



Affordable Solutions: Forging the Missing Link

Projects to Portfolio

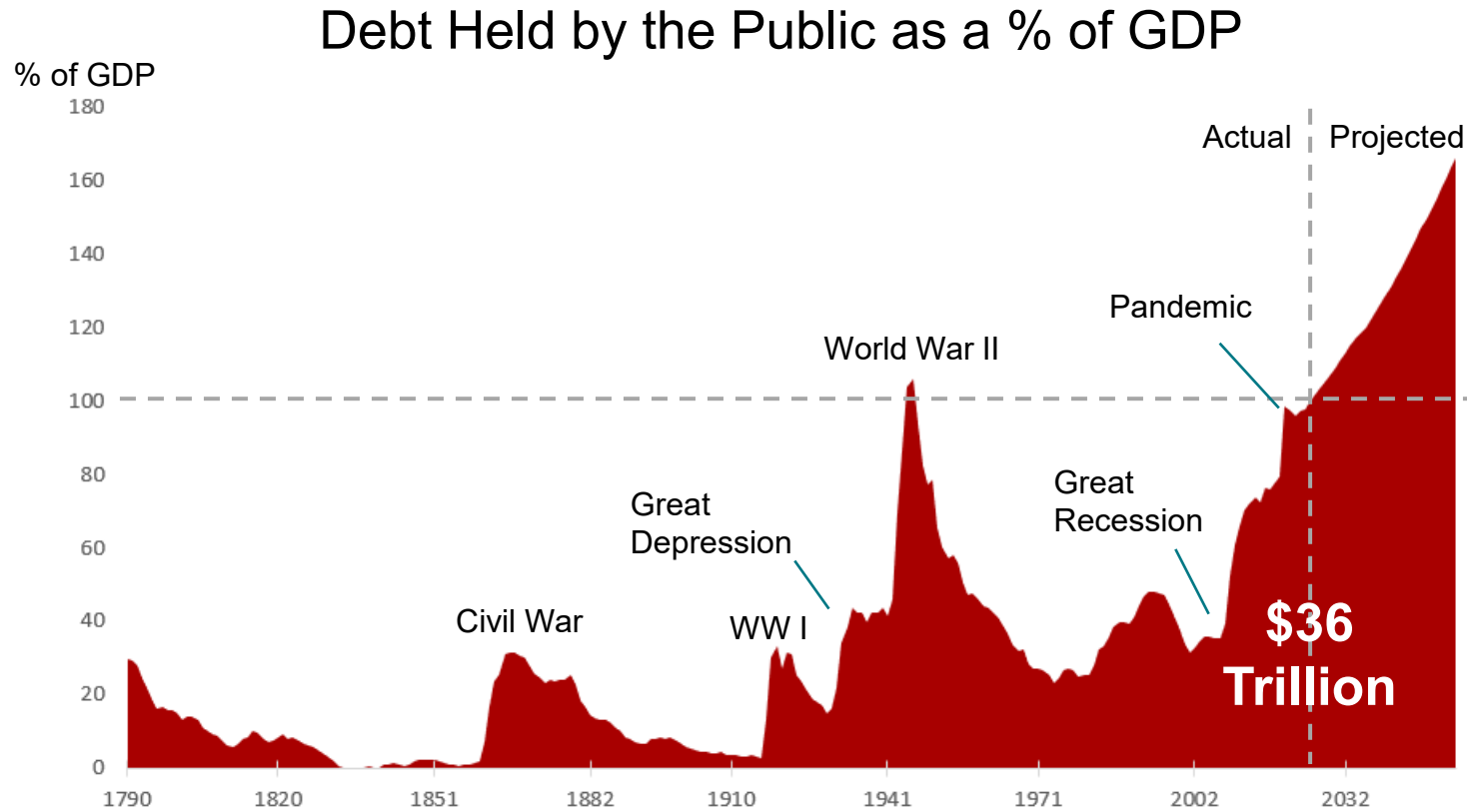
International Cost Estimating
and Analysis Association
(ICEAA)

Atlanta, GA

13 to 15 May 2025

PRELUDE – Lady Liberty at Risk

*Our free nation
deep in debt*



The nation's debt: “The single **greatest threat** to our national security”

BOTTOM LINE

“We have good decision makers, but they don’t view the *totality* of decision space”

Pentagon Acquisition Executive

This research offers an innovative, risk-focused paradigm for analyses of project affordability. It eschews the myopic perspective of addressing *only* the availability of funding

Integrating life-cycle costs, assessments of risk, and evaluation of resource availability, the paradigm offers leadership a menu of cost constraints (goals and caps) informed by project S-curves and impacts on the portfolio

The result? Better **illumination** of trade space and stronger **alignment** of projects with strategy



Ben Bergen



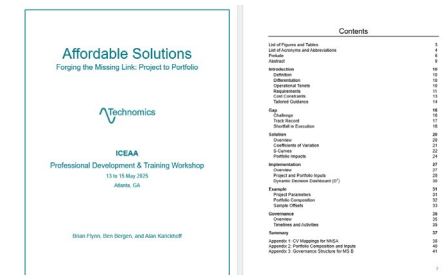
Brian Flynn



Alan Karickhoff

Outline

- Introduction
- Gap
- Solution
- Implementation
- Example
- Governance



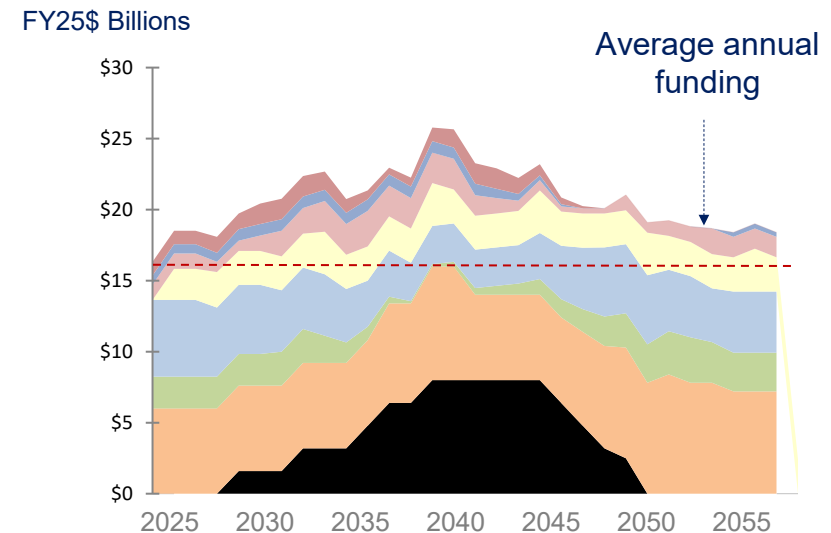
Research Paper

INTRODUCTION

Affordability Analysis: addresses the degree to which the life-cycle cost of a program or project accords with long-range modernization, force structure, and manpower plans, given resource constraints

An affordable program

- Syncs with strategy
- Reduces risk in the portfolio
- Yields an ROI greater than alternatives
- Fits within the topline



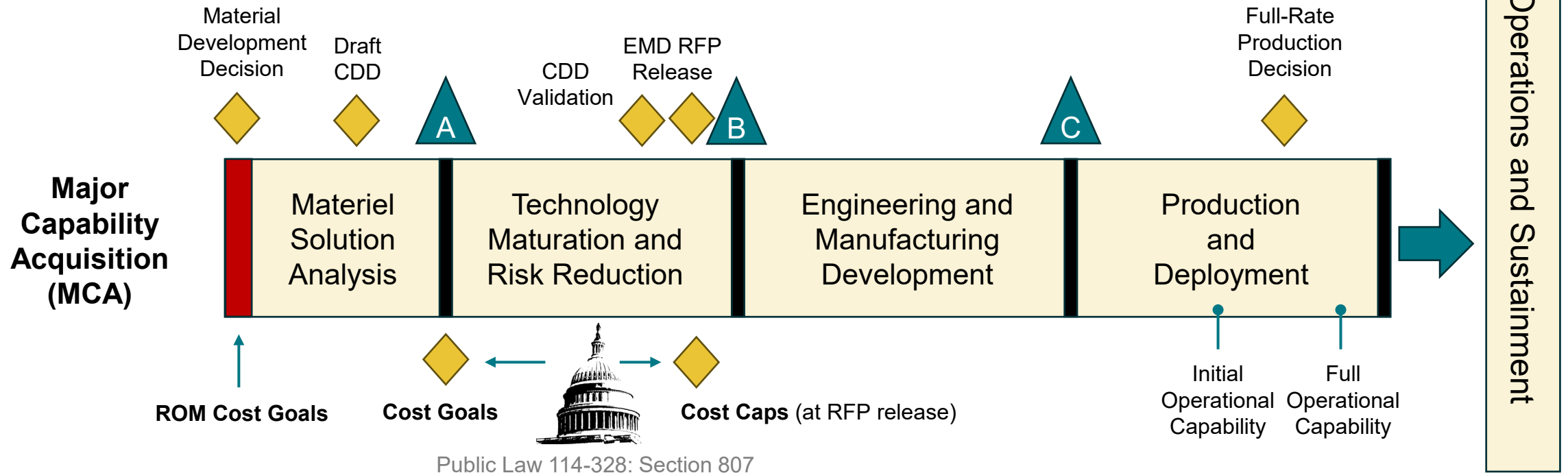
Life-cycle perspective essential since O&S sometimes exceeds $\frac{2}{3}$ of total project cost

