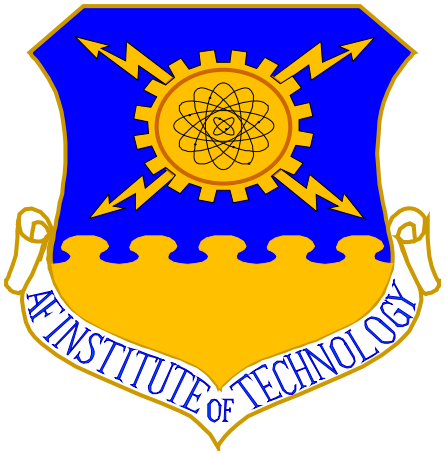
*The Intellectual and Leadership Center of the Air Force*



# Center for Operational Analysis

*We make a difference…*

*one student at a time*

**Lt Col Stephen Chambal, PhD**
**Dr. Jeffery Cochran, AFIT/ENS**

# Overview



- Center for Operational Analysis
- Decision Analysis in the Department of Defense
- Brief look at Value Focused Thinking
- Defense Examples
  - JIEDDO
  - HLS
  - EOD
  - NRO
- Q&A

# Center for Operational Analysis



## Vision

To be operationally relevant by providing conduit for leading edge research which directly impacts the Air Force, DoD, and the National Security Structure of the United States

## Mission

Build truly collaborative relationships with operational sponsors to achieve the Center Vision and support the Center Goals

# Decision Analysis



- Budget and prioritization
  - "Rack and Stack"
  - At all levels – from unit to DoD
  - Number one use
  - Justification and defense
- Portfolio Management
  - Project funding, prioritization, and management
  - Multiple on ramps/off ramps, integration across acquisition
- Risk and uncertainty
  - Understanding impacts on operations, programming, and budget implications

# Versions of VFT



- Value focused thinking
  - Wide spread use across the AF and DoD
  - Implemented with various success
  - Driven by changes in requirements process
    - Capability based acquisition process
- Air Force Analysis Capabilities
  - Scientific analytical community
    - At all levels – advanced education – Air Force Institute of Technology
  - Organic within A9 structure
  - Supported via defense contracting

# Values Focused Thinking



Decision Situation

**Alternative-Focused Thinking (AFT)**

What Alternatives Are Available?

then

⇩

What Do We Like About Them?

**Value-Focused Thinking (VFT)**

What do We Value?

then

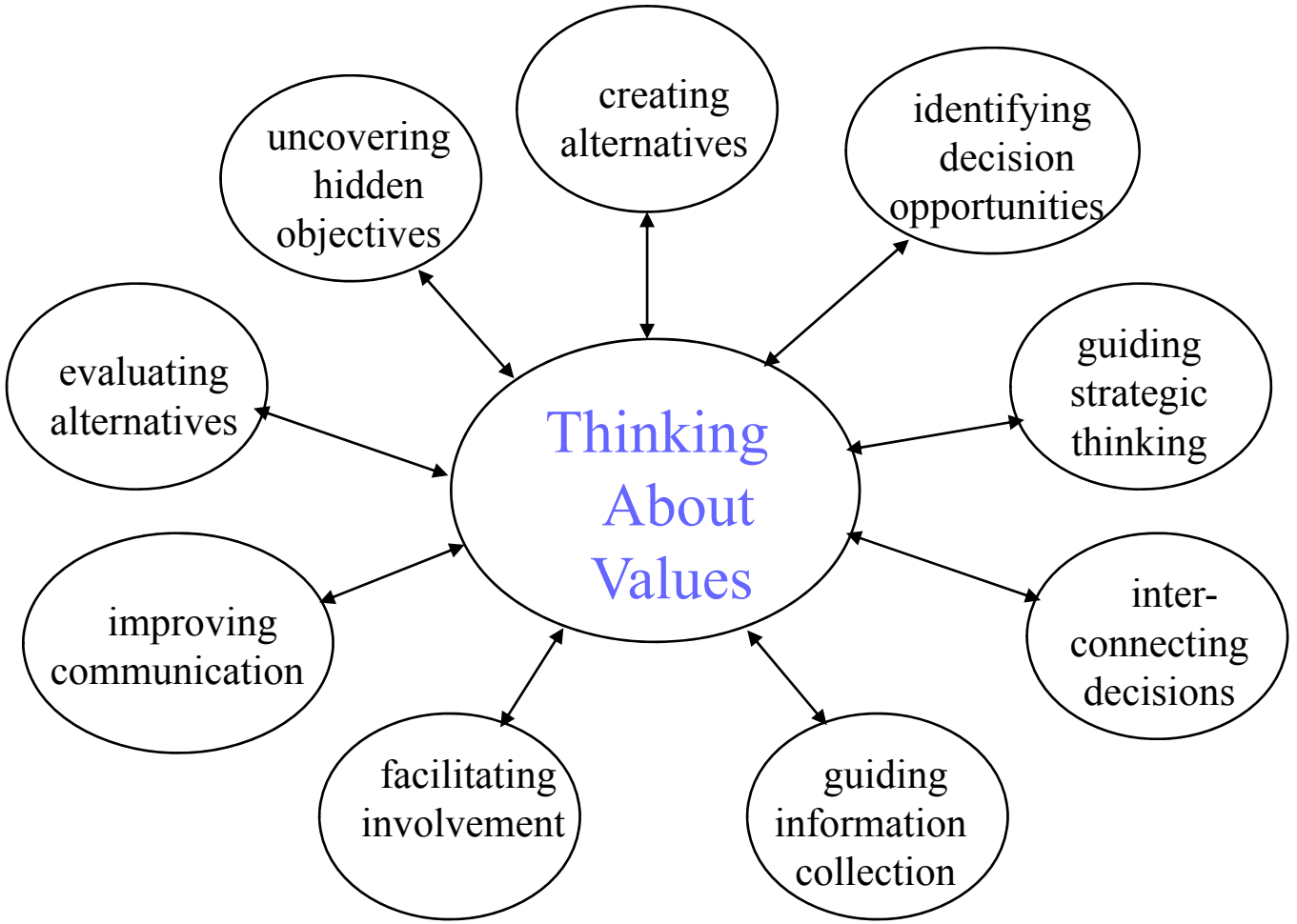
⇩

What Alternatives Satisfy Our Values?

