

Program Affordability Engineering Framework (AEF)

NPS Acquisition Research Symposium Panel Discussion

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Overview

- Program Affordability is of paramount importance in the current fiscal environment.
- MITRE's Affordability Engineering Framework (AEF) Project aims to develop a systems engineering process to address Program Affordability.
 - Goal: Shape program to achieve BBP "should cost" and address affordability challenges.
 - Maturity: ~60% overall; development scheduled to complete Sep '12.
 - Currently identifying pilot programs to shape and validate AEF tools and techniques.

The AEF can benefit the PMO by providing an actionable process to proactively manage program affordability.



AEF Objectives

Provide a standardized, actionable, systems engineering approach to make programs more affordable in execution.

Improve government program technical and budget planning.

- Develop a government technical reference design.
 - Requirements feasibility, cost/performance modeling, RFP preparation and proposal evaluation.

Reduce "uncertainty" in cost-estimating to mitigate affordability risk.

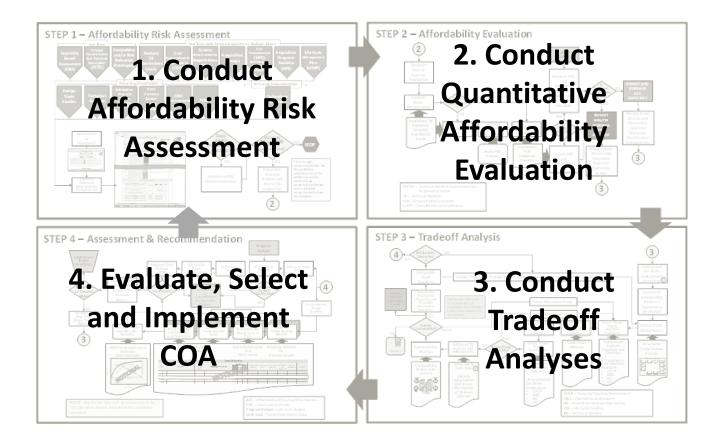
- Build a comprehensive program baseline based on the reference design "Acquisition Systems Engineering Baseline" – similar to CARD.
- Frequently iterate the ASE baseline as a "living document" to tightly couple PMO cost analysis and technical activities.
- Develop integrated program trade-space for cost, schedule and performance to construct COAs to address affordability.
 - Provide data driven analytical products for more accurate and defendable PMO cost positions and trade offs.
 - Emphasize integrated systems engineering and cost estimating activities.

Institutionalize "cost consciousness" in PMO decision-making.



The Affordability Engineering Framework

 Multi-step process conducted iteratively throughout the program lifecycle.



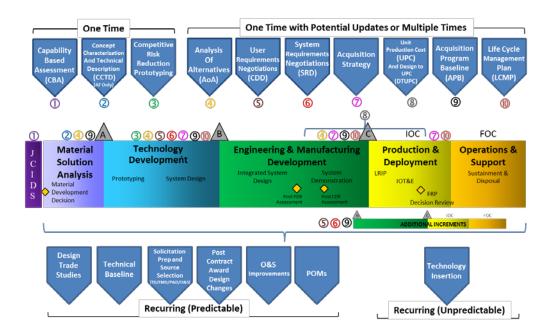


AEF in the Program Lifecycle

- AEF initiated by "triggers" that map to critical acquisition engineering/management activities and decision points:
 - Program changes
 - POM cycles
 - Regulatory and statutory requirements

More frequent assessments

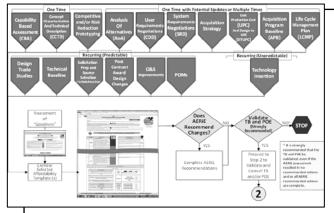
(beyond the current regulatory and statutory requirements)



designed to provide better affordability "situational awareness" and coherency between measurements.

Increased affordability "situational awareness" for improved program decision-making.

AEF Step 1 – Affordability Risk Assessment



- Affordability Engineering Risk Evaluation AERiE Tool
- "Quick look" using an excel-based tool – "AERiE".
- Templates designed for each "trigger" point derived from lessons-learned and SME recommendations.
- Interview and evaluate program information/documentation...
- "Maturity Assessment": Content detail?
- "Confidence assessment": Process and content quality?

Output(s):

> Affordability Risk Assessment.