Requirement – Embedded in Law & Regulation

U.S. DoD

- *All* acquisition pathways (not only Major Capability Acquisitions)
- “*Prioritize product support and affordability*” within a portfolio [DODI 5000.02]

Congress: programs must “... *be affordable*”



Requirement – Statutory

Program Cost Targets [Public Law 114-328 Section 807, as implemented in 10 USC 4271]



Cost Goals

- Procurement Average Unit Cost (PAUC)
- Acquisition Program Unit Cost (APUC)
- Yearly O&S cost



Cost Caps

Established as fixed-cost requirements equivalent to Key Performance Parameters (KPPs)

- PAUC, APUC, yearly O&S
- Binding? E.g., CVN-78?

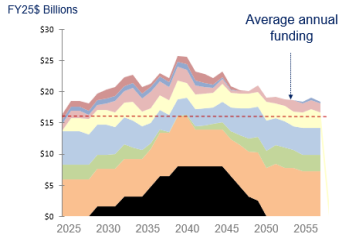
Programs required to establish “... *the procurement unit cost & sustainment cost*” as affordability targets

Requirement – Joint Chiefs of Staff

Joint Capabilities Integration and Development System (JCIDS)

Budget Constraints

“Describe how resources are affordable ... given limitations of the Component’s budget authority”



Life-Cycle Cost Estimates

“Ensure best practices are followed” in accordance with DoDI 5000.73 “*Cost Analysis Guidance and Procedures*”

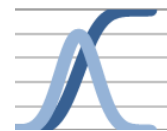


Portfolio Offsets

Identify “... legacy capabilities which will be reduced in scope or eliminated to allow funding of the proposed new capability”

Cost Risk Analysis

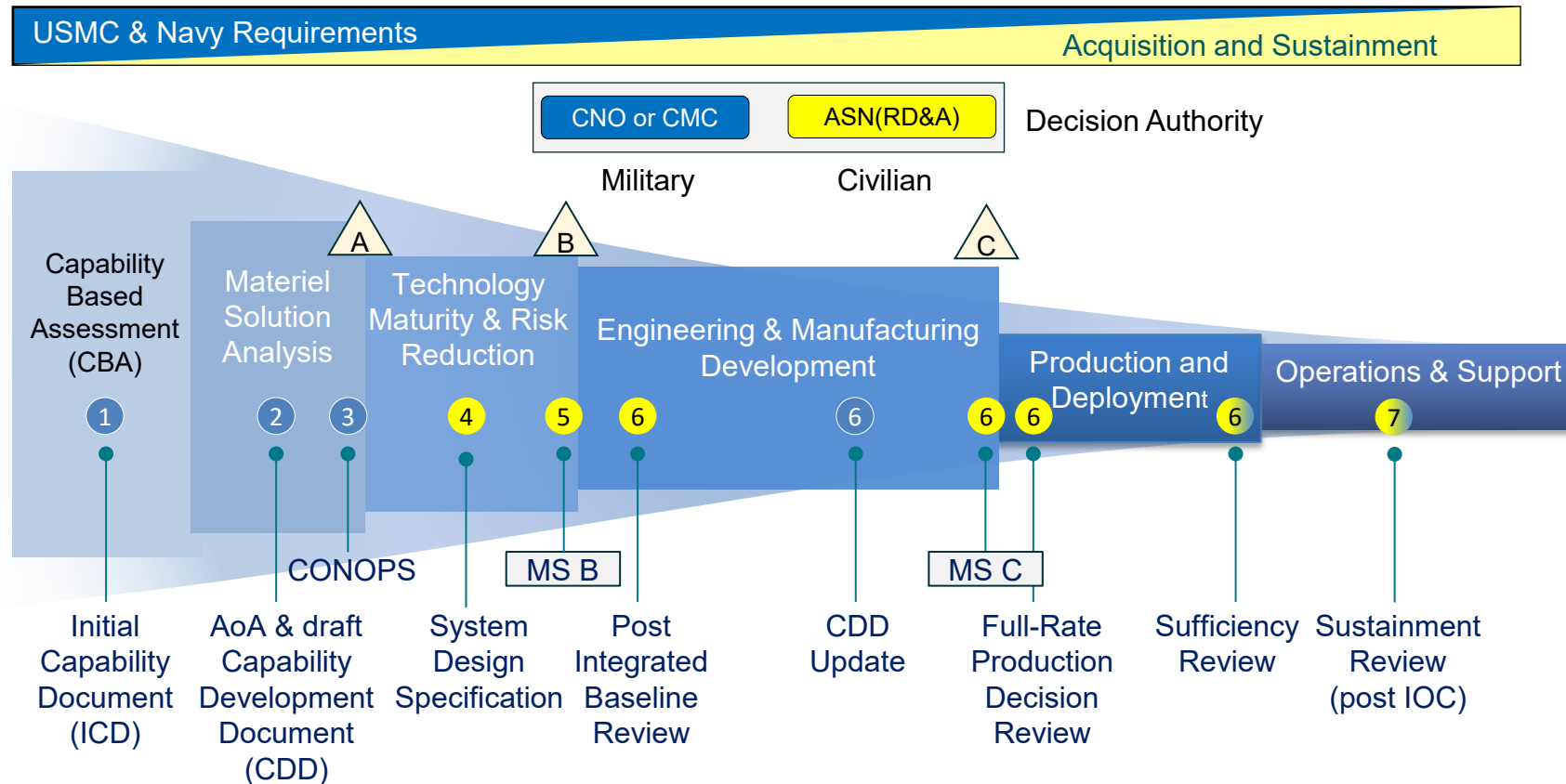
“Present key results from sensitivity and uncertainty analyses, including the confidence levels”



Requires an assessment of affordability in the Capability Development Document

Requirement – MILDETs and Services

DAU: “Each DoD Component develops constraints for all its programs”



Department of Navy (DON): “Program affordability shall be reviewed at each gate.” SECNAVINST 5000.2G

Overarching Goal of Affordability Analysis

Through the illumination of trade space (cost, capability, capacity, funding, and risk), affordability analysis addresses these two critical questions:

Development &
Procurement



*Can an organization afford **to buy** the material solution or capability?*

Sustainment



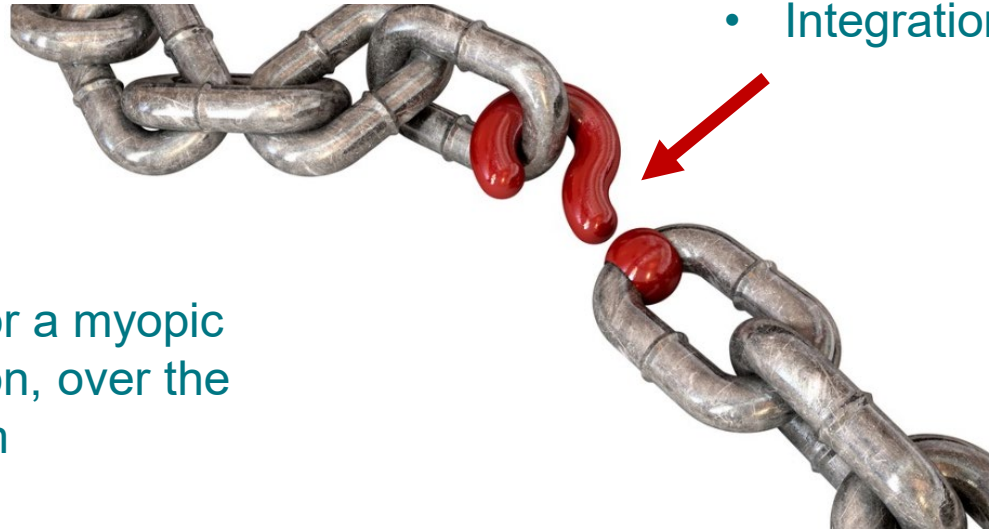
*And, once bought ... can the organization afford **to own** it?*