**Ask not what your alternatives can do for you, but ask first what you want from your alternatives.**

# Benefits of VFT

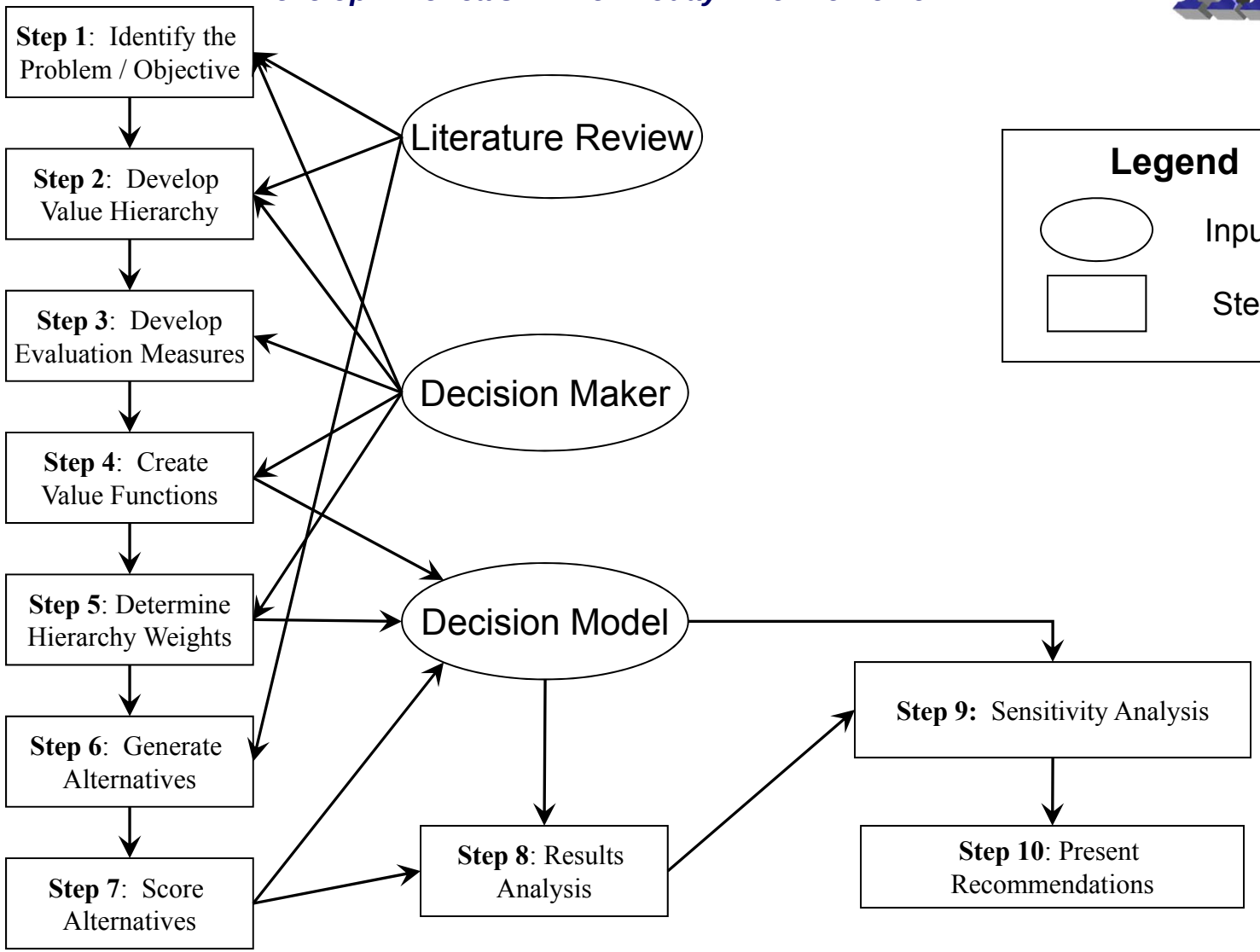





Keeney, Ralph L., Value Focused Thinking: A Path To Creative Decision Making, Harvard University Press, Cambridge, MA, 1992, pp.. 3-28.

# VFT Ten-Step Process

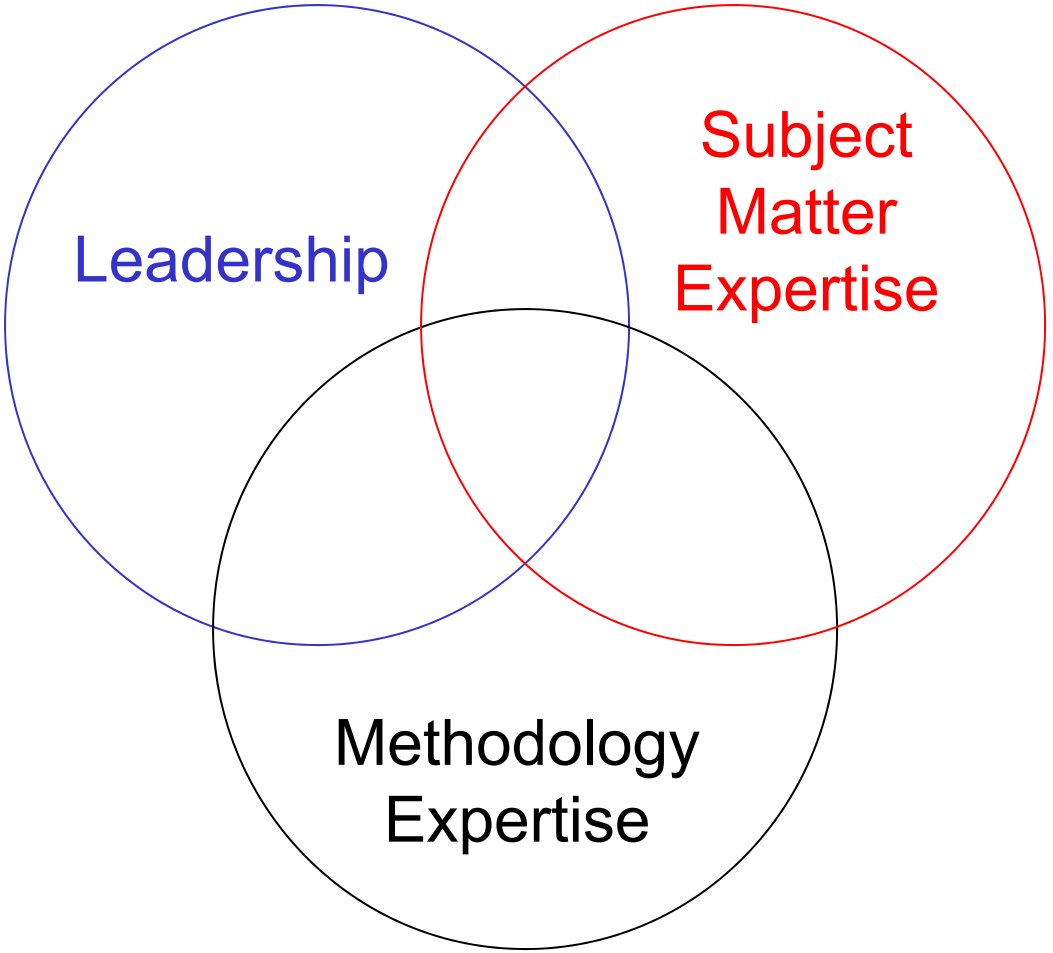




# VFT Components



Support
Guidance
Insight
Resources




Knowledge
Experience
Insight
Credibility

Tools, Analysis, Rigor, Defensibility

# Decision Analysis



- Department of Defense Examples
- JIEDDO – Joint IED Defeat Organization
  - More detailed briefing tomorrow with Dr. Jeff Weir
- HLS – Homeland Security
  - AFIT sponsored research
- EOD – Explosive Ordnance Disposal
  - JSEOD Capability Based Value Modeling
- NRO – National Reconnaissance Office
  - Briefed at the Director CIA/Congressional level

# DEVELOPING A DECISION ANALYSIS MODEL FOR JOINT IMPROVISED EXPLOSIVE DEVICE DEFEAT ORGANIZATION (JIEDDO) PROPOSAL SELECTION


Maj Lyle Dawley
Maj Lenore Marentette
Capt Marie Long

2 June 2008

# IEDs


- Primary source of US and coalition casualties
- Wide variety of devices
  - Fuse, explosive fill, detonator and power supply, and a container
- Generally difficult to detect and protect against

# JIEDDO Background


## JIEDDO Mission

To focus (lead, advocate, coordinate) all DoD actions in support of COCOMs and their respective JTFs' efforts to defeat IEDs as weapons of strategic influence.

