethality	GBI Lethality
Affordability	GBI Cost Reduction to Allow Greater Weapon Utilization Against Objects Not Fully Discriminated
Survivability	Operated in a Nuclear Environment



TMD and NMD Common Technology Needs

(3 December 1998 BMDO Development Plan)

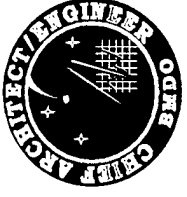


TMD	NMD	COMMON TECHNOLOGY NEED
Upper Tier Sensor	BMC3	Acquisition and Tracking <ul style="list-style-type: none"> Data fusion from multiple sensors
Upper Tier Sensor	XBR	Discrimination <ul style="list-style-type: none"> High bandwidth and angular resolution Address chaff and jammers
Upper Tier Sensor	XBR	Kill Assessment <ul style="list-style-type: none"> High probability of accurate kill assessment
Upper and Lower Tier Sensor	XBR	Reliability <ul style="list-style-type: none"> T/R modules
Upper Tier Sensor	XBR/SBIRS	Track and Track Accuracy <ul style="list-style-type: none"> Address jammers
SBIRS	SBIRS	Survivability <ul style="list-style-type: none"> Natural environment OPINE
Upper Tier Sensor	GBI	Survivability <ul style="list-style-type: none"> OPINE
Upper Tier Interceptor	GBI	Lethality
SBL	SBL	All



Test and Evaluation Need Areas

(3 December 1998 BMDO Development Plan)



System Need	Test Need
End game scoring	Miss distance measurement
Lethality	Validation of sled test scaling
Kill assessment	Debris measurements
Target discrimination	IR signature collection of foreign missile characteristics



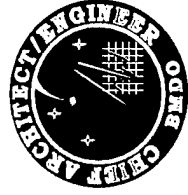
Affordability Need Areas

(3 December 1998 BMDO Development Plan)



- **Recent BMDO/PO Cost Driver Study results suggest substantial cost benefits in reducing component cost for**
 - **T/R modules**
 - **signal processors**
 - **seeker assemblies**
 - **DACS**

- **Use of open system concepts should also reduce costs**
 - **common components across multiple systems**
 - **non-proprietary interfaces, protocols and standards to promote modular design solutions**
 - **commercially driven, industry based solutions**



Attack Operations Need Areas

(3 December 1998 BMDO Development Plan)

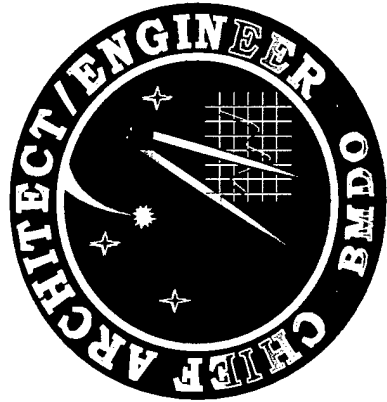
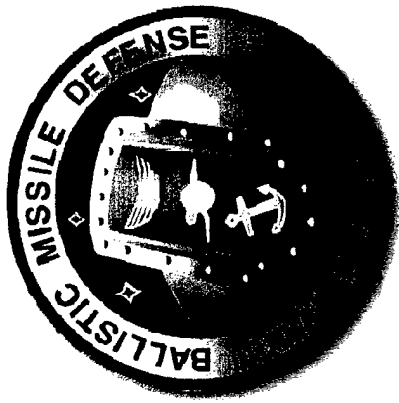
Functions	CRD Requirement	Deficiencies
Intelligence Preparation of the of Battlespace (IPB)	Must include all-source intel for ID; prioritizing and targeting TMs; infrastructure; terrain delimitation capability; and priority for WMD	NTM priority; data interoperability; production tools and priorities; and training
Classify/Identify	TMD/ FoS requires sensors to provide Launch Point Estimate (LPE) and Impact Point Prediction (IPP); launch times; impact times; state vectors; and co-variances and missile type ID	ID of moving targets and processing, exploitation and dissemination deficiencies
Data Management/Fusion	TMD C2 centers must display a consistent, near real-time tactical picture for attack ops, active defense and passive defense	Processing, exploitation and dissemination deficiencies, data interoperability and data flow constraints
Task & Direct	US TMD attack operations forces require the ability to rapidly locate, identify, track and attack both TM and infrastructure elements	Interoperability, excessive control levels resulting in increased timelines, manual voice systems require excessive time for target updates and ECM Susceptibility
Commit Decision	Attack operations C4I systems must include consistent tactical picture; interoperable data links; battlespace deconfliction; and weapon-to-target pairing	Target volume overload and manual process limitations