GAP

Program Perspective

Then-Year/M	Prior	FY23	FY24	FY25	FY26	FY27	FY28	FYDP Total	To Comp	Prog Total
ROT&E										
Primary Line Items: APPR,xxx - BA,xxx; PE,xxx										
Prior \$ (PB 23)										
Current \$ (PB24)										
Delta \$ (Current - Prior)										
Required \$										
Delta \$ (Current - Required)	-	-	-	-	-	-	-	-	-	-
PROCUREMENT										
Primary Line Items: APPR,xxx - BA,xxx; PE,xxx										
Prior \$ (PB 23)	-									
Current \$ (PB24)	-									
Delta \$ (Current - Prior)	-									
Required \$	-									
Delta \$ (Current - Required)	-									

Outbreak of “Spruill-only-itis” – or a myopic focus on funding, by appropriation, over the Future Years’ program

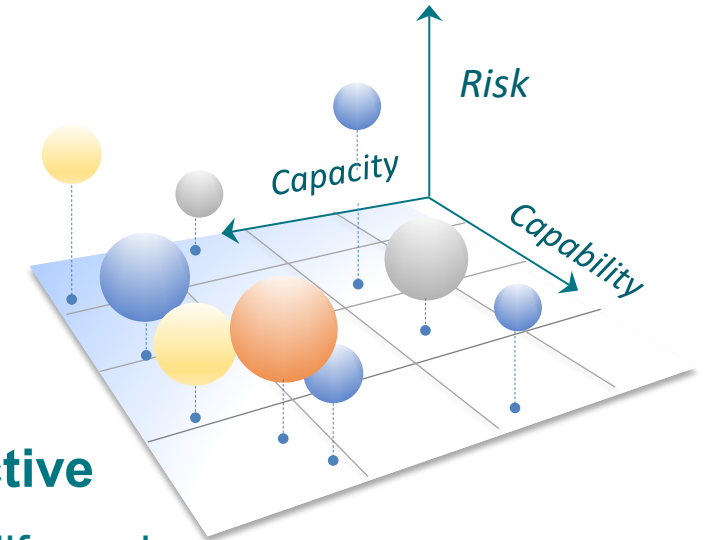


Missing Link – the Portfolio Impact

- Impact of cost constraints
- Portfolio tradeoffs
- Integration of project and portfolio risk

Portfolio Perspective

All projects over the life cycle



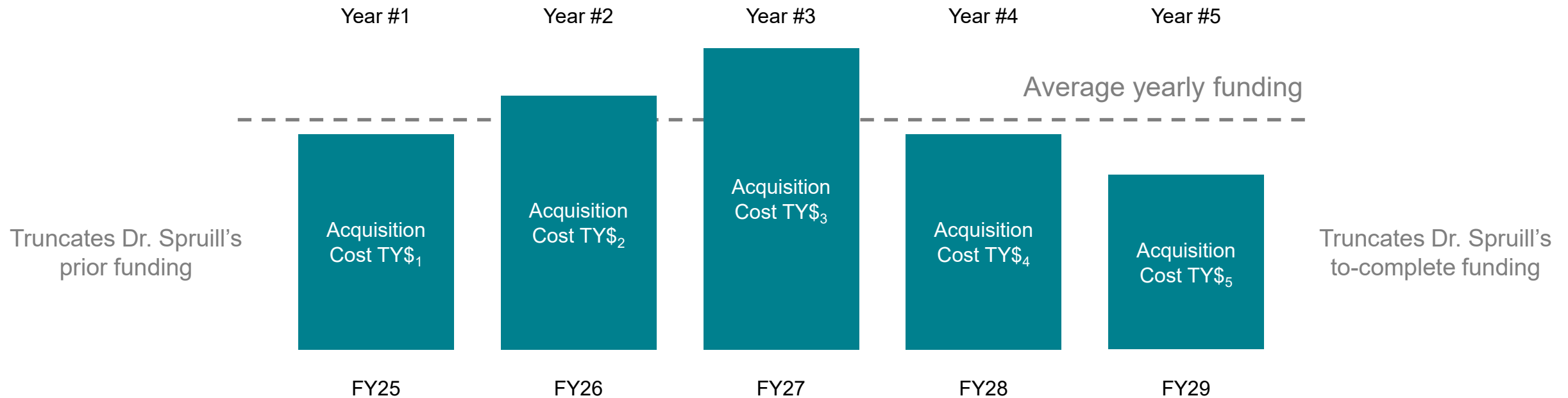
Generation of a Dr. Spruill table (an invaluable contribution to the cost community) is necessary but not sufficient

Gap – example

Affordability Determination: One Organization's Perspective

Ignores: (1) acquisition costs outside of window, (2) O&S costs, (3) impact on the portfolio

Omits: (1) quantity streams, (2) unit costs, and (3) current vs original estimates



If the five – year funding total $\geq \left(\sum_{i=1}^5 \text{acquisition cost}_i \right)$, then the project is affordable

SOLUTION

Project and
Portfolio Pricing



Project Risk, and
Cost Constraints

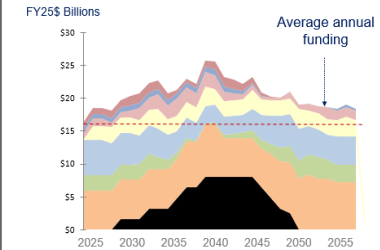
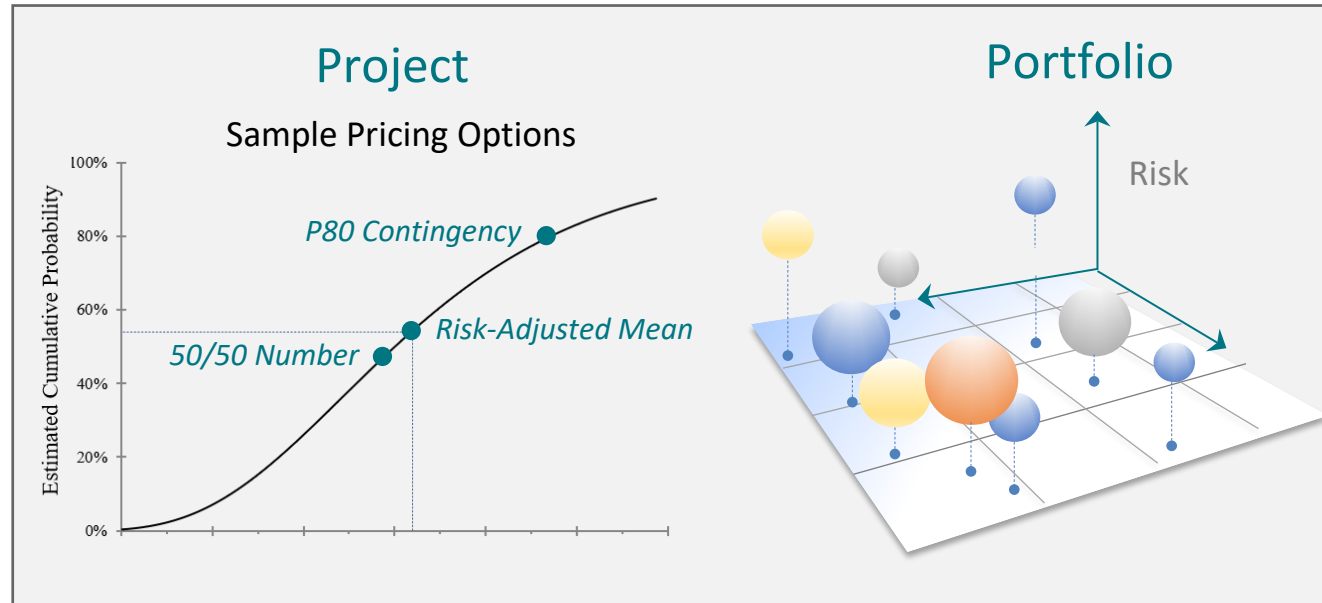


