Studying Acquisition Strategy Formulation for Incremental Development

A Case Study Based Approach

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This Research Studies….

- **Incremental Development**
  - **Responsiveness.** Evolutionary acquisition strategies are the preferred approach to satisfying operational needs. ***Incremental* development is the preferred process** for executing such strategies. (DoDD 5000.01)
- **Acquisition Strategy Formulation**
  - Using the Joint Common Missile (JCM) program as a case study
  - Surveys acquisition professional to develop the components of an acquisition strategy for the JCM program
- **How acquisition professionals think**

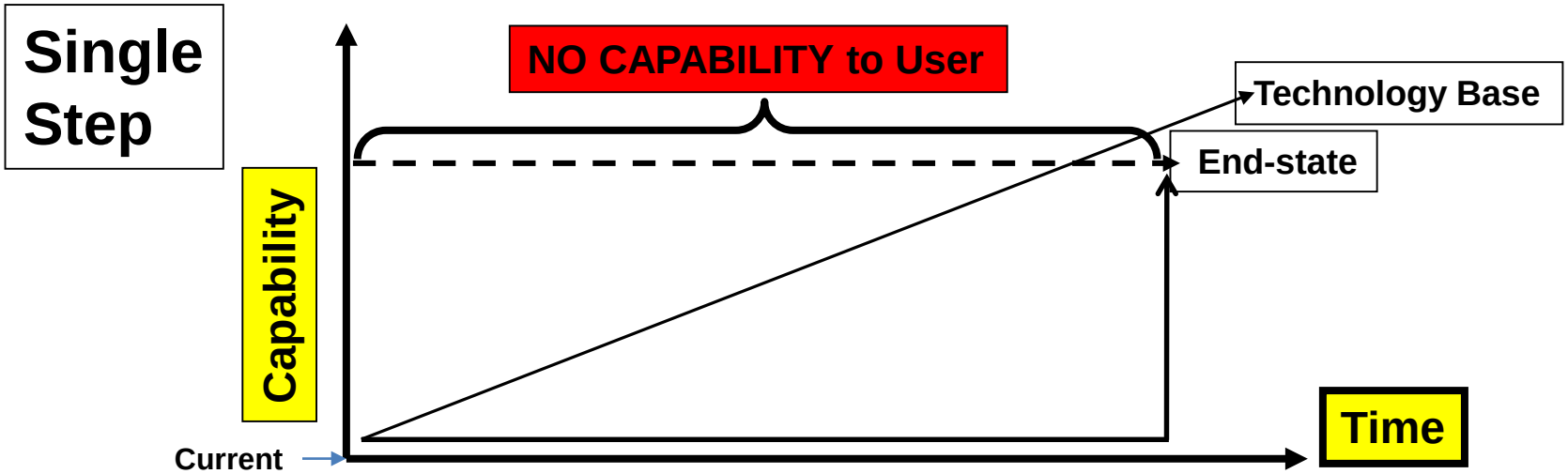
This Research….