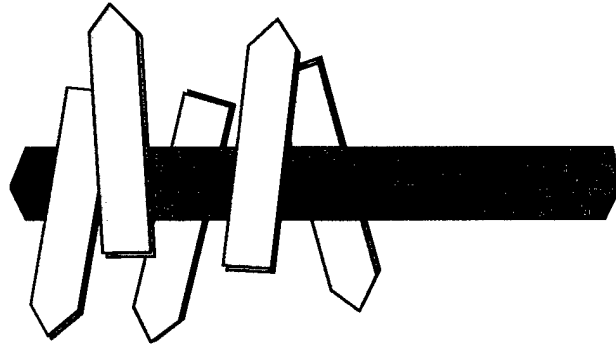
Benefits That Have Been Produced

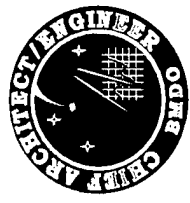


- **Planning for Technology Base**
 - Better organized to address key system needs
 - Better documentation (Technology Master Plan, Development Plan)
- **Interaction with System Engineering Communities**
 - More teaming to address technical issues (e.g. JTB, Development Planning IPT, Tech. Planning Teams)
 - Reach out encompasses users, developers and technologists
- **Process initiated which includes proposed use of analyses using models and simulations to identify future system capability options and system needs in support of those options**
 - Identify shortfalls and deficiencies based on threat risk
 - Identify system sensitivities to better set priorities for system needs