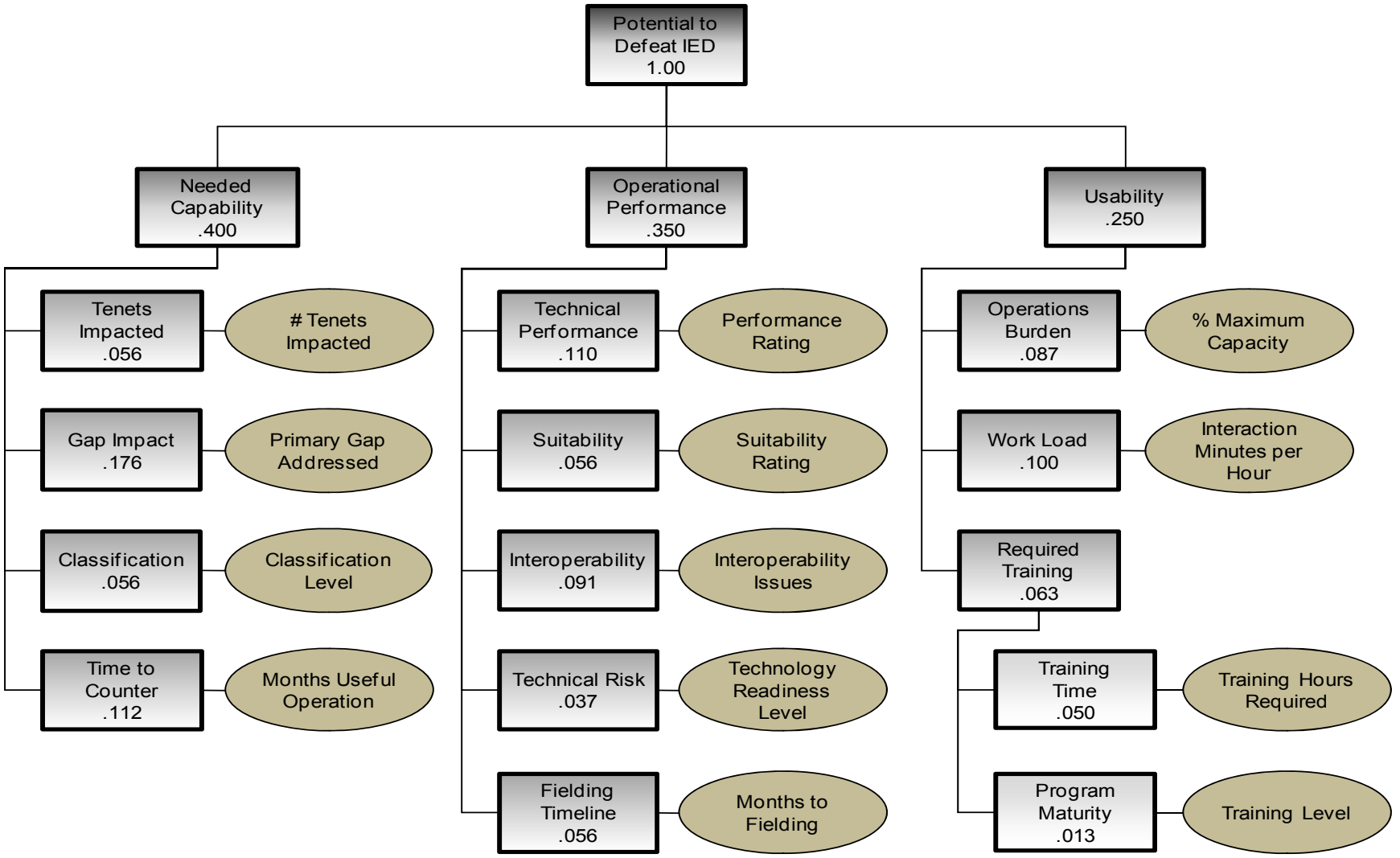
- DODD 2000.19E

# JIEDDO's Process


- Joint IED Defeat Capability Approval and Acquisition Management Process (JCAAMP)
- Broad Area Announcement (BAA)
- BAA Information Delivery System (BIDS)
- Extremely large budget ($4.37B)
- Enables **traceable, repeatable,** and **defensible** selection decisions

# Decision Analysis Model

## Global Weighting



# Conclusions


- Decision model closely matches current selection decisions
- Portable for use in later stages of JCAAMP process
- Provides traceable, repeatable and defensible scoring of competing JIEDDO proposals to aid decision process

# Air Education and Training Command

***Replenishing the Combat Capability of America's Air Force***


U.S. AIR FORCE

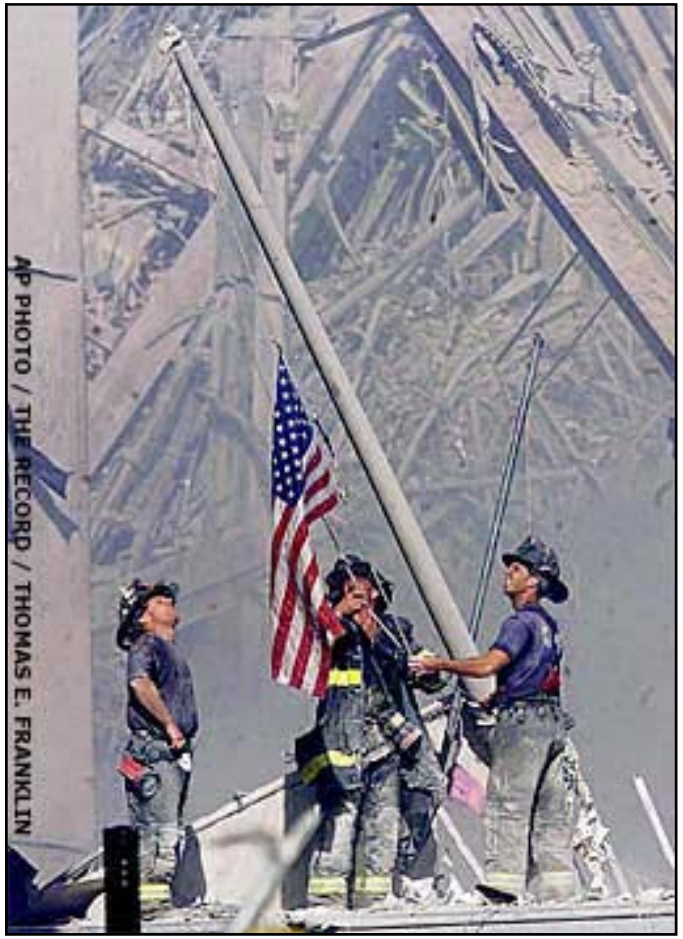
## Modeling Homeland Security: A Value Focused Thinking Approach

**Pruitt, Chambal, Deckro**

***Integrity - Service - Excellence***

# Problem Statement

- Provide Federal level homeland security decision-makers with a decision support structure to leverage in the development and evaluation of alternative homeland security strategies.