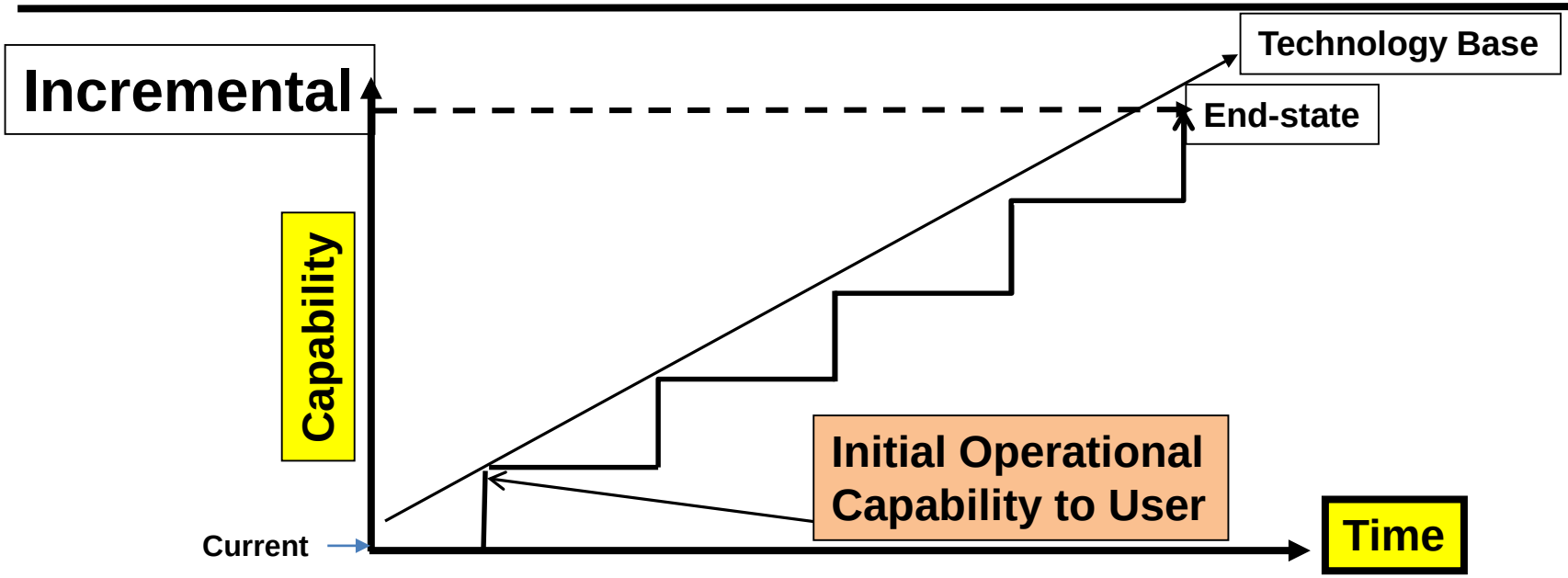
- **Problem Statement:** Acquisition professionals struggle to formulate the preferred approach at program approval milestones, and many programs are approved as single step development efforts whereas an incremental approach may be more appropriate and effective in delivering capability.
- **Goal is to examine the challenges in formulating an acquisition strategy with an ID approach**

This Research….

- **Objectives:**
  - Develop insights into how acquisition professionals use typical programmatic decision inputs to formulate the components of an acquisition strategy with an incremental development approach.
  - Recommend defense acquisition policy changes that better support the planning of successful incremental development acquisition strategies.