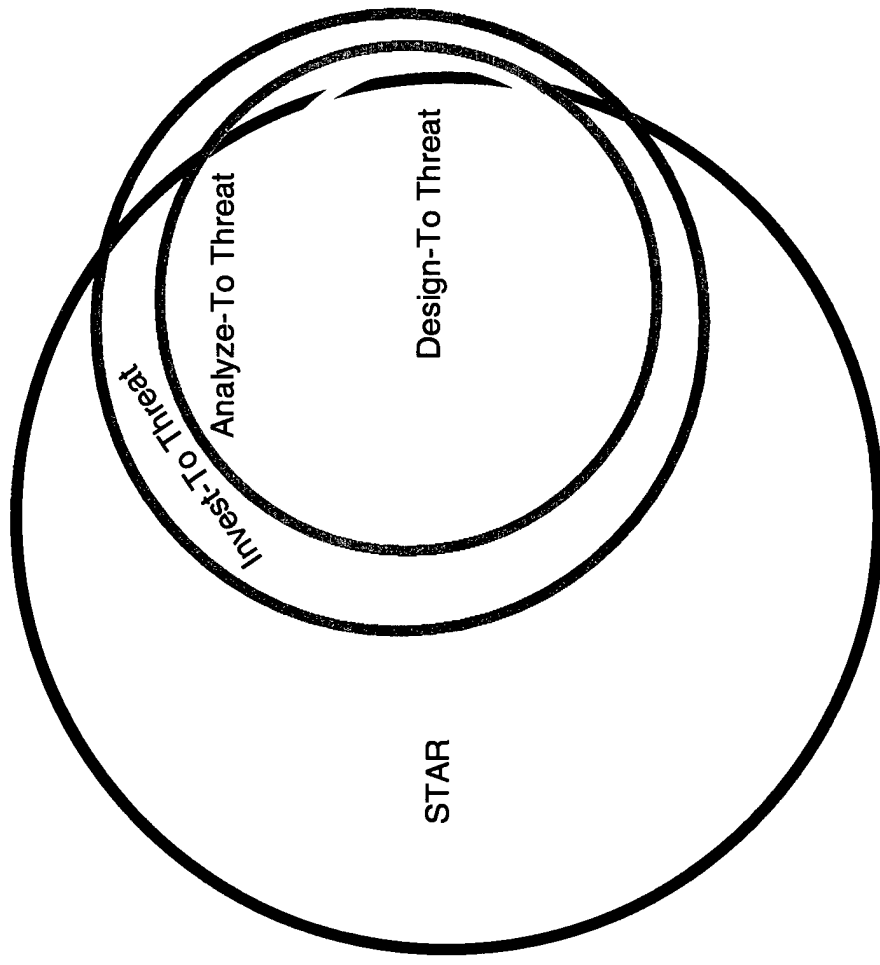
System Planning for the Future





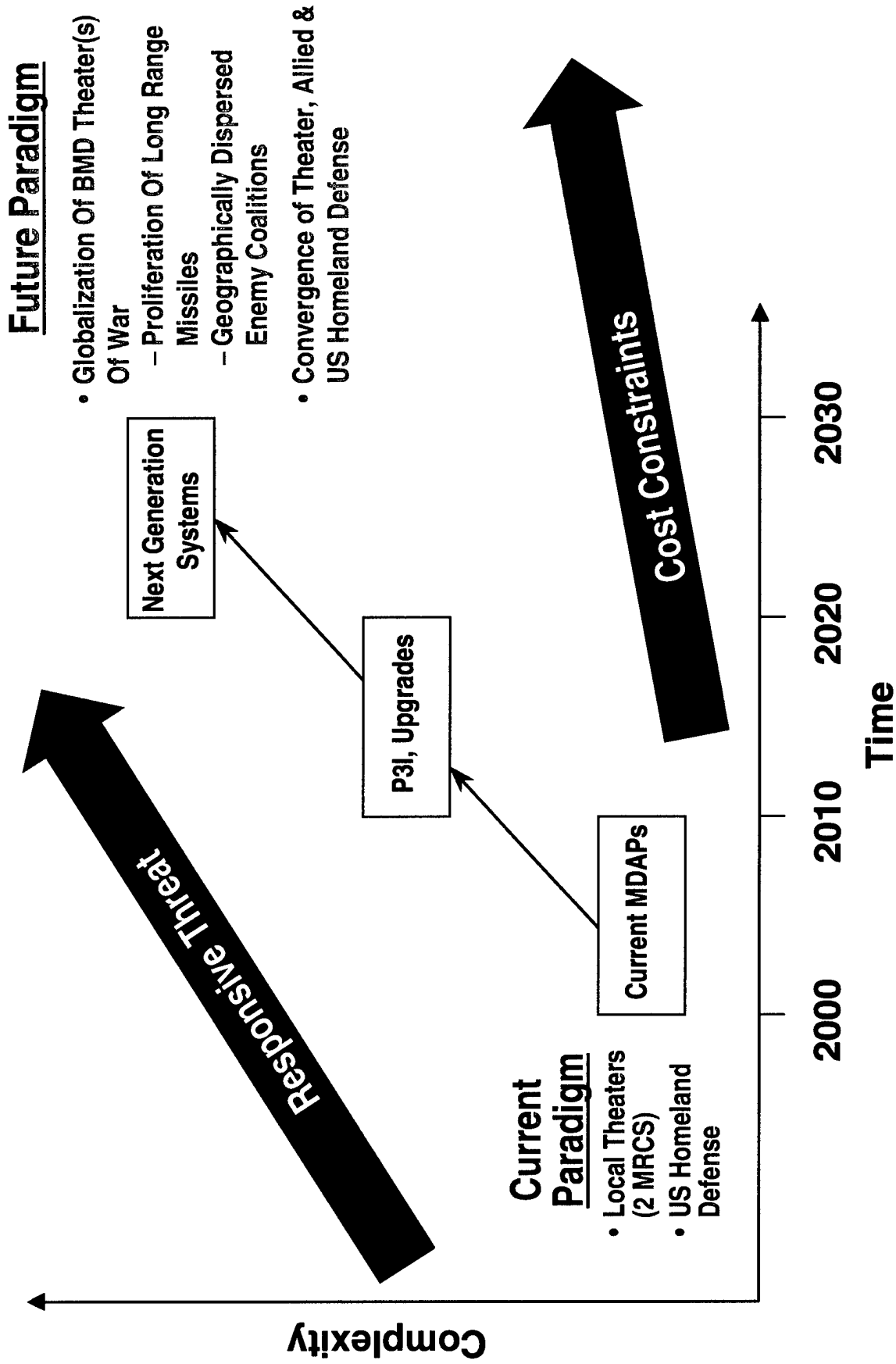
Threat

- A variety of overlapping threat characterizations have been defined
- Most support MDAP development
- Threat characterizations for the 2010-2025 timeframe have received more attention of late (BMD SAS, SBL)
- For system planning, an Invest-To Threat is needed whose characteristics are:
 - Broad scope
 - Not constrained by current MDAP system concepts or assumptions