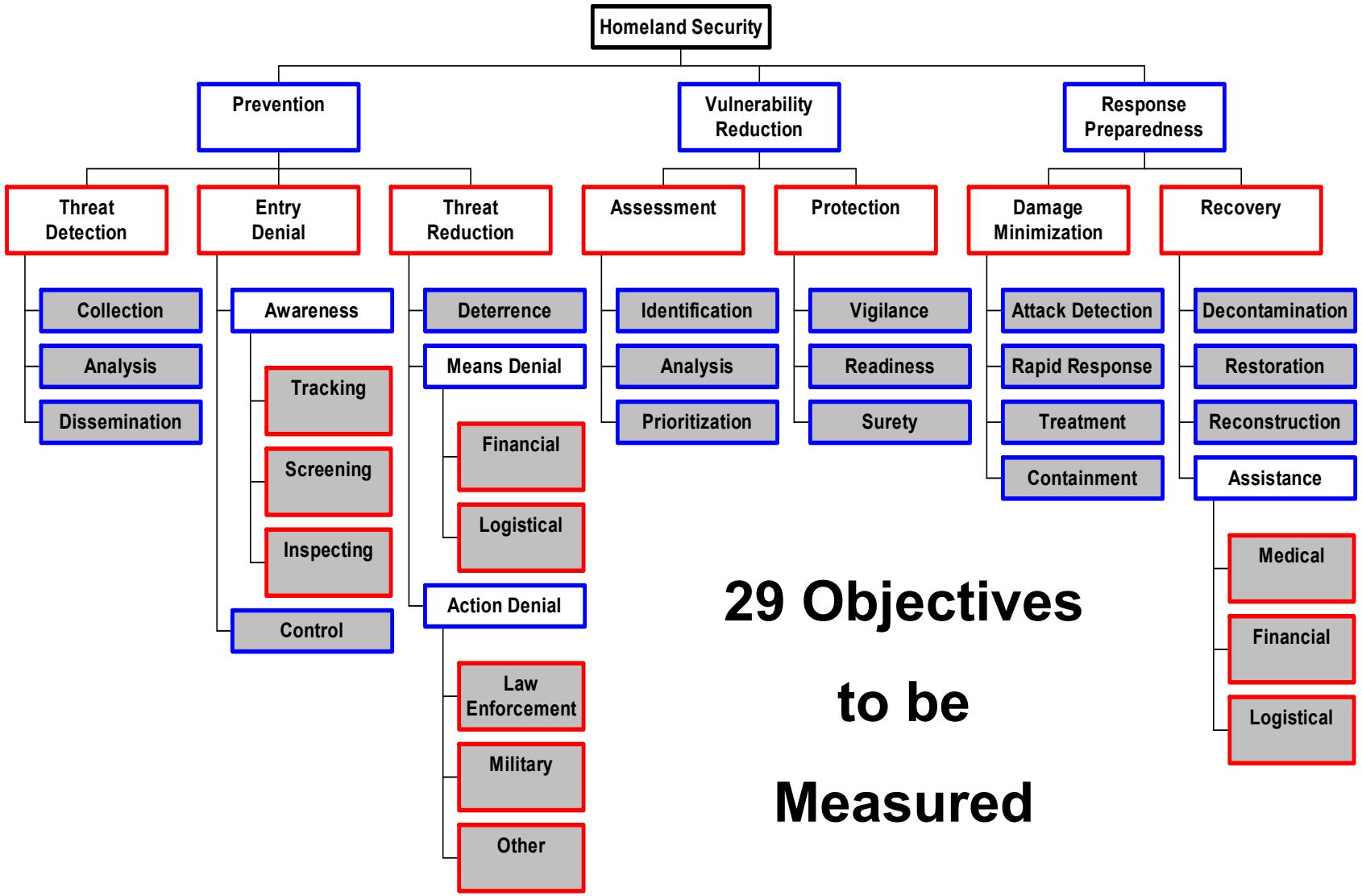


# Model for Homeland Security

- Homeland security decision-makers must balance security, resource costs, and civil liberties

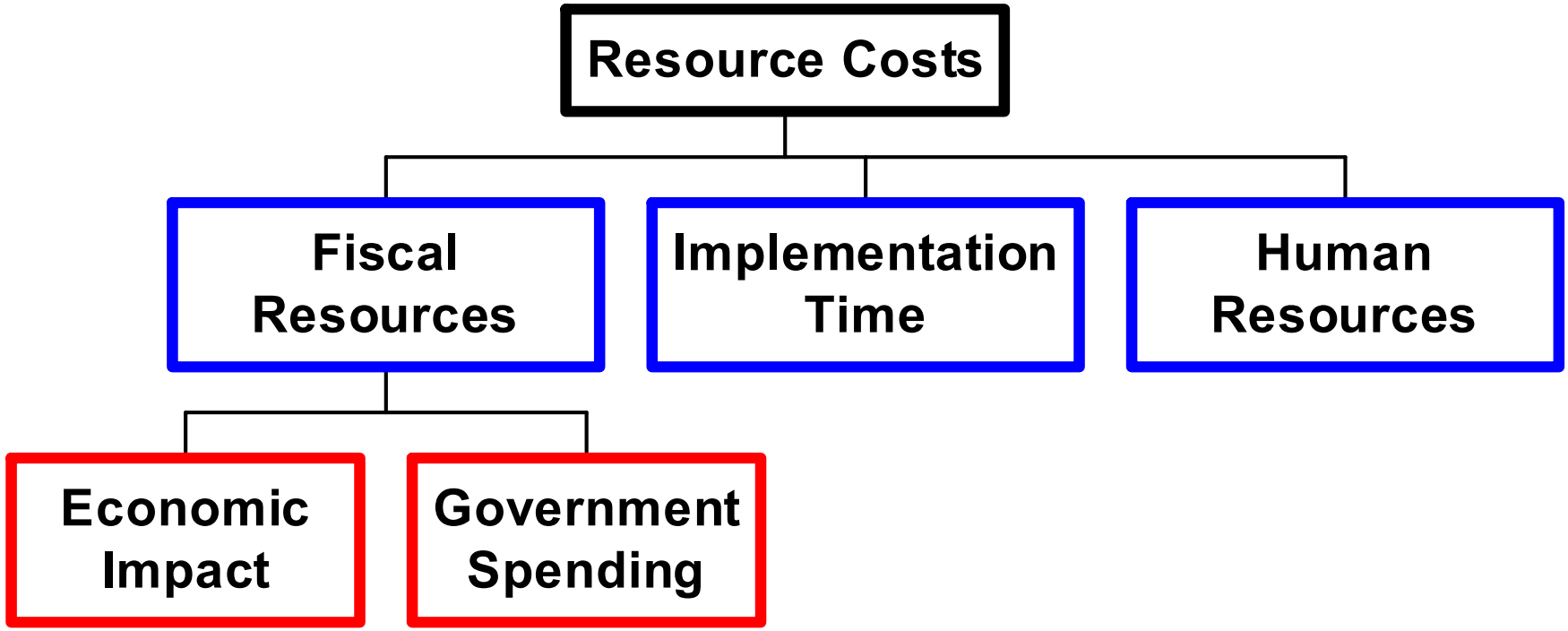
- This study accounts for these tradeoffs through the utilization of **three distinct value hierarchies**
  - Security
  - Resource Costs
  - Civil Liberties