Evolutionary Acquisition – Incremental Development

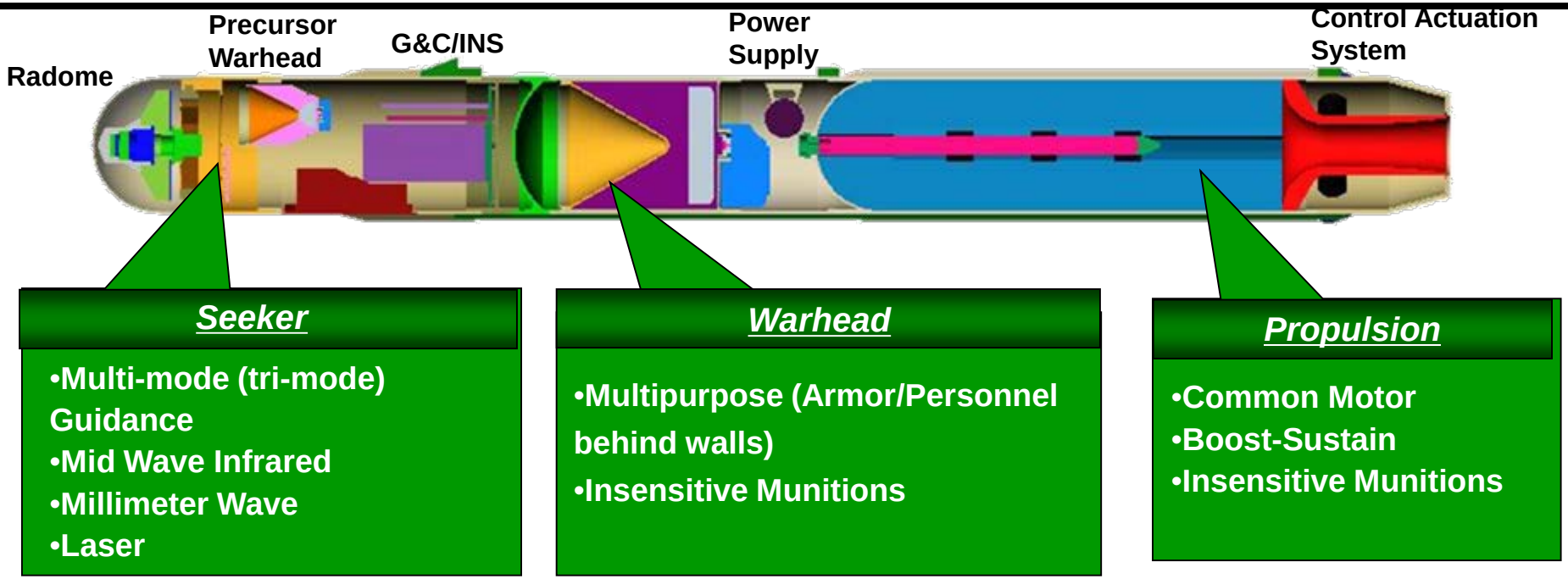




Why a Case Study Based Approach?

- Joint Common Missile (JCM) program was ideally suited for an ID strategy
- JCM program had a approved MS B for single step development AS in 2004
- JCM program was cancelled and renamed the Joint Air to Ground Missile (JAGM) that had a approved MB B for incremental development AS in 2015.
- JCM and JAGM programs addressed the same capability gaps.