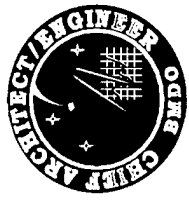


Motivation Behind BMD Systems Architecture Study (SAS) Process





BMD System Architecture Study

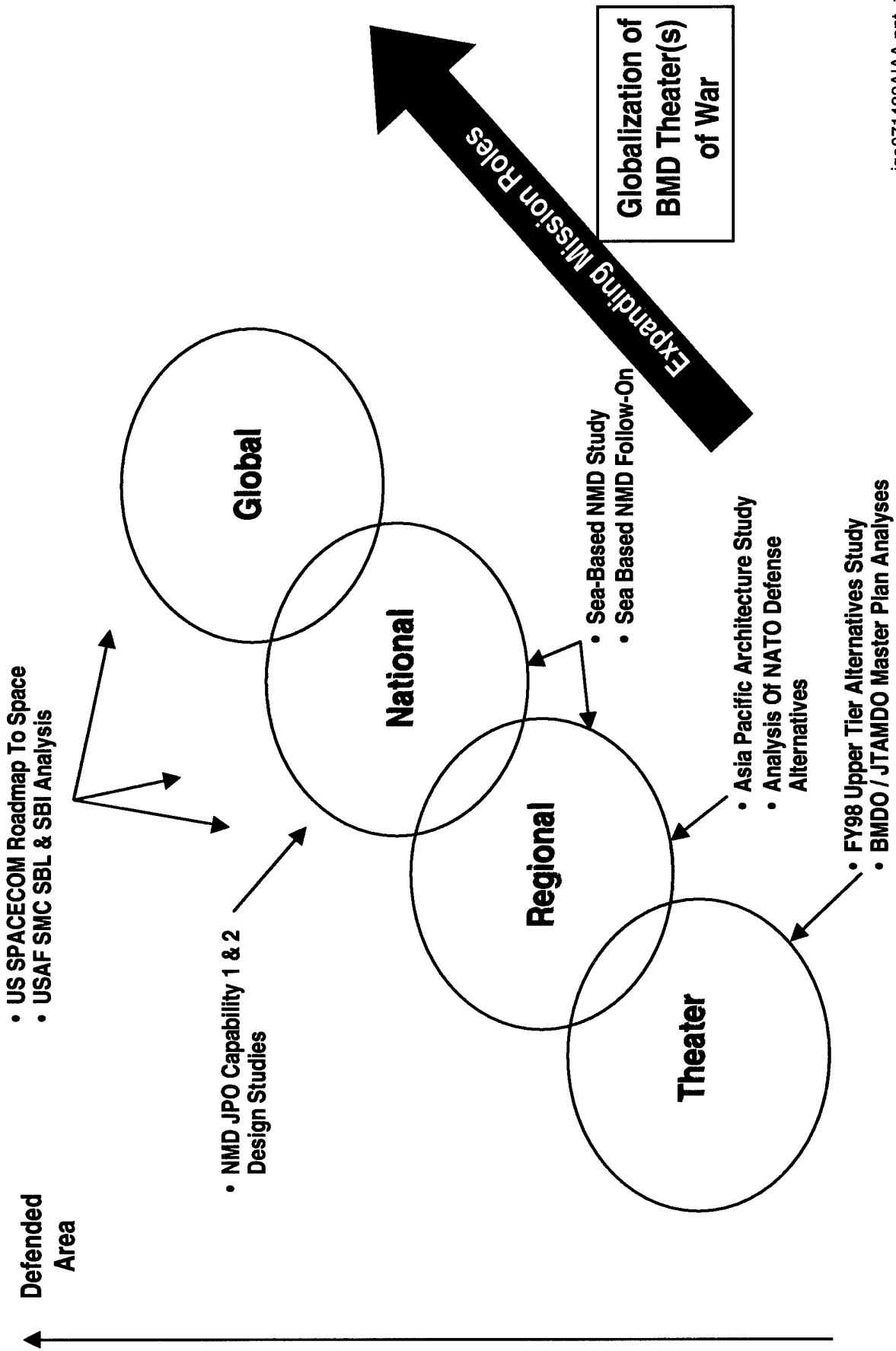


Questions To Be Addressed

- In response to the proliferation of longer range missiles to multiple regions...
 - What are the most cost-effective overall BMD system architecture alternatives?
 - For specific mission roles within the overall BMD system architectures, what are the most cost-effective alternatives:
 - Space-based weapons (SBL, SBI) versus enhanced ground-based NMD?
 - Enhanced/expanded ground-based NMD versus sea-based NMD adjuncts?
 - Land- versus sea-based regional defenses and NMD adjuncts?
 - Current dual TMD upper tier versus one upper tier or NTW with common land-based?
 - Accelerate/enhance TMD upper tier versus expand lower tier inventory?