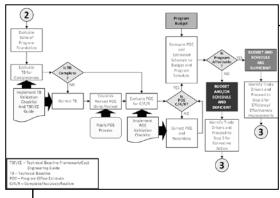
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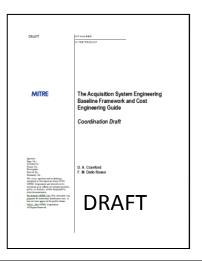
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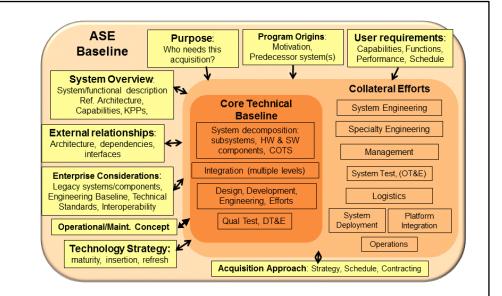
Partial Acquisition Systems Engineering (ASE) Baseline (analogous to DoD CARD data)

AEF Step 2 – Affordability Evaluation



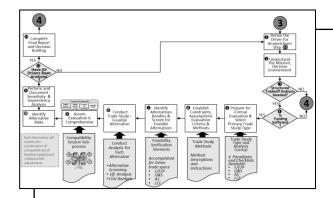
- Conduct quantitative evaluation of the program affordability
- Assemble a comprehensive "Acquisition Systems Engineering (ASE) Baseline". ..similar to CARD.
- Emphasis on:
- Multi-discipline Teams
- Detailed Core
 Technical design
- Risk mitigation.
- > Modeling.
- Program
 Interdependency.
- Acq Strategy.





- Evaluate and iterate the Program Office Estimate (POE).
 - Compare the POE to the existing program budget.
- Outputs:
 - Quantitative affordability position.
 - Completed ASE Baseline and POE.
 - Integrated C/S/P trade space.
 - Cost drivers and uncertainty.

AEF Step 3 – Tradeoff Analysis



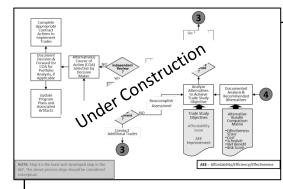
- □ Leverage integrated C/S/P trade space to develop and analyze trade offs.
- Structured trade study analysis process: constraints ,assumptions, evaluation criteria, weighting.

Durida	Critical Criteria											Nor	n-Criti	cal Cri	iteria		ss	"Raw De	"Raw Decision Criteria		
Decision Criteria	Speed	Weight = .22	SupportVendors	Weight 07	Tech Brandy Level		Op Avenitity A _o	Weehler .17	RangeineMiles	Weight = 20		wi 60 .07	Tech T	Veiener .04		.e			Schedule in Months	Risk Score (P)	Comments
Baseline Case >																					
Scored Weighten Core	0.60	0.13	1.00	0.07	4.00	0.60	0.40	0.12	0.80	0.16	2.00	0.14	4.90	0.20	4.00	0.36	1.73	1465	24	69.00	Baseline System for Effectiveness
Actual Value	23 m	nph	1 ven	dor	TR	L 9	A ₀ =	72%	195	mi	9 le	vel	20.7	mo	On	e Sys	1.75	1405		05.00	Comparison
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Score / Veight of Score	2.40	0.53	3.00	0.21	1.00	0.15	2.90	0.49	3.10	0.62	2.00	0.14	4.90	0.20	1.00	0.09	2.43	1155	36	58.93	
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Alternative 2																					
Score / Weighted Score	4.50	0.99	3.00	0.21	2.00	0.30	3.80	0.65	3.20	0.64	3.00	0.21	3.10	0.12	5.00	0.45	3.57	1071	21	47.14	
Actual Value	60 m	nph	3 vend	iors	TR	L 7	A ₀ = 8	39.5%	255	mi	7 Le	vel	12.3	mo	NSA	Prod	3.57	10/1	21	47.14	
Alternative 3																					
Score / Weighted Score	4.50	0.99	1.00	0.07	2.00	0.30	0.00	0.00	3.20	0.64	1.00	0.07	2.40	0.10	3.00	0.27	2.44	1605	18	72.02	Eliminate Alternative - Fails to meet minimum
Actual Value	60 m	nph	1 ven	dor	TR	L 7	A ₀ =	60%	255	mi	1 Of	ficer	10.2	mo	Accr	r Pend	2.44	1005	18	72.02	operational availability

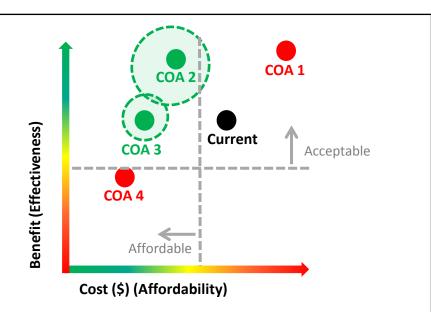
Tradeoff Alternatives Analysis Summary Table