Portfolio Risk and
Tradeoffs



Resource
Impacts

Inputs
Point Estimates
CVs
Budget Positions
Figures of Merit
Quantity Profiles

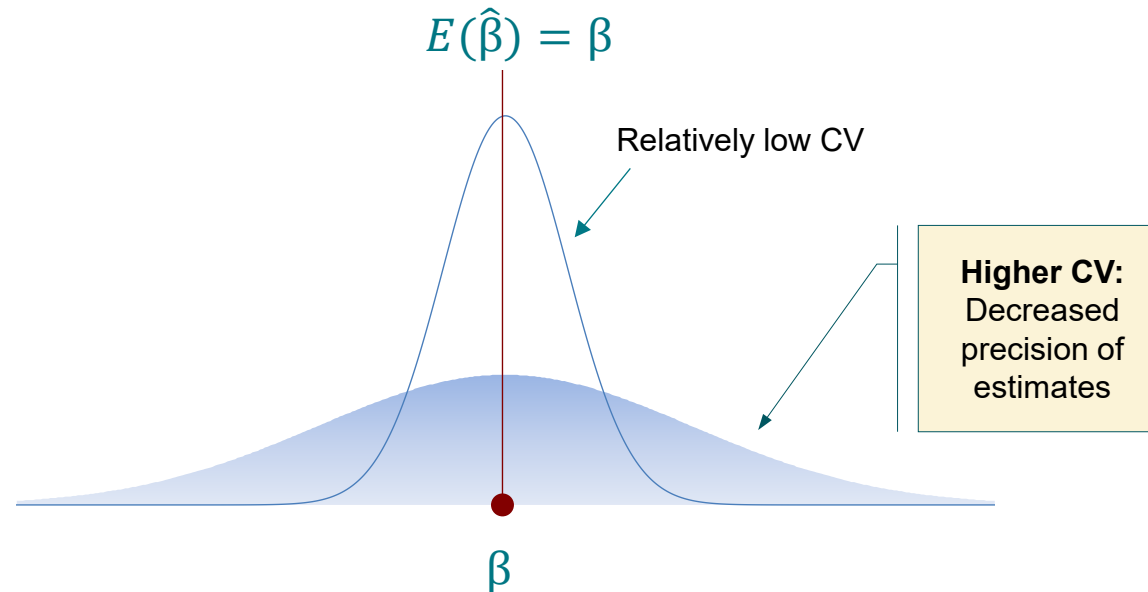


Forging the missing link – a laser focus on risk

Analytical Backbone – the CV

Coefficient of Variation (CV) + Point Estimate → S-Curve

$$CV \equiv \text{a cost distribution's standard deviation divided by its mean} = \frac{\sigma}{\mu}$$



CV benchmarks available based on U.S. DoD acquisition outcomes

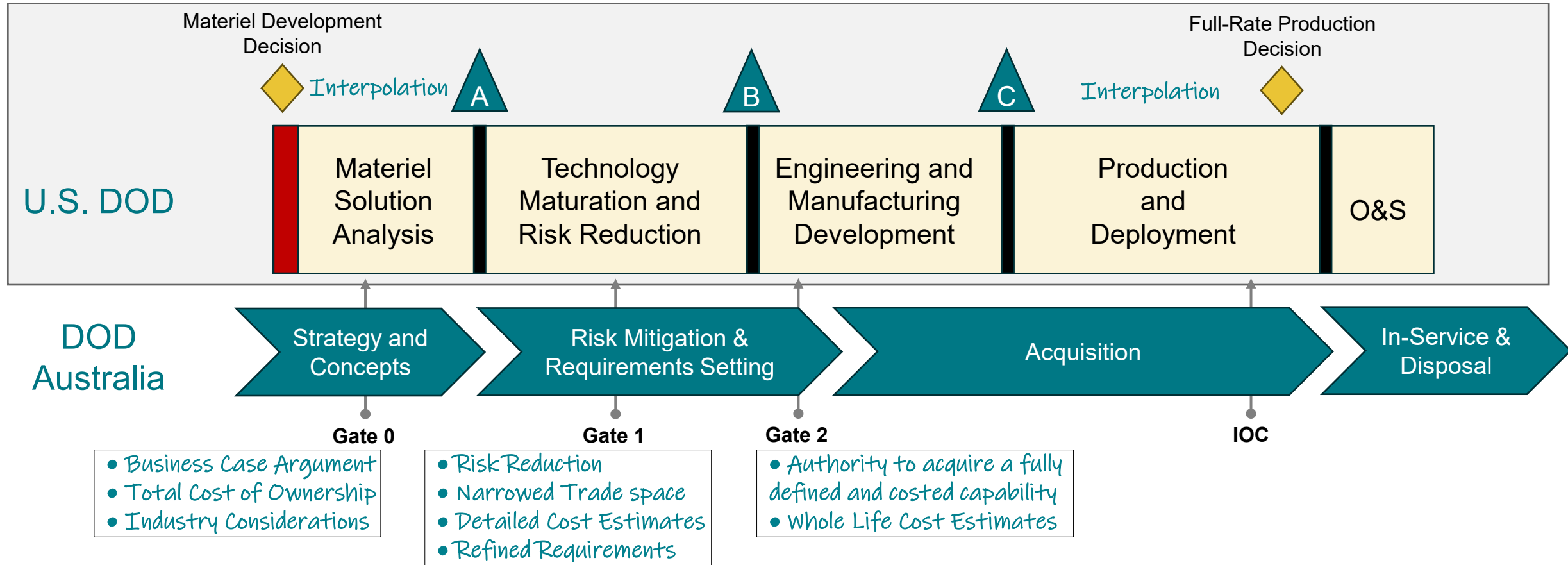
CVs Mappable as Proxies:



Australian Government

Defence

CVs by Milestone: Planning (A), Development (B), and Production Estimates (C)

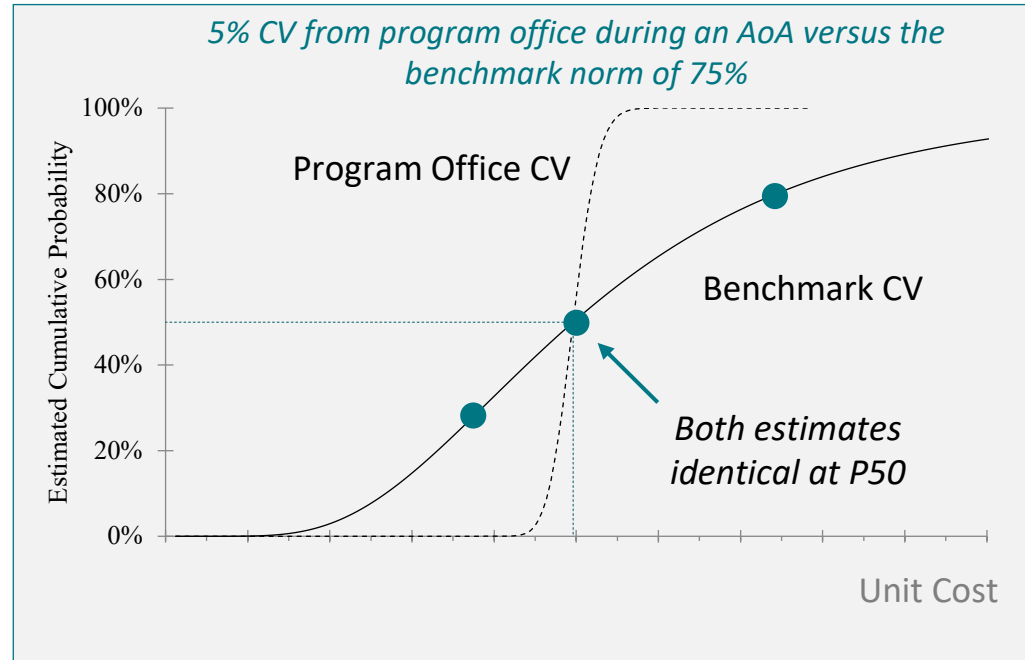


Mappings available for Department of Homeland Security (DHS), National Nuclear Security Administration, Public Services and Procurement Canada (PSPC), Department of National Defence Canada, and a “notional” framework

Analytical Backbone – the S-Curve

Prospective S-Curves for a Project

CVs Benchmarks



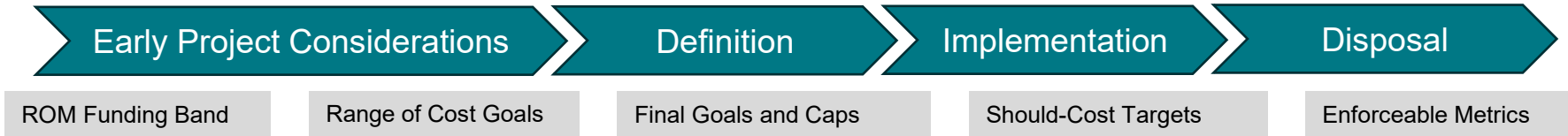
Each point represents a different level of risk and level of funding