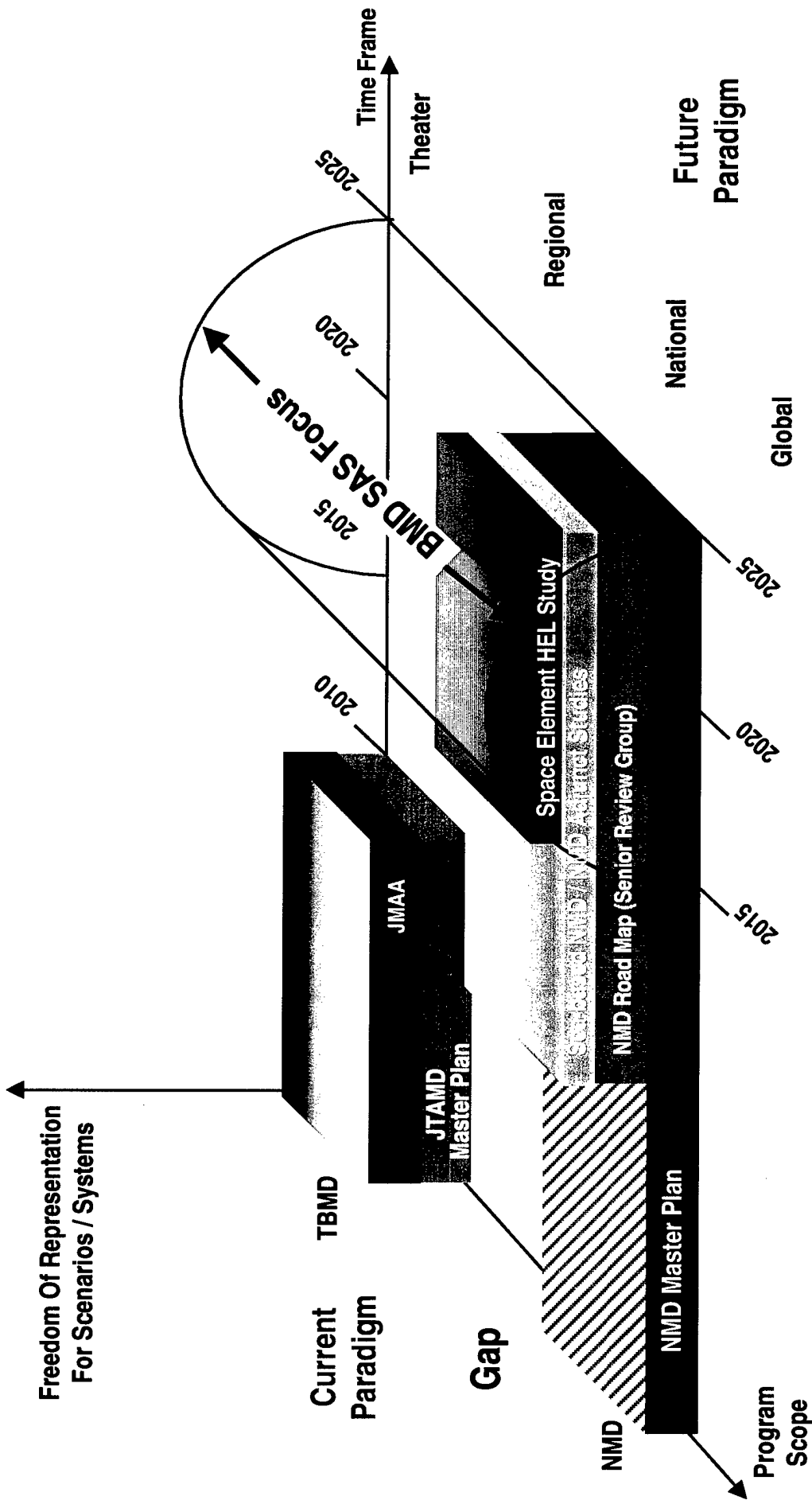
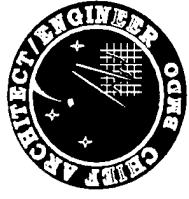


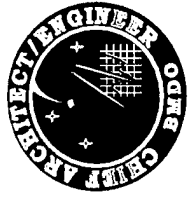
BMD SAS Leverages Previous And On-going Studies