JCM Description



AH-64

AH-1

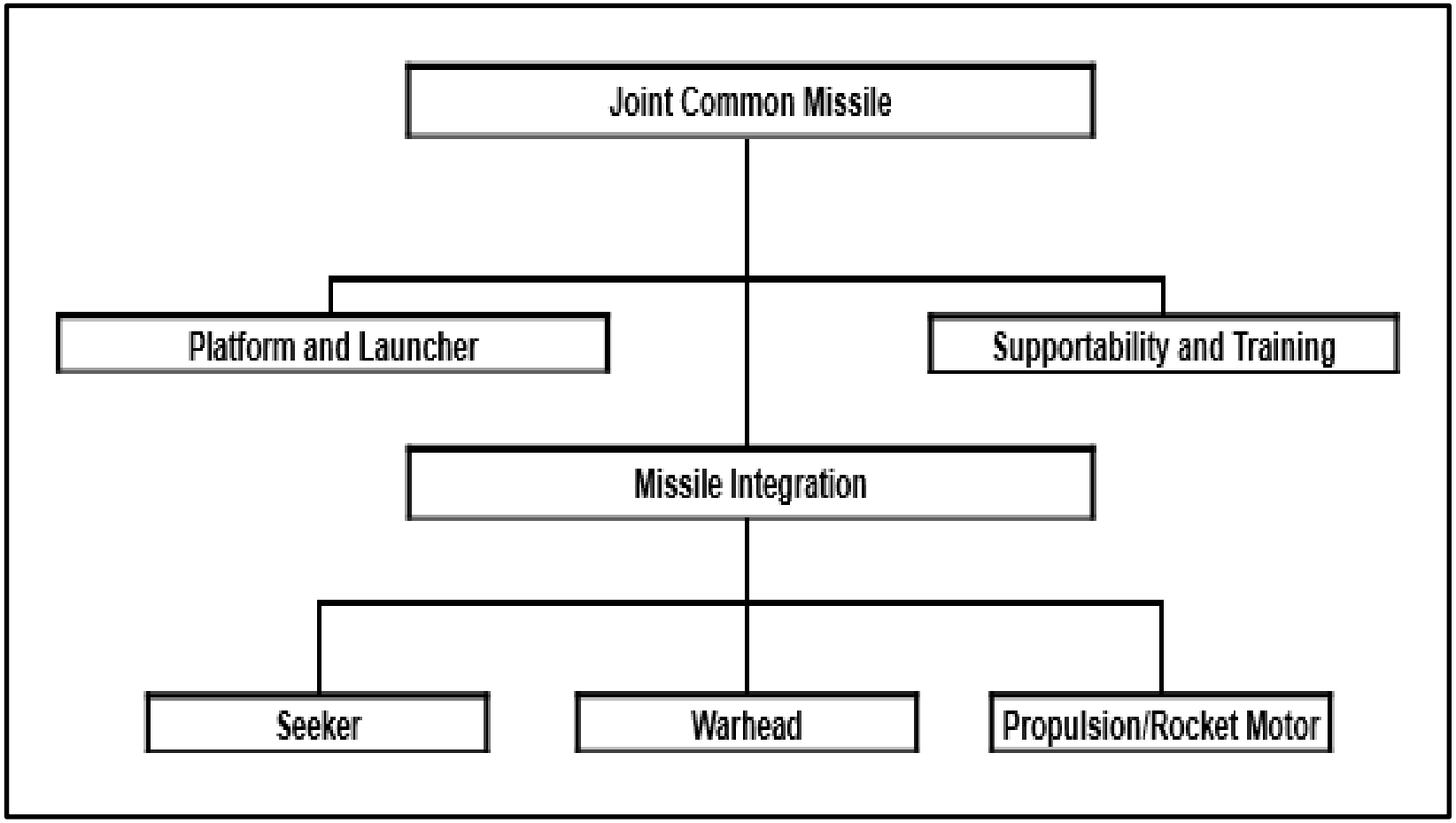
F/A-18 E/F

H-60

JCM Benefits

- Increased Performance
  - RW Range – Doubled (from 8 to 16 km)
  - FW Range – 28 km
  - Lethality – Multi Mode Warhead
  - Engagement Modes – Multi Mode Seeker
  - Battlefield Conditions
- Reduced Logistics – Single Modular Missile for all Services, Missions, and Launch Platforms

JCM WBS


Joint Common Missile
Platform and Launcher
Supportability and Training
Missile Integration
Seeker
Warhead
Propulsion/Rocket Motor

JCM Consensus Risk Assessment

JCM Integrated System Risk		
Risk	MS B	MS C
Integrated System	Med/High	Med/Low

Platform and Launcher		
Risk	MS B	MS C
AH-64D	Med	Low
AH-1Z	Med	Low
F/A-18E/F	Med	Med/Low
MH-60	Med	Med/Low

Supportability and Training		
Risk	MS B	MS C
Sup/Tng	Med	Low

Missile Integration		
Risk	MS B	MS C
Msl Integ	Med / High	Med/Low

Seeker		
Risk	MS B	MS C
Trimode seeker & Dome	Med	Low

TRL 6

Warhead		
Risk	MS B	MS C
Warhead / Fuze (Multi-Purpose)	Med/Hi	Med/Low

TRL 6

Propulsion / Rocket Motor		
Risk	MS B	MS C
Propulsion	Med	Low

TRL 6

LEGEND	
Risk Level	Color
High	
Med / High	
Med	
Med / Low	
Low	

JCM Requirements drove design and risk

- **Requirements:**
  - KPP1 drove a tri-mode seeker
  - KPP2 drove a multi-purpose warhead
  - KPP3 drove propulsion system (common motor)
  - KPP4&5 drove number of platforms
- **Risk Assessment:**
  - Tri-mode seeker, multi-purpose warhead and motors all TRL 6 but…
  - Risk rating for multi-purpose warhead was med/high

JCM Case Study

- **JCM had a successful MS B and EMD Contract Award in Spring 2004, but ….**
- **What's the "Rest of the Story?"**
  - The JCM program was canceled by OSD in Dec 2004 due affordability concerns
  - Effort put into low level effort extended technology maturation phase and renamed Joint Air-to-Ground Missile (JAGM)