# Security Hierarchy

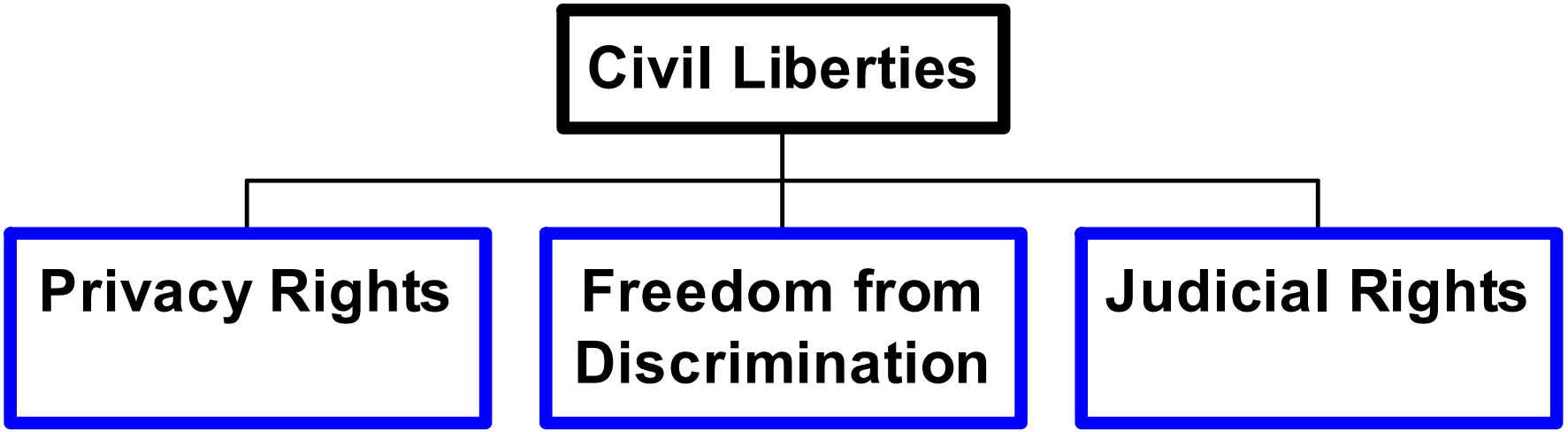



**29 Objectives to be Measured**

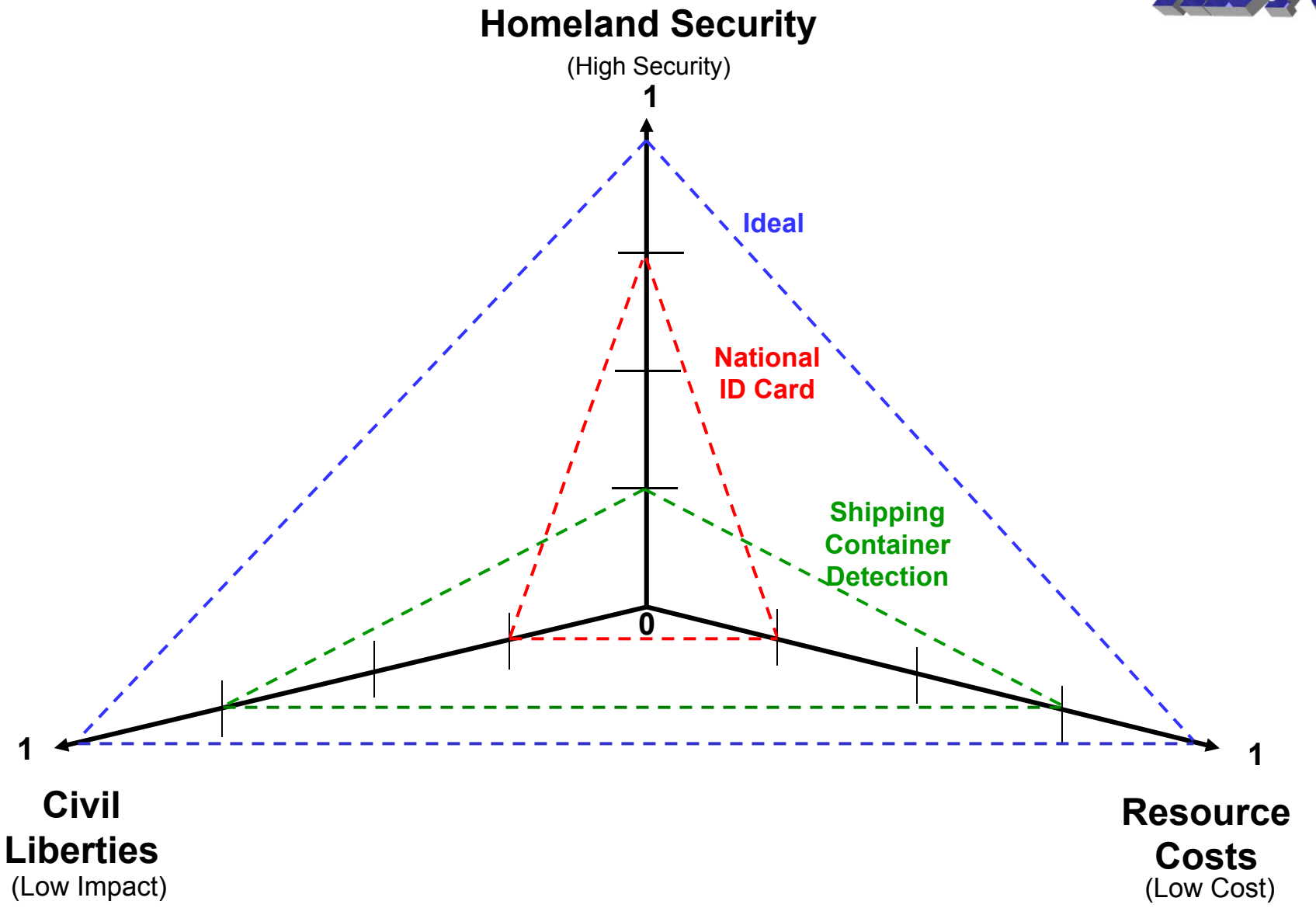
# Resource Costs Hierarchy



# Civil Liberties Hierarchy



# Example Application



# Conclusions

- Homeland security will remain of imminent concern
- Value hierarchies provide insight to the development of effective strategy
- Provides a foundation for the Federal government to leverage in efforts to secure the homeland

# MTAB Role in Establishing Requirements Using CBVM

# Weighted Hierarchy

| EOD AMA Matrix | | | Operational Tasks | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Detect/ Locate | Access | Diagnose | Render Safe/ Neutralize | Recover | Exploit | Dispose |
| Functional Areas | 5 | Buried Munitions | 25 | 5 | 30 | 25 | 5 | N/A | 10 |
| | 22 | Surface Munitions | 14 | 16 | 30 | 25 | 4 | 4 | 7 |
| | 15 | Underwater Munitions | 30 | 15 | 15 | 25 | 10 | N/A | 5 |
| | 30 | IEDs | 15 | 20 | 27 | 23 | 5 | 9 | 1 |
| | 14 | Chemical Munitions/WMD | 15 | 20 | 27 | 23 | 5 | 10 | N/A |
| | 3 | Biological Munitions/WMD | 15 | 20 | 27 | 23 | 5 | 10 | N/A |
| | 11 | Nuclear Munitions/WMD | 15 | 20 | 27 | 23 | 5 | 10 | N/A |

# Prioritized Capabilities
## *(Top 10)*

| Rank | Functional Area | Operational Task | Global Weight | Cumulative Weight |
|---|---|---|---|---|
| **1** | **IEDs** | **Diagnose** | **8.10** | **8.10** |
| **2** | **IEDs** | **Render Safe/Neutralize** | **6.90** | **15.00** |
| **3** | **Surface Munitions** | **Diagnose** | **6.60** | **21.60** |
| **4** | **IEDs** | **Access** | **6.00** | **27.60** |
| **5** | **Surface Munitions** | **Render Safe/Neutralize** | **5.50** | **33.10** |
| **6** | **Underwater Munitions** | **Detect/Locate** | **4.50** | **37.60** |
| **7** | **IEDs** | **Detect/Locate** | **4.50** | **42.10** |
| **8** | **Chemical Munitions** | **Diagnose** | **3.78** | **45.88** |
| **9** | **Underwater Munitions** | **Render Safe/Neutralize** | **3.75** | **49.63** |
| **10** | **Surface Munitions** | **Access** | **3.52** | **53.15** |

# Metric & Value Function

*Value Functions*

*Metric*

## Detect/Locate Buried Munitions

| | |
|---|---|
| Level 1 (0) | Cannot detect, in any physical environment, metallic or non-metallic buried munitions |
| Level 2 (5) | Can detect, in good physical conditions, minimal metallic munitions up to 1ft deep |
| Level 3 (20) | Can detect, in good physical conditions, some metallic munitions up to 1ft deep and minimal up to 3 ft deep |
| Level 4 (40) | Can detect, in good physical conditions, most metallic munitions up to 1ft deep, some up to 3 ft deep, and minimal up to 6 ft deep |
| Level 5 (70) | Can detect, in good physical conditions, most metallic munitions up to 3 ft deep, some up to 6 ft deep, minimal up to 10 ft deep, and ***minimal non-metallic up to 1 ft deep*** |
| Level 6 (85) | Can detect, in good physical conditions, most metallic munitions up to 6 ft deep, some up to 10 ft deep, minimal up to 25 ft deep, and some non-metallic up to 1 ft deep and minimal up to 3 ft deep |
| Level 7 (100) | Can detect, in good physical conditions, most metallic munitions up to 10 ft deep, some up to 25 ft deep, minimal greater than 25 ft deep, and most non-metallic up to 1 ft deep, some up to 3 ft deep, and minimal up to 6 ft deep |