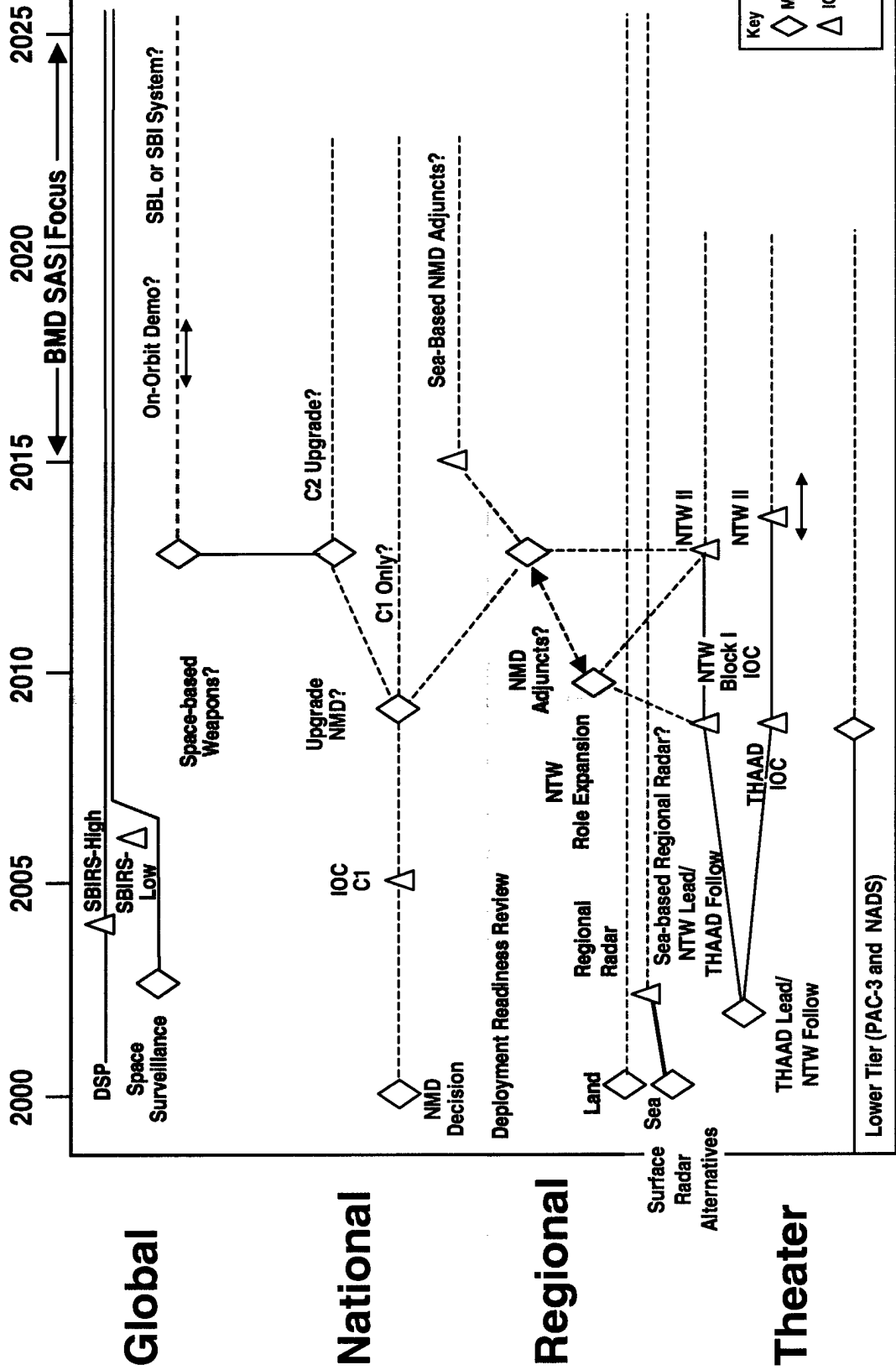
BMD SAS Scope Relative To Ongoing NMD and TMD Studies

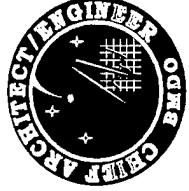
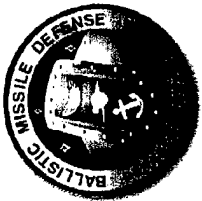