JCM Case Study

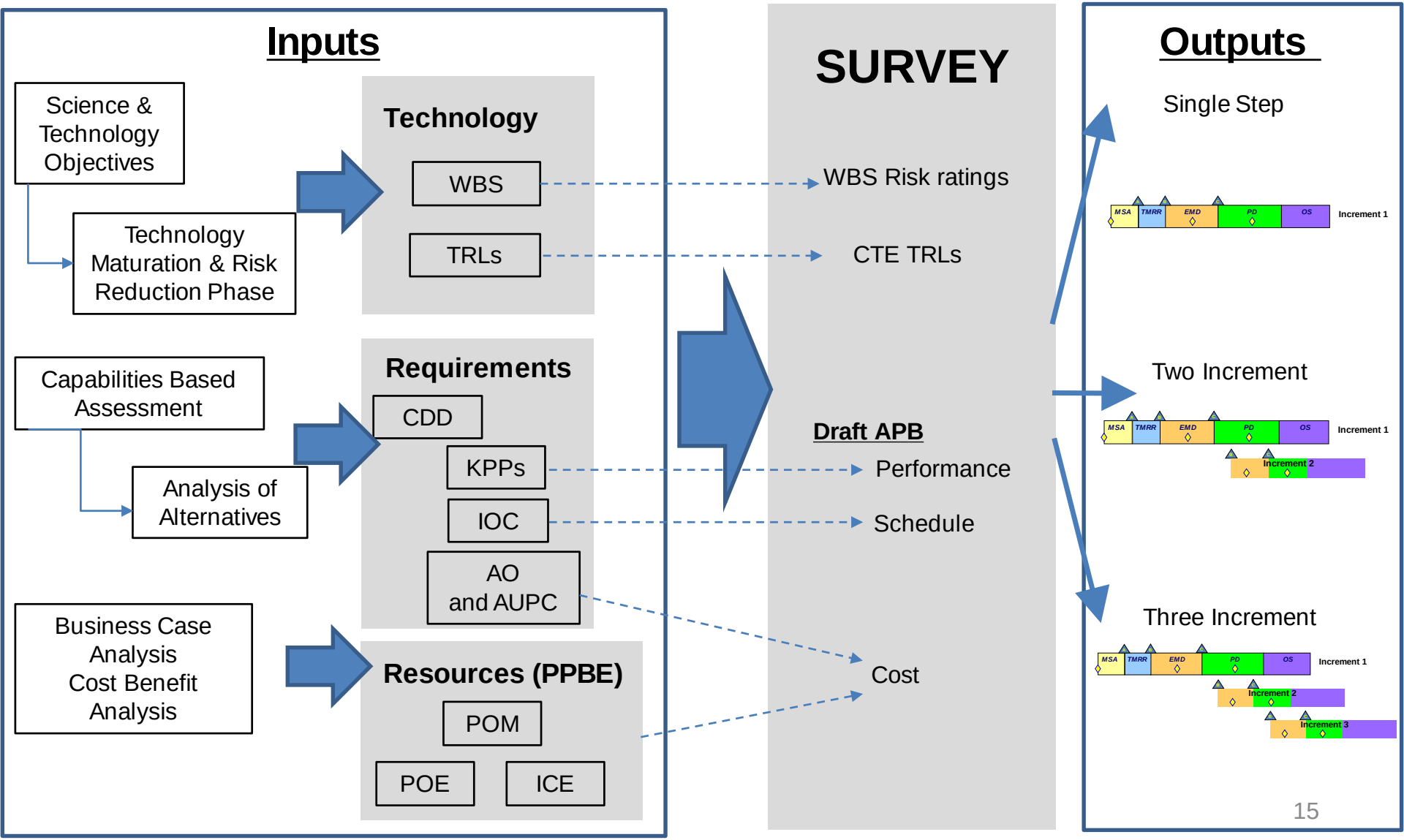
- **JCM Program (MS B in Spring 2004)**
  - Joint USA, USN, USMC and International Cooperative UK
  - Intended to replace TOW, HELLFIRE, MAVERICK, BRIMSTOMES and SEA SKUA existing missiles *Ineffective Acquisition Strategy*
  - Tri-mode seeker, multi-purpose warhead, common motor for four RW & FW threshold platforms
- **JAGM Program (MS B in Spring 2015)**
  - Joint USA and USMC *Effective Acquisition Strategy*
  - Intended to replace HELLFIRE and TOW
  - Dual-mode seeker, Hellfire warhead and propulsion as GFE, for two threshold RW platforms

The "Lost" Decade → Unresponsive Acquisition

Acquisition Strategy Formulation

- **Primary research question:** Given programmatic decision inputs for a specific program, can we gain a better understanding of how PMs or acquisition professionals formulate the components of the acquisition strategy?
- **Secondary research question:**
  - What is the most important factor in determining the recommended acquisition strategy?
  - How can the decision input factors be changed to enable a PM or acquisition professional to recommend an incremental development strategy that more closely resembles the actual strategy later adopted by the Services?

Survey Approach



Survey Format

- **Data Inputs (held constant)**
  - Requirements: CDD KPPs and IOC dates
  - Costing (AUPC): JCP and ICE
  - Schedule (EMD length): JCP and ICE
- **Data Inputs (varied – 11 variables) – studied**
  - TRL levels for CTEs and Risk Ratings for CTEs and integration
- **Survey Outputs is recommended Acquisition Strategy**
  - Single step, Two increments, or Three increments
  - Reliance on COTS (or GFE) or CTE development efforts

What Did I Expect?