At P80 there's a 20% chance that estimate will be exceeded. At P30 the chance is 70%

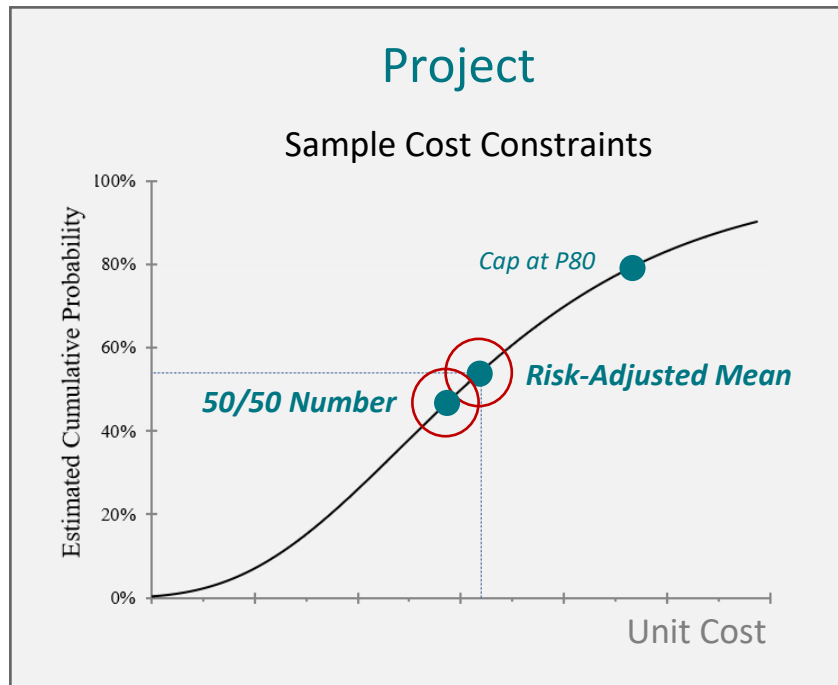
Actual data – sanitized

Benchmark CVs support **cost realism**. Projects too often suffer from optimism bias

Points on the S-Curve



Cost Goals



Critical Decision: Goals

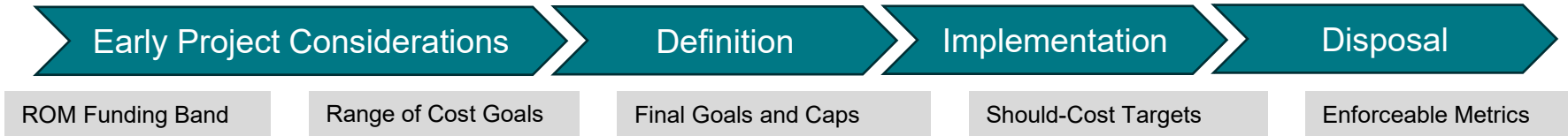
*What level of risk is acceptable in setting a budget?
Independent cost competencies in DOD prefer to use the
risk-adjusted mean, assuming a **realistic** S-curve*



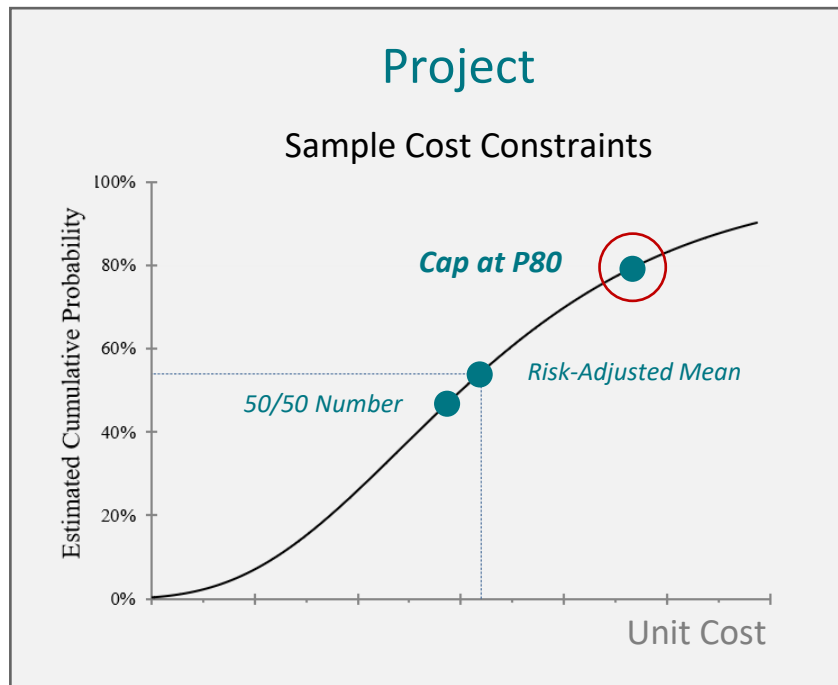
- Threshold (will cost)
- Objective (should cost)

The affordability paradigm illuminates the impact of choices

Points on the S-Curve



Cost Cap



Critical Decision: Cost Cap

*At **what point** does the cost of a new or enhanced capability become **so high** that component leadership would rather cancel the program, significantly reduce quantity or operational capability, or cut back other programs in the portfolio rather than continue?*

The affordability paradigm illuminates the impact of choices

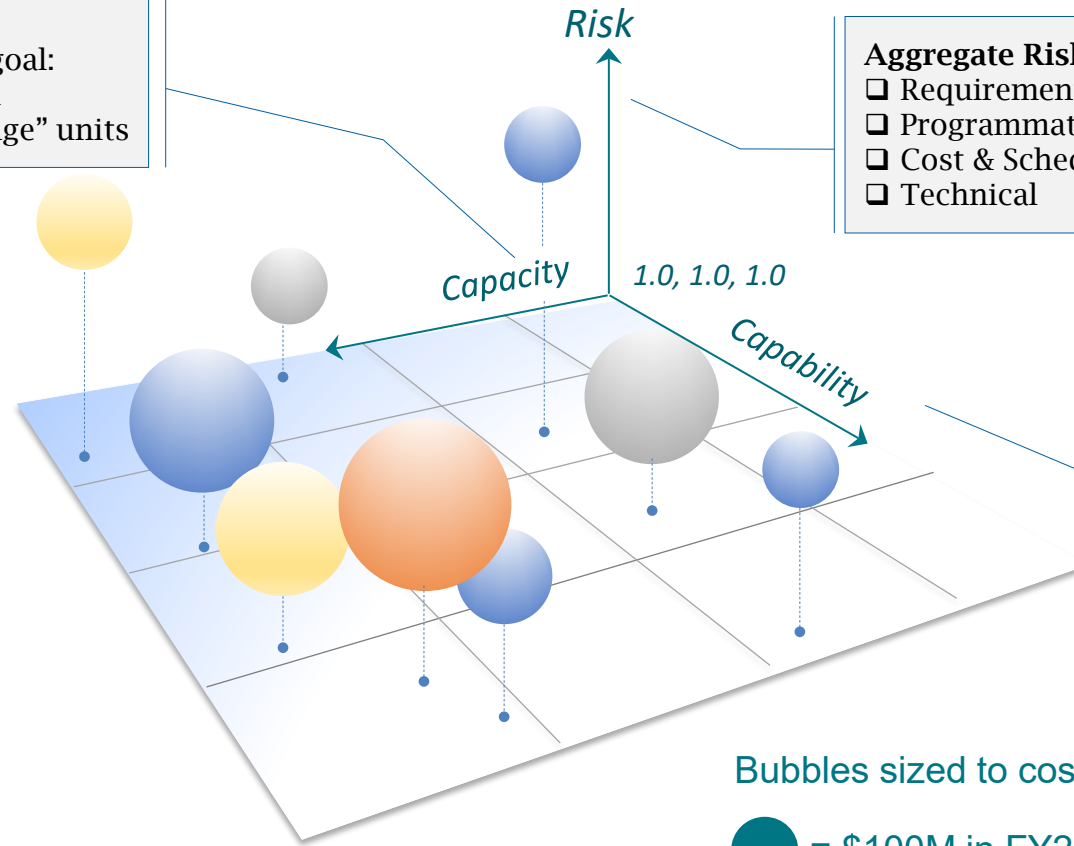
Portfolio Perspective



Capacity
❑ Criticality in meeting goal: authorized acquisition objective (AAO) + “hedge” units