Potential BMD Architecture Decision Branches

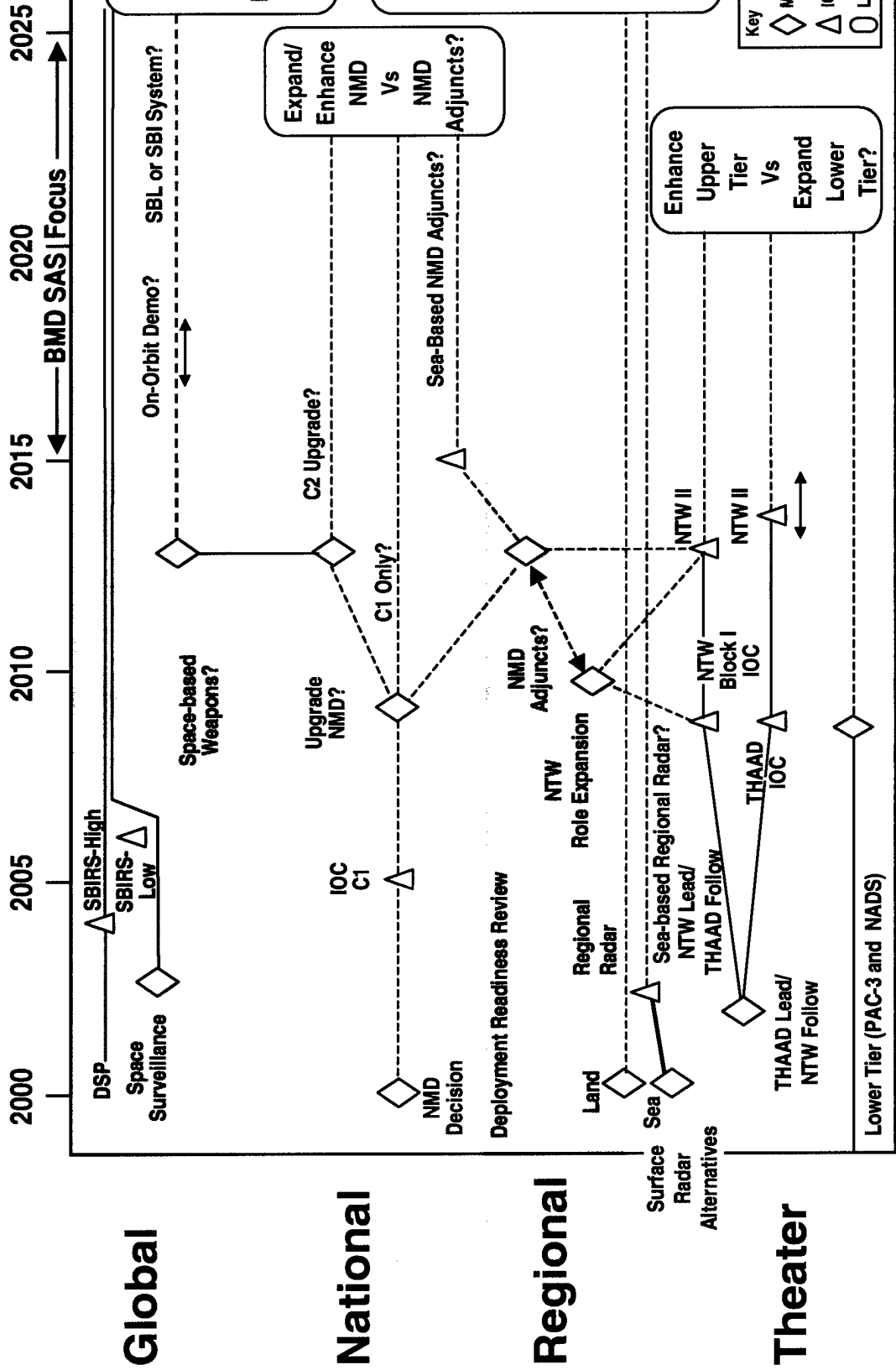
Representative Decision Points and Timelines





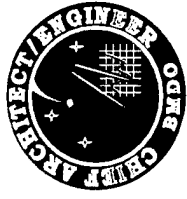
Potential BMD Architecture Decision Branches