- **With respect to the triple constraint of cost, schedule and performance**
- **Can the PM change cost to keep schedule and performance within APB?**

  Maybe, but….unaffordable program
- **Can the PM change schedule to keep cost and performance within APB?**

  Maybe, but….unresponsive program
- **Can the PM change performance to keep cost and schedule within APB?**

→ ***Incremental development***

Research Data Hypotheses

- **Hypothesis #1:** Acquisition professionals would not recommend the JAGM acquisition strategy from the JCM MS B data.
- **Hypothesis #2:** Most acquisition professionals would maintain the approved Service cost and schedule constraints and chose to delay capability, given the JCM MS B data.
- **Hypothesis #3:** For those acquisition professionals that recommended an incremental approach, they would recommend delaying capabilities linked to technologies with low TRLs and/or high-risk ratings.

Research Data

Survey Results

		Seeker			Warhead		Propulsion		Platform				Schedule (EMD length)		Cost (AUPC)	
	Respondents (n)	Single Mode (NDI) TRL 9	Dual Mode	Tri-mode APB KPP TRL 6 Med Risk	Single (NDI) TRL 9	Multipurpose APB KPP TRL 6 Med/High Rsik	Single motor (NDI) TRL 9	Common APB KPP TRL 6 Med Risk	AH64 APB KPP	AH1 APB KPP	MH60 APB KPP	F18 APB KPP	48 months APB POE	72 or 144 months ICE	$108K or $120K APB POE	$153K ICE
	31															
Single Step	7		1	6	1	6	1	6	6	6	6	7	1	6	2	5
Two Increment Approach																
Increment I	13		8	5	7	6	3	10	12	11	10	5	7	5	8	4
Increment II				13		13		13	13	13	13	13	3	8	5	8
Three Increment Approach																
Increment I	11	4	5	2	8	3	10	1	10	8	6	5	9	2	7	4
Increment II			4	7	5	6	8	3	10	9	9	8	7	4	6	5
Increment III				11		11	1	10	10	9	9	10	7	4	6	5

- Sample size (n) = 31
- 7 of 31 (23%) recommended single step
- 13 of 31 (42%) recommended two increments
- 11 of 31 (35%) recommended three increments

Analysis of Results

- **Hypothesis #1:** A low percentage of acquisition professionals would be able to predict the JAGM acquisition strategy from the JCM MS B data.
- Results: None (0 of 31, or 0%) of the respondents recommended an acquisition strategy close the JAGM strategy (dual mode seeker, COTS warhead, COTS motor, and integration of only AH64 and AH1 in first increment)

➢ Data supports Hypothesis #1 - it is extremely difficult to predict a successful acquisition strategy based on typical MS B programmatic data.

Analysis of Results

- **Hypothesis #2:** Most acquisition professionals would maintain the approved Service cost and schedule constraints and chose to delay capability, given the JCM MS B data.
- Only 14 in 31 respondents (45%) decided to maintain the approved Service cost and schedule constraints and incrementalize capability—indicating evidence counter to hypothesis #2.

Analysis of Results

- **Hypothesis #3:** For those acquisition professionals that recommend an incremental approach, they would recommend delaying capabilities linked to technologies with low TRLs and/or high-risk ratings.
- 15 of 24 (63%) respondents pushed the multipurpose warhead to a later increment. However, 17 of 24 (71%) respondents pushed the seeker to a later increment.

➢ These results neither confirm nor deny hypothesis #3

➢ The recommended approaches appear to be not entirely data-driven based on the CTE TRL and risk ratings.