Jump

**"Sweet spot"**

# Scoring Capabilities[5] Worksheet

**Buried Munitions:**
**Detect/Locate:** There is not a requirement to go beyond 25 ft
Minimal - Less than 50%, Some - Between 50% and 75%, Most - More than 75%
Good physical conditions - Low level of obscurants, good visibility, fair to good soil conditions, no NBC hazards

| | |
|---|---|
| Level 1 | Cannot detect, in any physical environment, metallic or non-metallic buried munitions |
| Level 2 | Can detect, in good physical conditions, minimal metallic munitions up to 1ft deep |
| Level 3 | Can detect, in good physical conditions, some metallic munitions up to 1ft deep and minimal up to 3 ft deep |
| Level 4 | Can detect, in good physical conditions, most metallic munitions up to 1ft deep, some up to 3 ft deep, and minimal up to 6 ft deep |
| Level 5 | Can detect, in good physical conditions, most metallic munitions up to 3 ft deep, some up to 6 ft deep, minimal up to 10 ft deep, and minimal non-metallic up to 1 ft deep |
| Level 6 | Can detect, in good physical conditions, most metallic munitions up to 6 ft deep, some up to 10 ft deep, minimal up to 25 ft deep, and some non-metallic up to 1 ft deep and minimal up to 3 ft deep |
| Level 7 | Can detect, in good physical conditions, most metallic munitions up to 10 ft deep, some up to 25 ft deep, minimal greater than 25 ft deep, and most non-metallic up to 1 ft deep, some up to 3 ft deep, and minimal up to 6 ft deep |

**Capability Levels**

**Current** _____ **1-yr** _____ **3-yr** _____ **5-yr** _____

**Justification for capability scoring for family of systems for JEOD community.**

# Final Recommendations

- Approach to Augment Current AMA Process
  - Use CBVM to determine capabilities gaps/shortfall prioritization for resource allocation
  - Evaluate progress towards closing capability gaps
- Review mission area ranking
- Review EOD Capability Information
  - Current, 1yr, 3yr, 5yr by mission area
- Identify impact on prioritized capability gaps
  - Input new scoring data based on proposed initiatives
- Identify impact to changes in budget allocation
- Evaluate 5-year roadmap based on impacting/reducing high-priority capability gaps

# Implementation

- Institutionalize CBVM into processes
  - Update weighting and scoring periodically
  - Continue to improve metric definition
- Standardized terminology/support structure
  - Maintain FA/OT definition and structure
  - Ensure consistent higher-level groupings across JEOD community
- Linking across all program areas
  - Create database for all ongoing notional concepts
  - Maintain info on initiatives being funded externally
  - Single source for info regarding capabilities, research and development, and acquisition

# Investing in the Future

## Using Decision Analysis to Simplify the Complex Evaluation of Future Space Systems

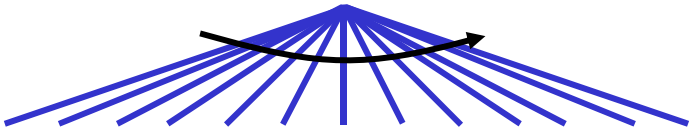
# Problem

- Develop a first-class NRO architecture vision and investment strategy that best satisfies user needs across the Intelligence Community and National Security space domain.
- Provide the NRO a defensible and repeatable investment planning process to produce Planning, Programming and Budgeting recommendations traceable to User Needs and Strategic Guidance.

# Intelligence Value Hierarchy

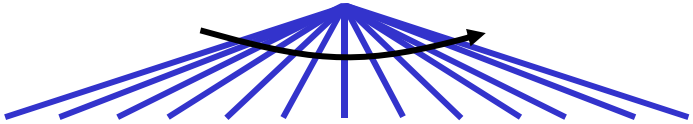
## Overall NRO Benefit

**Intel Value**



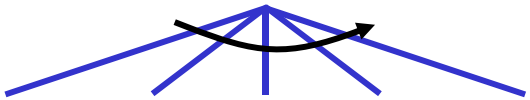
**What Intelligence Problems should drive future architectures?**

**Intel Problems**



**What are the driving information needs for each problem?**

**Core Information Needs**



**What kinds of capabilities are required in each discipline?**

**Critical Capabilities**

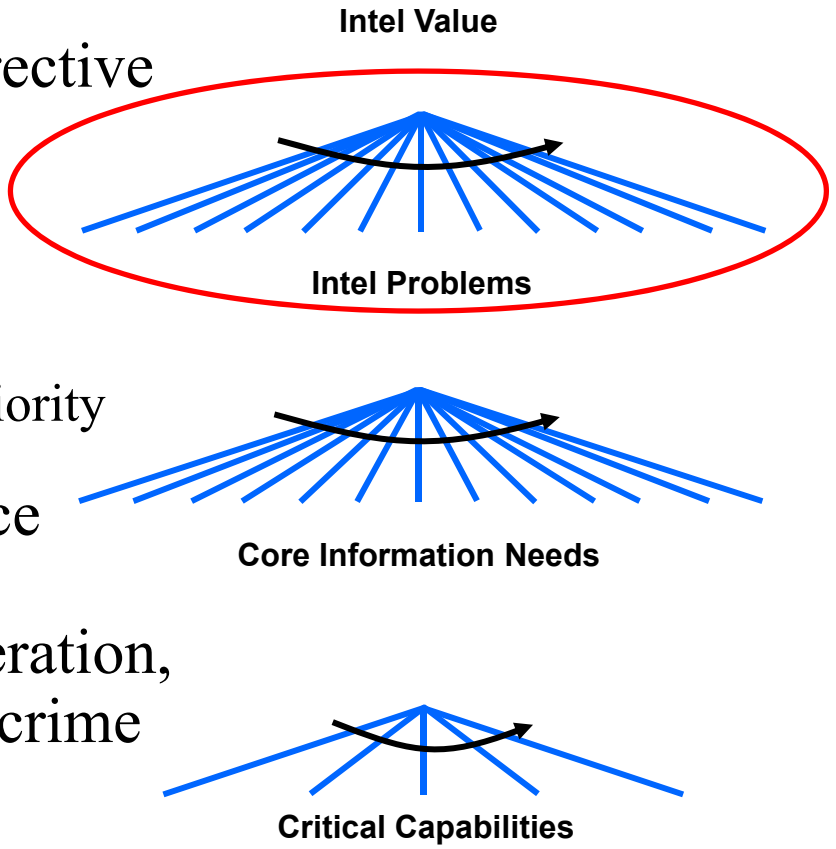
| CC-01 | CC-02 | CC-03 | CC-04 | CC-05 |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | Metric definitions and scales. | | | |
| | | | | |
| | | | | |

**How well does the architecture provide the critical capabilities?**

| Value | Score |
|---|---|
| 100 | 5 |
| 80 | 4 |
| 50 | 3 |
| 20 | 2 |
| 0 | 1 |