Aggregate Risk Score
❑ Requirements (threat)
❑ Programmatic
❑ Cost & Schedule
❑ Technical

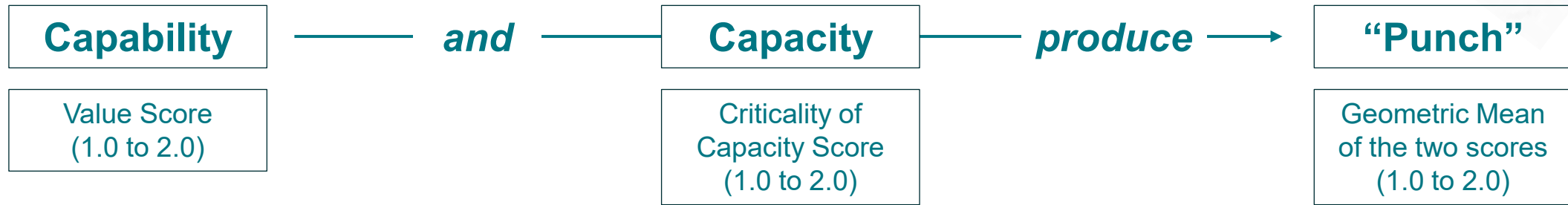
Figure of Relative Merit
❑ Importance in meeting strategic requirements
❑ Conflation of wargaming and MCDA



Bubbles sized to costs over acquisition or the lifecycle

● = \$100M in FY25\$

Project Punch



The ability to achieve a desired outcome in a specific operating environment

Number of systems of a defined capability

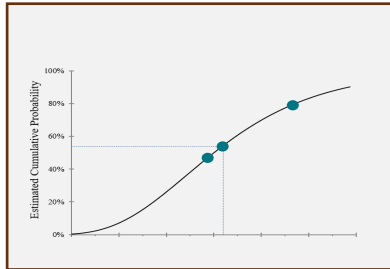
$(\text{capacity score} \times \text{capability score})^{1/2}$

“Production is deterrence” [Dr. Bill LaPlante, former USD(Acquisition & Sustainment)]

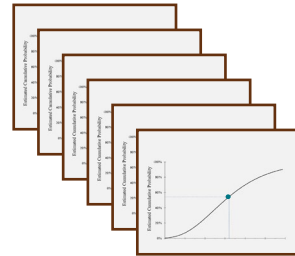
IMPLEMENTATION

Project and Portfolio Inputs

1 S-Curves and Budgets

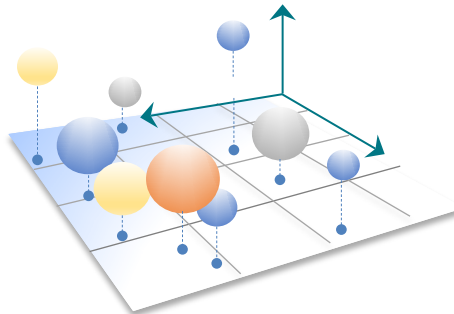


Material Solution



Each project in the portfolio

2 Portfolio Parameters



For current budget positions & capacity goals

Management Engagement

3 Pricing Options



- Dollar impact of choices for goals & caps
- Impact on the project and the topline
- Risk considerations

4 Portfolio Offsets to Support Affordability



- To individual programs
 - Unit prices & budget risk
 - Project punch
- *Is the program affordable? At what price & risk?*
- *What is the impact on the portfolio? What are the offsets?*

The Affordability Analysis Tool enables rapid analysis in a dynamic resourcing environment

Project Inputs

Programmatic Data

ESTIMATE TITLE			
COST UNITS	<input type="radio"/> \$K	<input checked="" type="radio"/> \$M	<input type="radio"/> \$B
DOLLARS TYPE	<input checked="" type="radio"/> Base Year (\$)		<input type="radio"/> Then Year (\$)
ORGANIZATION			
COMMODITY			
Quantity (AAO)			
MS OR GATE			
LIFE CYCLE PHASE			

U.S. DoD
DoD Australia
Public Services & Procurement Canada

E.g., Sea Domain, Air Domain

E.g., U.S. DoD MS A, B, or C; AU Gate x
Generic Framework Gate 1, 2, or 3

Acquisition (Production & Development)
Development
Production

Project Inputs

Cost Estimates

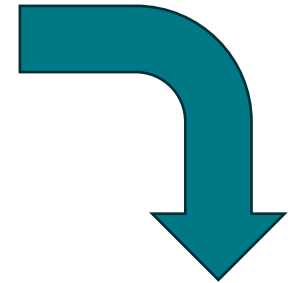
PRIMARY (E.g., Independent Cost Estimate (ICE))

Distribution Type

Coefficient of Variation (CV)

Unit Cost (Point) Estimate
At the Mean or Median

- Normal
- Lognormal
- Benchmark (re programmatic entries)
- User Input
- Mean
- Median



SECONDARY (E.g., Program Office Estimate (POE))

Distribution Type

Coefficient of Variation (CV)

Unit Cost (Point) Estimate
At the Mean or Median

Same basic inputs

Pricing Options

p40 p50 P μ p60 p70 p75

Risk-adjusted mean

Portfolio Inputs

Sufficient to define an S-curve for each project

Establishes baseline acquisition cost
(= Q x unit cost)

Exogenous input from portfolio analysis

Sustainment up to ¾ of life-cycle costs

Program or Project	Median or Mean Unit Cost in FY25\$ M	CV for Point in Acquisition	P-Value at which Budget Set	Quantity: AAO + Hedge Units	% of Quantity Bought	Inputs from Portfolio Analysis (Ratio Scales: 1.0 Low to 2.0 High)			Acquisition Funding in FY25\$M	Yearly Average O&S Cost
						Criticality of Capacity	Composite Risk	Figure of Merit		
1										
2										
3										
4										
5										
6										
7										
8										
...										
n										