Future Work

- **For which combination of TRLs and risk ratings would acquisition professionals predict the actual strategy?**

	Technology Readiness Level (TRL)			Risk Ratings (RR)							
Survey Number	Seeker (s)	Warhead (w)	Motor (m)	Seeker (s)	Warhead (w)	motor (m)	integration (i)	AH-64 Apache (64)	AH-1 Conbra (1)	MH-60 Seahawk	F/A18E/F (18)
Survey #1 - baseline	6	6	6	m	mh	m	mh	m	m	m	m
Survey #2 - seeker TRL	4	6	6	m	mh	m	mh	m	m	m	m
Surevy #3 - seeker RR	6	6	6	h	mh	m	h	m	m	m	m
Surevy #4 - seeker TRL & RR	4	6	6	h	mh	m	h	m	m	m	m
Survey #5 - warhead TRL	6	4	6	m	mh	m	mh	m	m	m	m
Survey #6 - warhead RR	6	6	6	m	h	m	h	m	m	m	m
Survey #7 - warhead TRL & RR	6	4	6	m	h	m	h	m	m	m	m
Survey #8 - motor TRL & RR	6	6	4	m	mh	h	h	m	m	m	m
Survey #9 - F18 platform RR	6	6	6	m	mh	m	mh	m	m	m	h
Survey #10 - MH60 platform RR	6	6	6	m	mh	m	mh	m	m	h	m
Survey #11 - motor TRL & RR and F18 RR	6	6	4	m	mh	h	h	m	m	m	h
Survey #12 - motor TRL/RR and F18/MH60 RRs	6	6	4	m	mh	h	h	m	m	h	h
Survey #13 - integration RR	6	6	6	m	mh	m	h	m	m	m	m
Survey #14 - JAGM	4	4	4	h	h	h	h	m	m	h	h

- **Can we avoid the "*Lost Decade*" in which the warfighters got no capability increase?**

Acquisition Policy Recommendations

- For technology development MDAPs, the DoDD 5000.01 should require milestone decision authorities (MDAs) to justify any single-step acquisition, making incremental development the default strategy.
- Component technology TRLs should be augmented with risk ratings. Specifically, risk ratings should be medium or lower for all program-identified risks before proceeding into the EMD phase of the first increment.
- The integration risk should be specifically addressed at all milestone reviews, either through the program risk assessment or the introduction of an integration readiness level (IRL), similar to the TRL and MRL levels.

Research Extension

- New area of research called "**behavioral acquisition**."
- Analogous to behavioral finance that studies both economics and psychology within finance decision-making.
- **Behavior Acquisition**: the study of program management, organizational dynamics, and psychology within the defense acquisition decision-making environment
- What biases are in play? Confirmation bias, recency bias
- What fears are in play?
  - Failure, not meeting requirements, delaying milestone, not being a team player

Research Extension

Behavioral Acquisition

- **Can we better understand how PMs think when formulating an acquisition strategy?**
  - Critical thinking
  - Decision making
  - Problem solving
  - Resource management
  - Stakeholder engagement

ABILENE PARADOX

Paradigm Shift

Hierarchies

Leading Change (E versus O)

Decision Making (Advocacy versus Inquiry)

Conflict (Task versus Relationship)

- **How get the acquisition system to better support PMs who must balance getting program approval and developing an executable plan?**