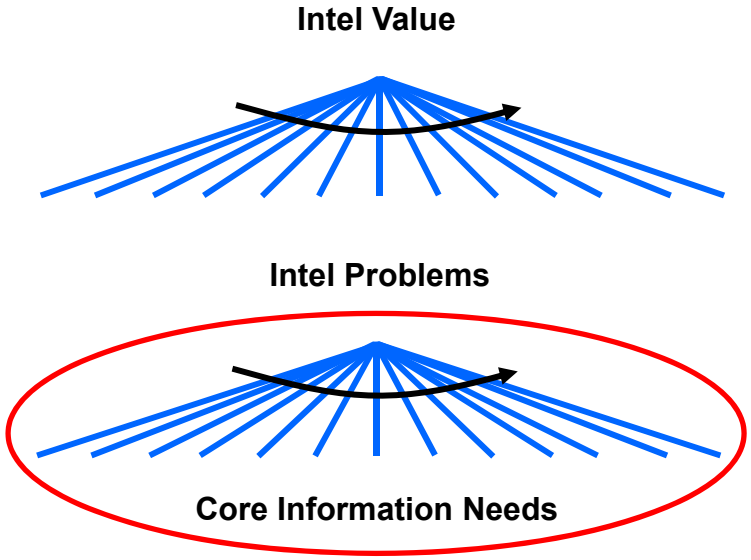
# Top Level Guidance

- National Security Presidential Directive (NSPD) – 26
- List of 30 Intelligence Topics of interest to the U.S.
  - Divided in to 3 bands of differing priority
- Covers a wide range of intelligence subjects important to U.S. efforts against terrorism, weapons proliferation, military aggression, international crime and human rights abuse.
- Incorporates insight from Defense Planning Guide and DCI Guidance

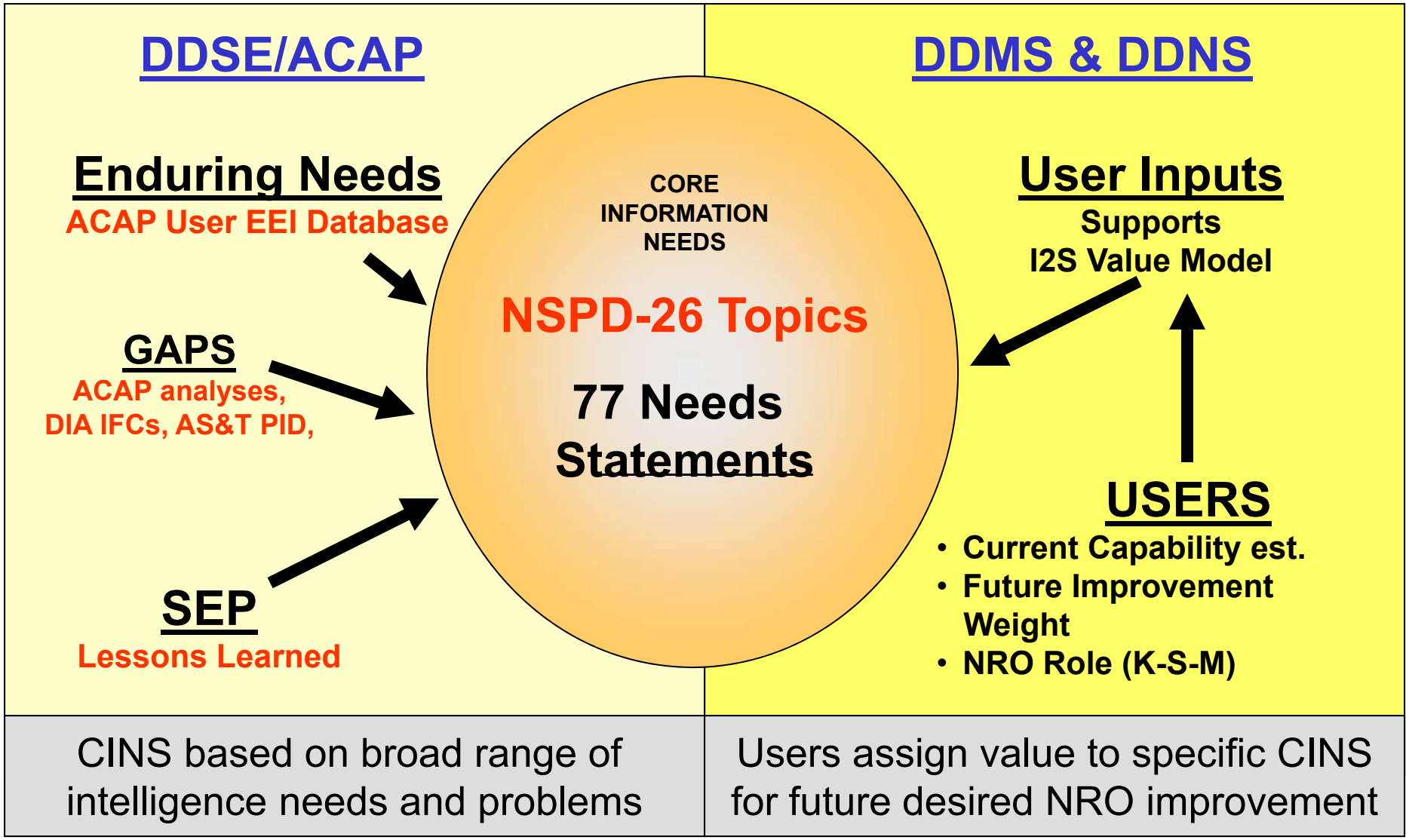


# User Requirements

**Overall NRO Benefit**



# CORE INFORMATION NEEDS

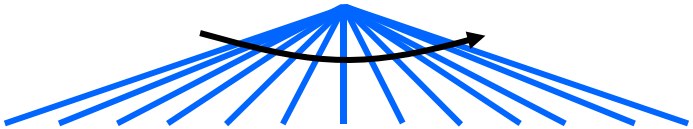



★ = CHANGES

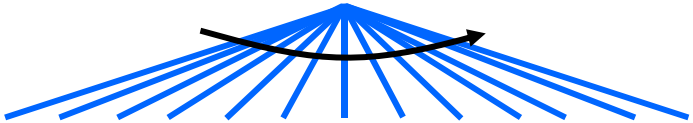
# Top Level Value Hierarchy

**Overall NRO Benefit**

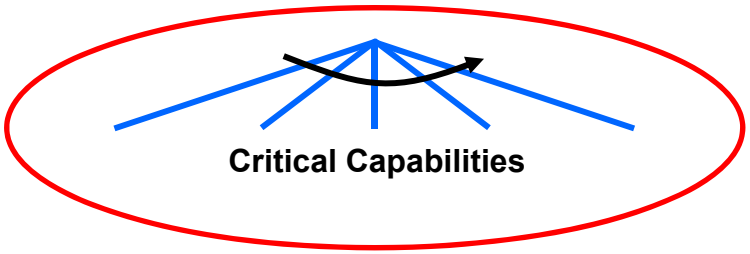
**Intel Value**



**Intel Problems**



**Core Information Needs**



# Metrics (Critical Capabilities)

Identifies Critical Capabilities required to attain Core Information Needs (CINs). Assigns a 7 level scale for measuring level of achievement. Then assigns a value to each level of achievement.

| Critical Capability | Definition | Level | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| | | Value | 0 | 10 | 25 | 50 | 75 | 90 | 100 |
| | | Metric | | | | | | | |
| Resolution | The ability of an optical sensor to discriminate objects or features of increasing smaller dimensions. | Metric | 1000sq Meters | 500sq Meters | 100sq Meters | 50sq Meters | 25sq Meters | 10sq Meters | 1sq Meters |

This is the final step that transforms a large, complex, often subjective decision into a precise, simple, objective decision.