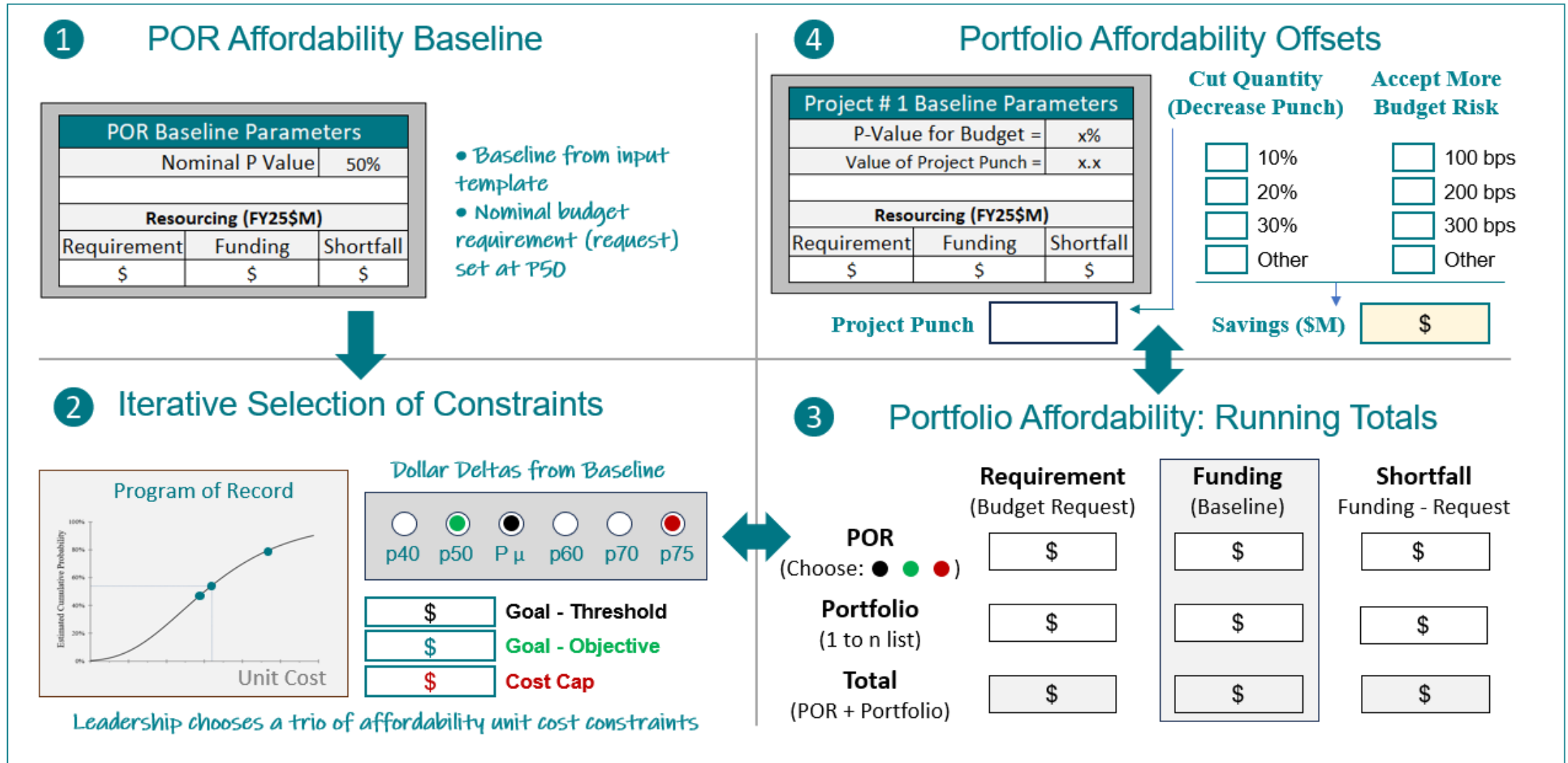
Establishes budget risk

Defines remaining trade space

Establishes resource availability

Dynamic Decision Dashboard

Bp = basis point = 1/100 of 1 percent



EXAMPLE

Is the Navy's frigate program affordable?



Notional ship and portfolio leveraging sanitized actuals from U.S., Canadian, & Australian projects

Portfolio Inputs - example



Inputs for Strategic Ballistic Missile Submarines (SSBNs)

Boomers
Attack Submarines
Aircraft Carriers
Destroyers
Command Ships
Large Deck Amphibs
Mine Countermeasure Ships
Supply Ships
Fleet Oilers
Unmanned Vessels

Cost, CV, and Budget

Unit Cost in FY25\$M (@P64)
\$10,807

CV for Point in Acquisition
0.56

P-Value for Budget Request
0.64

Quantity Objectives

Quantity: AAO + Hedge Units
10 Boats

% of Quantity Bought
5%

Portfolio Scores (1.0 low to 2.0 high)

Criticality of Capacity
1.90

Composite Risk Assessment
1.75

Figure of Value or Merit
2.00

SSBN's: High unit cost, high value, high risk, and firm need to buy 10 boats

Frigate Inputs & Outputs

Inputs

Program Office

- Point Estimate = \$1,000M
- CV = 10%
- Distribution = Normal
- Estimate at the Median
- Quantity = 30

ICE

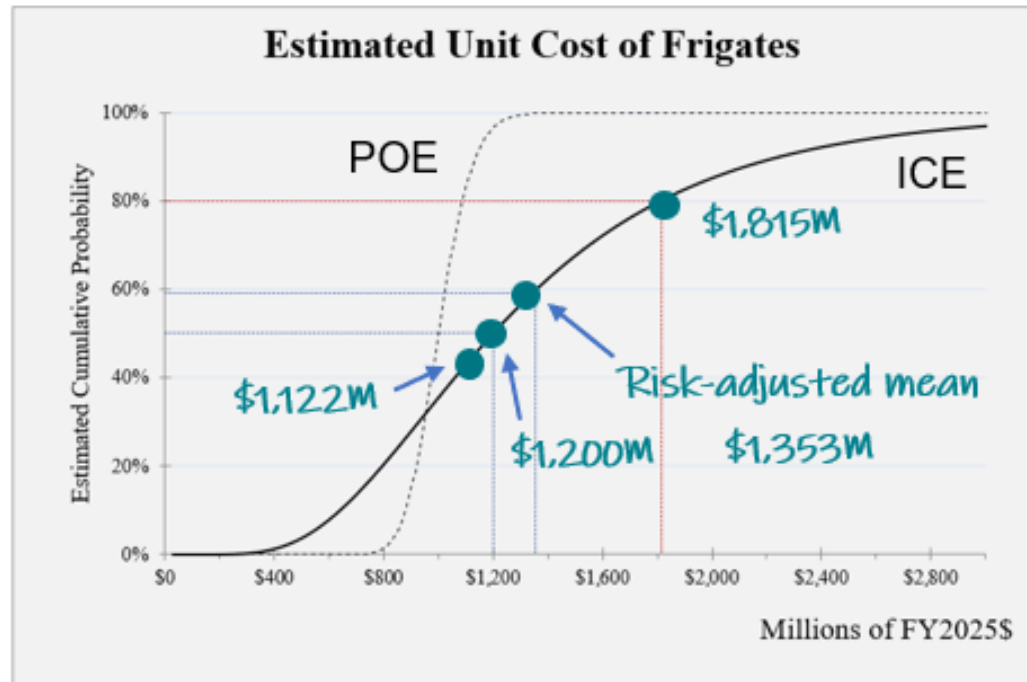
- Point Estimate = \$1,200M
- CV = 52%
- Distribution = Normal
- Estimate at the Median
- Quantity = 30

Initial pricing selections from decision-maker

- P80
- P75
- Pμ
- P50
- P45



Output



Total Cost (\$Shortfall)

- P80 \$54,450M (\$22,450M)
- P75
- Pμ \$40,590M (\$8,590M)
- P50 \$36,000M (\$4,000M)
- P45 \$33,600M (\$1,600M)

Funding = \$32,000M for 30 Ships

Affordability Baseline

Portfolio Affordability: Baseline (FY25\$M)

Fixed – an exogenous variable

Pricing at the Threshold value

Frigate
(Choose: ● ● ●)

Portfolio
(1 to 10 list)

Total
(Frigate + Portfolio)

	Requirement (Budget Request)	Funding (Baseline)	Shortfall Funding - Request
	\$36,000	\$32,000	\$4,000
	\$696,084	\$674,861	\$21,223
	\$732,084	\$706,861	\$25,223

Sample Offsets

Offsets: Carriers

Bp = basis point = 1/100 of 1 percent

Offsets: Amphibs

Carriers: Baseline		
P-Value for Budget =		60%
Value of Project Punch =		1.45
Resourcing (FY25\$M)		
Requirement	Funding	Shortfall
\$108,029	\$108,029	\$0

**Cut Quantity
(Decrease Punch)**

 10%
 20%
 30%
 Other

**Accept More
Budget Risk**

 100 bps
 200 bps
 300 bps
 Other

600 bps

Project Punch
(unchanged)

1.45

Savings (\$M)

\$5,450

Amphibs: Baseline		
P-Value for Budget =		75%
Value of Project Punch =		1.37
Resourcing (FY25\$M)		
Requirement	Funding	Shortfall
\$93,875	\$93,875	\$0

**Cut Quantity
(Decrease Punch)**

 10%
 20%
 30%
 5% Other

**Accept More
Budget Risk**

 100 bps
 200 bps
 300 bps
 Other

500 bps

Project Punch

1.35

Savings (\$M)

\$8,550

Offsets: Unmanned Vessels

Unmanned Vessels: Baseline		
P-Value for Budget =		75%
Value of Project Punch =		1.80
Resourcing (FY25\$M)		
Requirement	Funding	Shortfall
\$80,352	\$78,000	\$2,352

**Cut Quantity
(Decrease Punch)**

 10%
 20%
 30%
 Other

**Accept More
Budget Risk**

 100 bps
 200 bps
 300 bps
 Other

Project Punch

1.72

Savings (\$M)

\$11,747

Portfolio Affordability: Running Totals (FY25\$M)

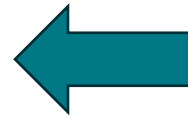
	Requirement (Budget Request)	Funding (Baseline)	Shortfall Funding - Request
<p style="color: teal;">Pricing at the Threshold value</p> <p>Frigate (Choose: ● ● ●)</p>	\$36,000	\$32,000	\$4,000
Portfolio (1 to 10 list)	\$670,337	\$674,861	\$4,524
Total (Frigate + Portfolio)	\$706,337	\$706,861	\$534

GOVERNANCE

The affordability analysis framework and tool illuminate trade space for leadership – with a laser focus on risk and impact

But *what's the governance structure, or how do you run the machine?*

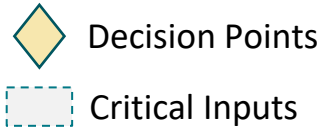
- Timelines of activities
- Deliverables
- Providers of information
- Stakeholders
- Decision points



Who does *what* and *when* and *how* to implement the framework and to execute the analysis?