Back ups

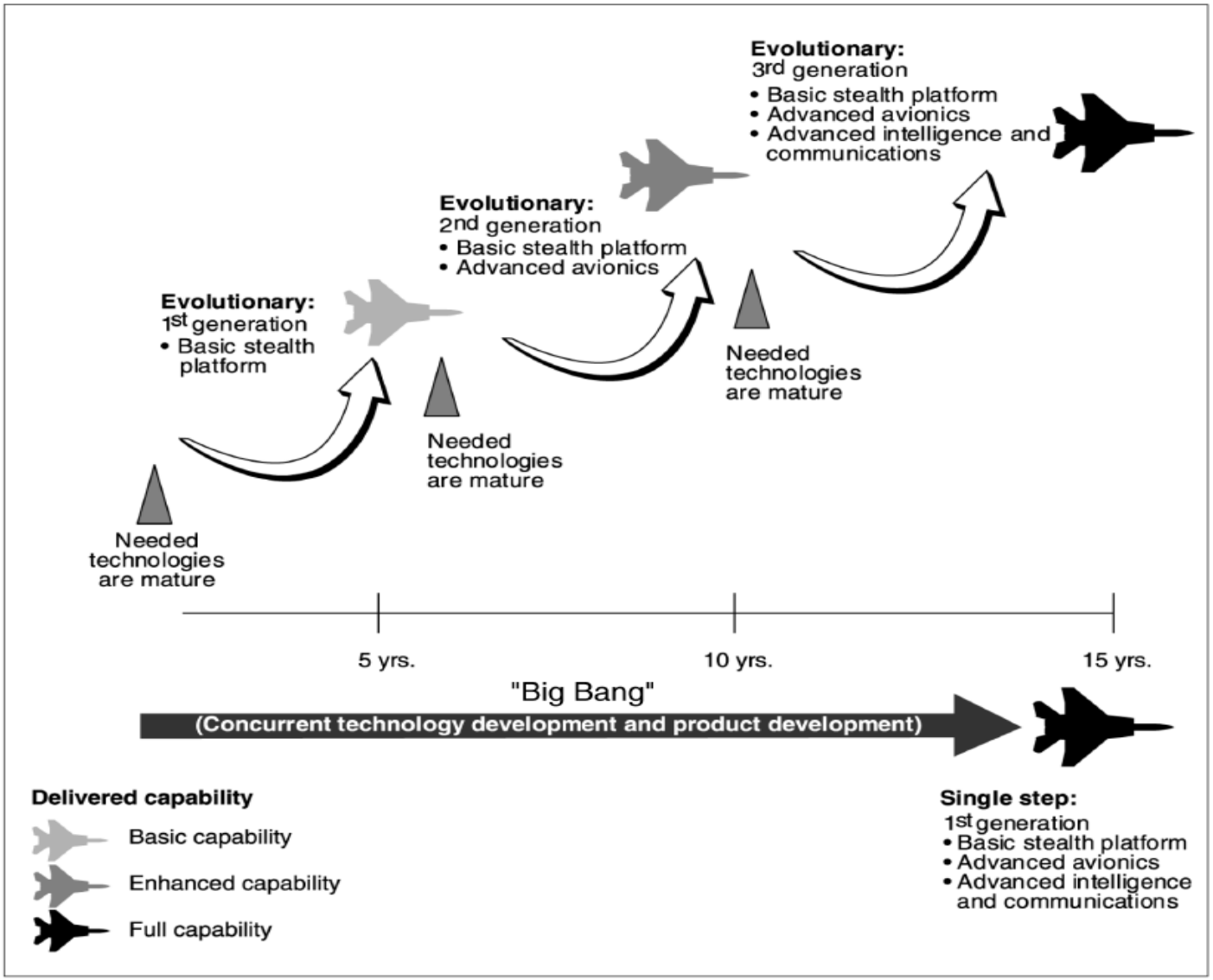
Emphasis on Incremental Development – Is It New?

National Defense Authorization Act (NDAA)			
Fiscal Year	Total Page Count	Page Count of Title VIII - Acquisition Policy, Acquisition Management, and Related Matters	Uses of word "evolutionary" or "increment" or "block"
1996	519	10	40
1997	450	14	0
1998	450	22	0
1999	360	10	0
2000	466	16	0
2001	515	20	0
2002	384	18	0
2003	306	19	23
2004	436	20	1
2005	389	20	14
2006	423	32	16
2007	439	38	38
2008	602	70	48
2009	417	47	22
2010	656	23	16
2011	383	64	3
2012	566	45	49
2013	682	40	29
2014	494	13	14
2015	698	37	12
2016	585	80	52
2017	970	93	79

DoD Acquisition policy has been consistent over time

Department of Defense Acquisition Regulations							
Department of Defense Directive (DoDD) 5000.1				Department of Defense Instruction (DoDI) 5000.2			
Revision Year	Total Page Count	Total Word Count	Uses of word "evolutionary" or "increment" or "block"	Revision Year	Total Page Count	Total Word Count	Uses of word "evolutionary" or "increment" or "block"
1971	7	1897	0				
1975	8	2308	0				
1977	15	3623	0				
1980	*			1980	58	14056	2
1982	*						
				1983	34	*	1
1985	16	4808	1	1985	32	7035	1
1986	15	5133	1	1986	34	7117	1
1987	15	4425	2	1987	26	7958	0
1991	35	14000	2	1991	345	92029	10
				1993	542	126858	32
1996	14	5734	4				
2000	15	4117	14				
2001	12	4220	14				
				2002	193	46636	98
2003	8	3075	2	2003	50	14958	52
2007	10	3210	3				
				2008	80	28852	62
				2013	152	*	40
				2015	154	61220	68
				2017	110	*	52

GAO recommendations have been consistent over time



Source: GAO.