# Approving Chain

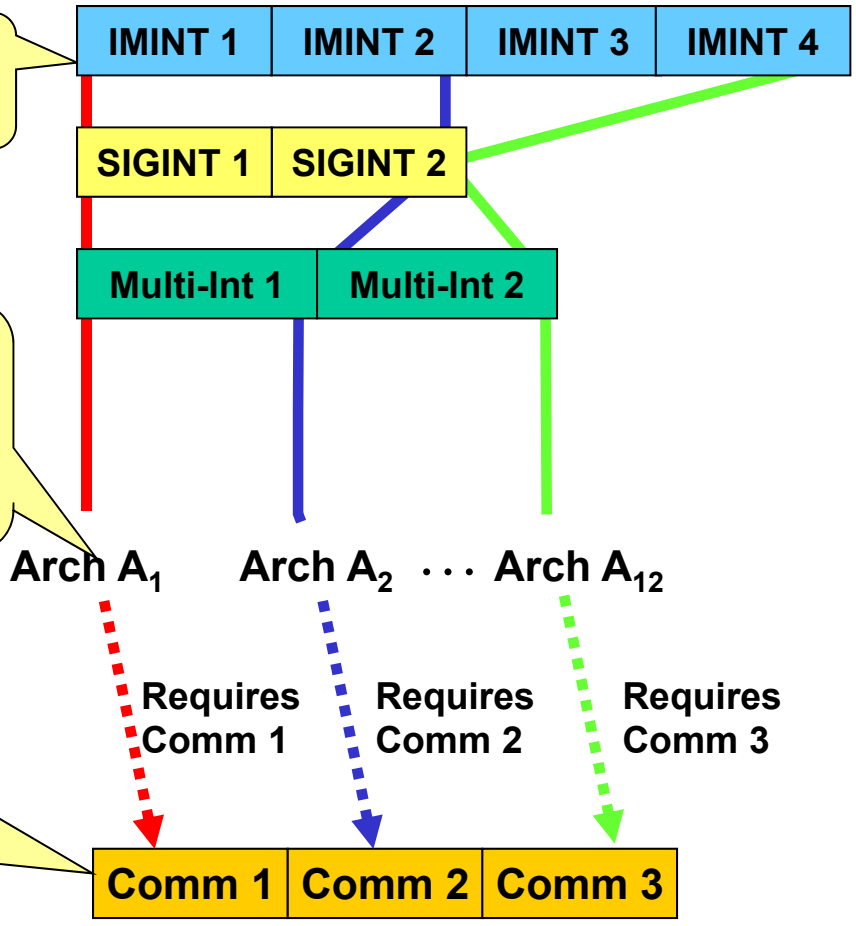
- SEP – System Evaluation Panel
  - Mid-level managers with subject matter expertise. Develop and review benefit scores.
- JSET – Joint System Engineering Team
  - Chief System Engineer from each Directorate. Integrate cost and benefit to produce recommendations (prioritized spending plan) to leadership.
- Change Gang – Directorate Chiefs
  - Review recommendations and make any adjustments for national or IC priorities not captured by process.
- DNRO – Director NRO – Final Approval

# INA - Generating Alternatives

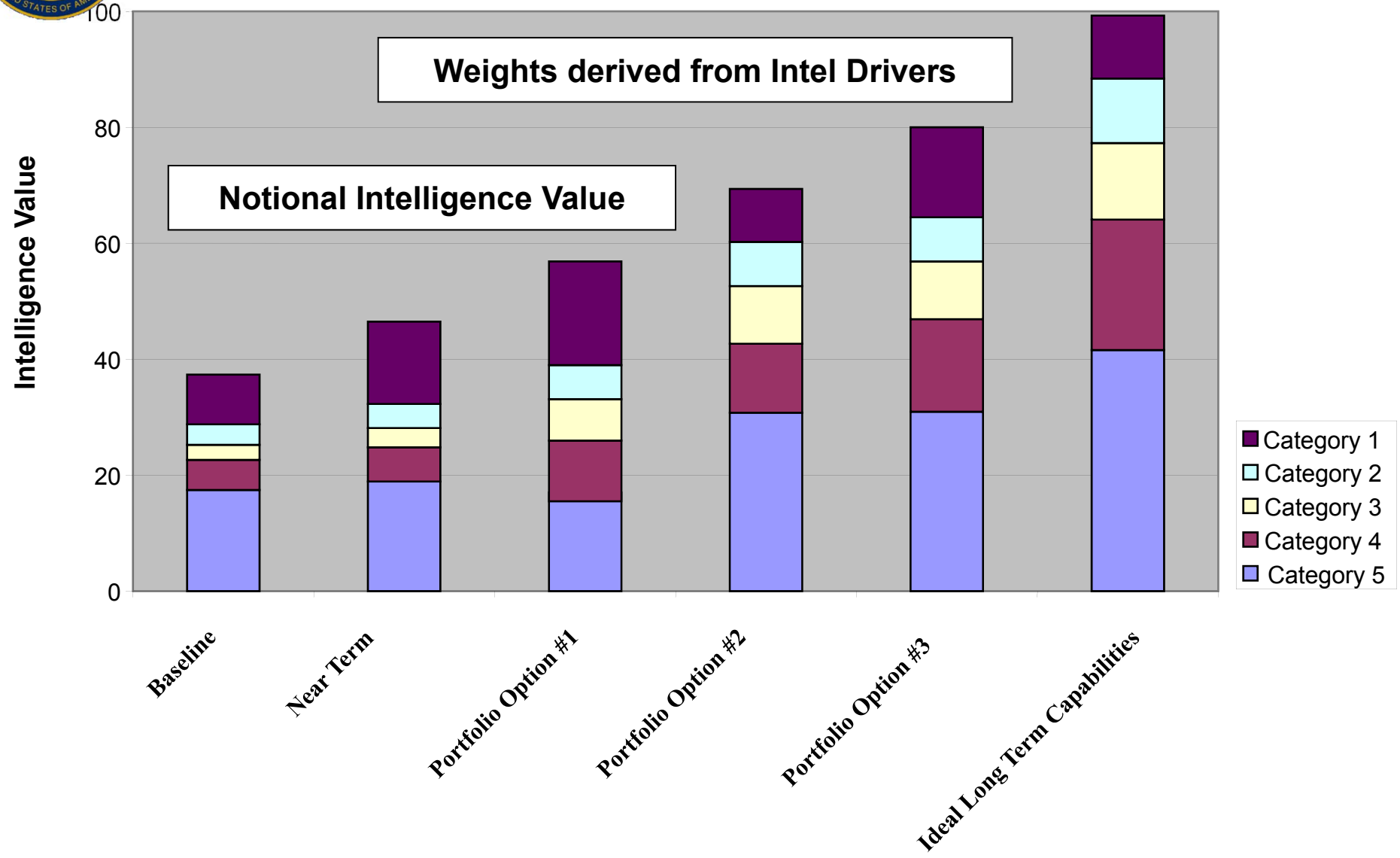
*Domain* alternatives are developed by Directorates.

*Architectural* alternatives are composed by the SEP for scoring. Bare bones & maximum capability architectures are bounding cases.

Pre-defined Comm Alternatives are matched with basic alternatives to treat dependencies.



# Evaluating Alternatives



# NRO Recommended Program

**Order of Buy**

**0. Fact of life, must pay items**

1. Program 1
2. Program 2
3. Program 3
4. Program 4
5. Program 5
6. Program 6
7. Program 7
8. Program 8

**Above Guidance**

9. Program 9
10. Program 10
11. Program 11

# Bottom Line

- The NRO uses **value focused thinking** and **decision analysis** as the foundation of its investment and architecture planning process. This ensures a:
  - Coherent, close link between the NRO vision, Executive Guidance and User needs
  - Capabilities-driven, transparent, objective, decision process
  - Defendable budget with clear links between spending and architecture capabilities
  - Clear budget priority for funding decisions
- DDSE **facilitates** NRO Planning by:
  - Providing the analytical expertise for VFT and DA
  - Organizing the inter-office work and communication