Rudyard Kipling: “I keep six honest serving-men (They taught me all I knew); their names are **What** and **Why** and **When** and **How** and **Where** and **Who**”

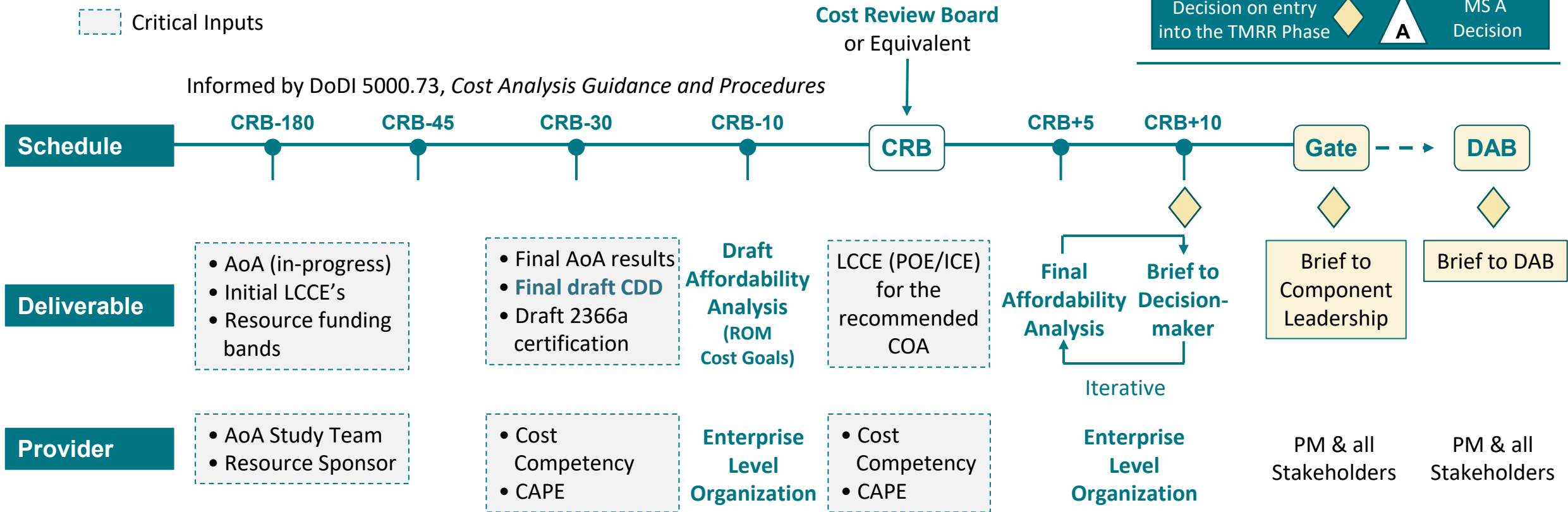
Governance: DOD Milestone A



DoDI 5000.85: Major Capability Acquisition



Informed by DoDI 5000.73, *Cost Analysis Guidance and Procedures*



AoA's run from six months to two years

● - - - - -> **JCIDS: KCP ROM Goals for the draft CDD**

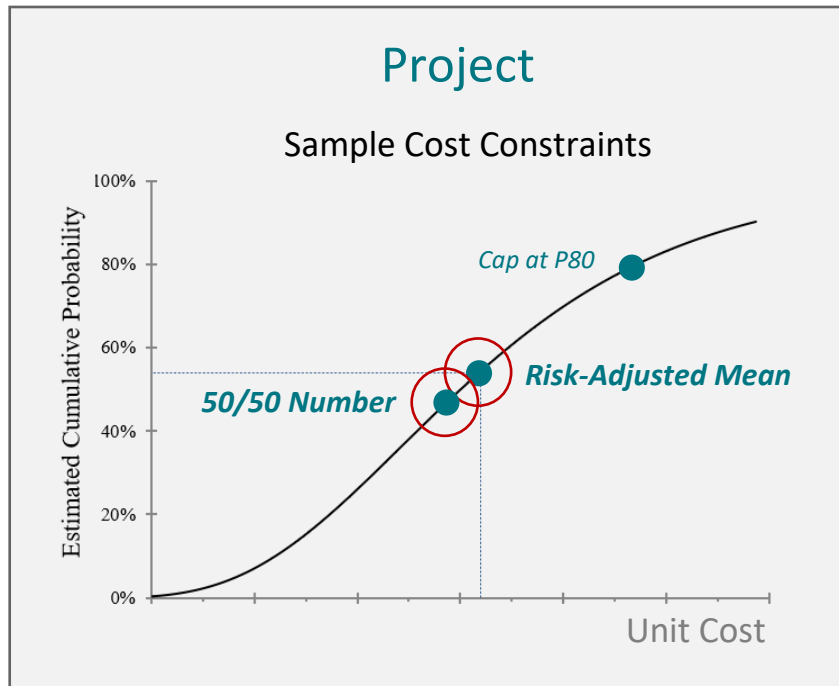
2366a: MDA certifies that "Level of resources required to develop, procure, and sustain the program is sufficient for successful program execution"

Affordability Analysis executed in tandem with the AoA

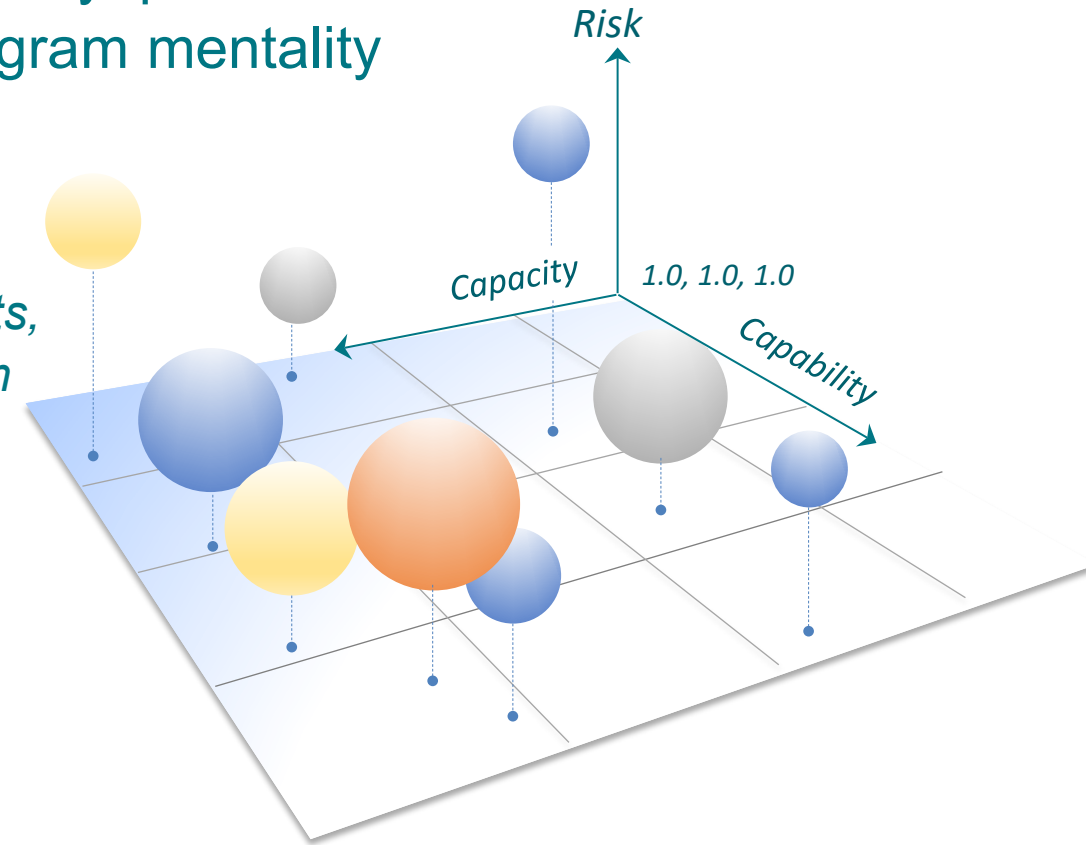
Key Cost Parameters: PAUC, APUC, & annual sustainment cost

SUMMARY

Our innovation **punctures** traditional thinking with its myopic reliance on sand charts and a fit-to-the-five-year-program mentality



Integrates project costs, funding, and risk with strategic decision-making



Transforms financial constraints into **opportunities** to right-size the **portfolio** to ensure **affordability**

SUMMARY



The right product at the right time