Representative Decision Points and Timelines

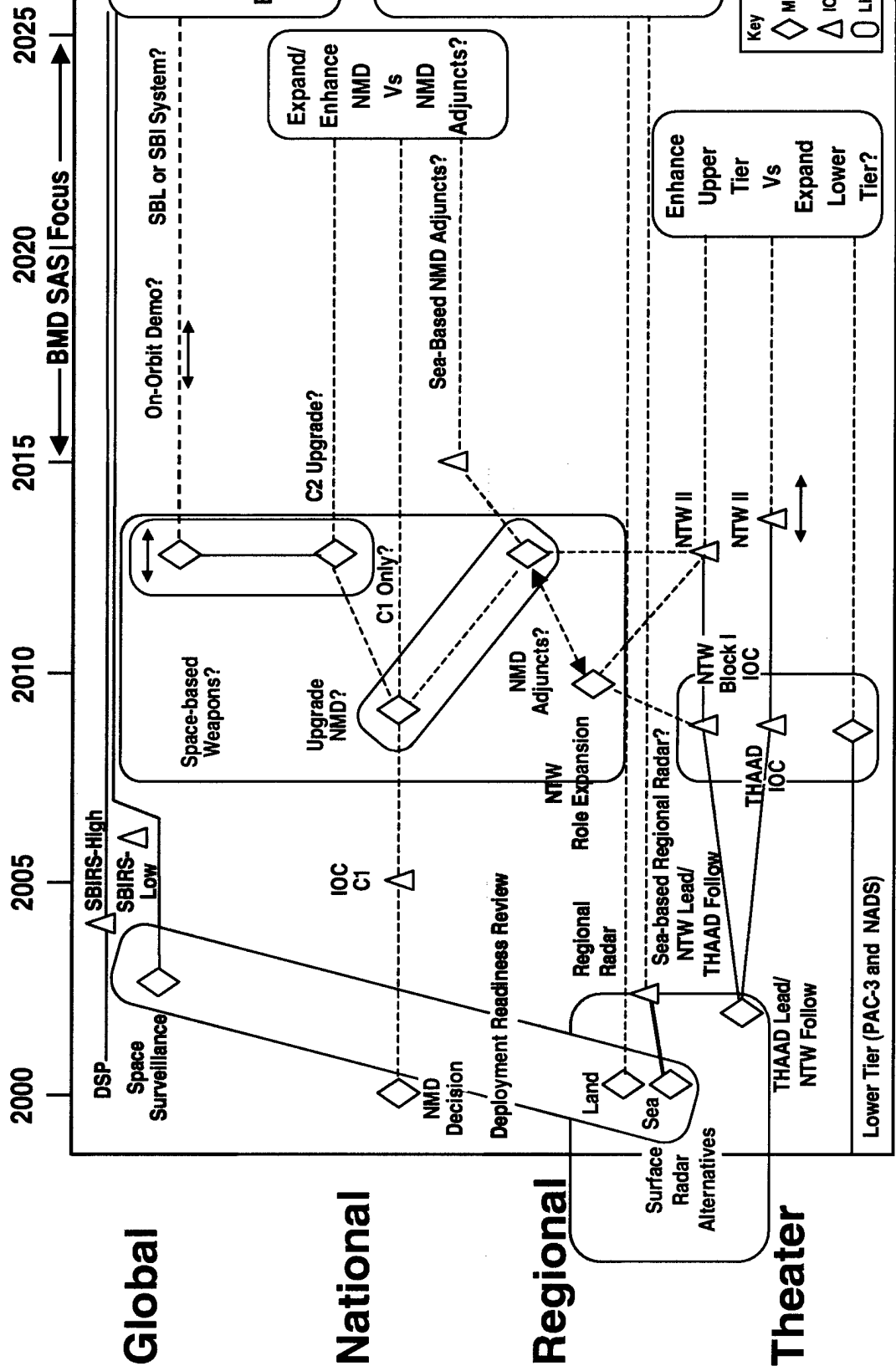




Potential BMD Architecture Decision Branches



Representative Decision Points and Timelines





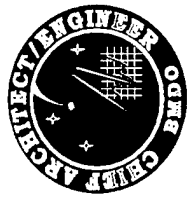
Candidate Architecture Options - Iteration 1



- **Global**
 - **Space Based Elements**
 - Space Based Infrared Sensor Systems - High & Low
 - Space Based Lasers
 - Space Based Interceptors
- **National**
 - **National Missile Defense**
 - Capability 1 (2005)
 - Capability 2 (2010)
 - **Sea-Based NMD Adjuncts**
- **Regional (substantial footprint of defended area per system)**
 - **Interoperability Modes**
 - **Family Of Systems TMD-GBR (Detached)**
 - **Upper Tier Program Alternatives**
 - THAAD Leads / NTW Block II Follows
 - NTW Block I Leads / THAAD Follows
 - NTW Block I Leads / Block II And Common Land-Based Follow
 - **Air Borne Laser - Nominal Program**
- **Theater (small footprint of defended area per system)**
 - **Lower Tiers**
 - Current PAC-3 & NADS Programs



BMD System Architecture Study Products



- **Inputs to architecture investment strategy**
 - **Considering cost-constrained and funding alternatives**
 - **Measuring performance across a spectrum of regional and global scenarios**
- **Used to derive system needs**
 - **For technology**
 - **Test infrastructure**
 - **Affordability**