- Tradeoff types determined by primary driver:
 - Features, functions, performance
 - Operations and support
 - Acquisition strategy
 - Life Cycle Funding
- □ Each tradeoff is measured for:
 - Effectiveness
 - Cost
 - Schedule
 - Risk scoring
 - Sensitivity analysis
 - Dependency (i.e., change compatibility)
- Output:
 - Tradeoff Analysis Summary Table

AEF Step 4 – COA Selection and Implementation



- Evaluate the candidate COAs for: affordability targets, mission effectiveness, and efficiency.
- Benefit scores are normalized values from decision factors.
 - Acceptable score determined from effectiveness measures.
- Cost score from analyses .
- Both benefit and cost scores incorporate uncertainty ranges.



- Select a COA and develop the implementation plan.
- **Output:**
 - Decision to execute Course Of Action to achieve affordability objective.
 - > Initial implementation plan.

Takeaways to Improve Program Affordability

Institute a data-driven SE process to measure program affordability and manage to "should cost".

- Develop and maintain a government reference technical design to strengthen government program technical team.
 - Use for requirements realism, cost estimating/modeling, proposal risk evaluation.
- Use a comprehensive "costable" program baseline (e.g. CARD or ASE) and iterate it frequently to maintain an accurate cost estimate.
 - Align cost models, technical configurations and performance models.
- Develop and leverage integrated C/S/P program trade space for COAs to respond to budget challenges.
- Conduct the process with integrated Systems Engineering and Cost Analysis teams.

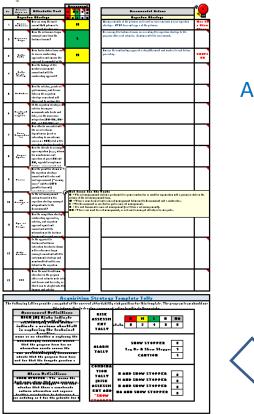
Adopt a rigorous Affordability Engineering approach to "exercise more disciplined use of defense dollars".

Back-Up

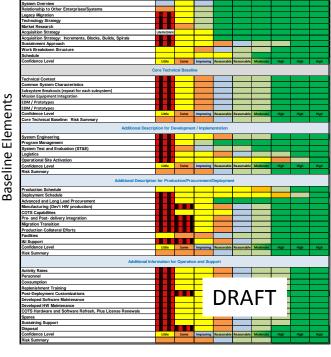
AEF Step 1 – Affordability Risk Assessment

Program Origins and Motiv

AERiE Tool







Lifecycle

Life Cycle Event: MDD AoA

MS A Pre MS B Post MS Post MS Post MS ON MS C

Acquisition Systems Engineering Baseline

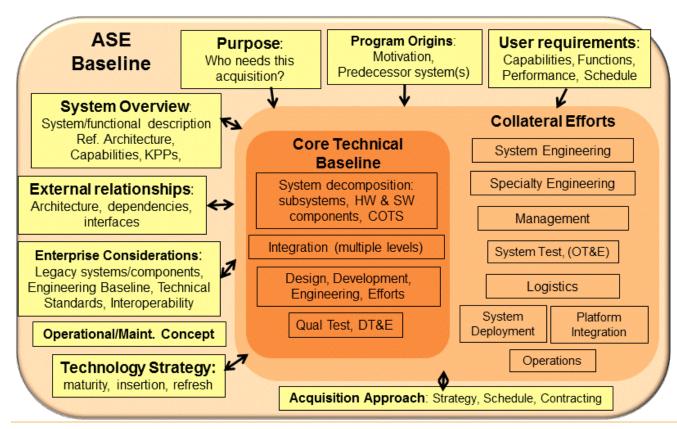
Chart Legend							
Can't Reasonably be Defined							
Assumptions							
Early Approximation							
Preliminary Definition							
Improved Definition							
Stable Definition							

Confidence Assessment

31	10	Risk Management	applied in production cost Is the risk management system described in the acquisition strategy managed independently by the Government?	management team. M = There is some for L = The Government U = It is not known w	ment system rm of jointly or an object ho runs risk	is performed by a prime contractor or another organization with a pecuniary stake in the actions of the risk run risk management between the Government and a contractor. <i>ive</i> party runs risk management. management (or if there is risk management). nagement, or risk can be managed effectively by any party.	
			Are the competition strategy, contracting approaches,				

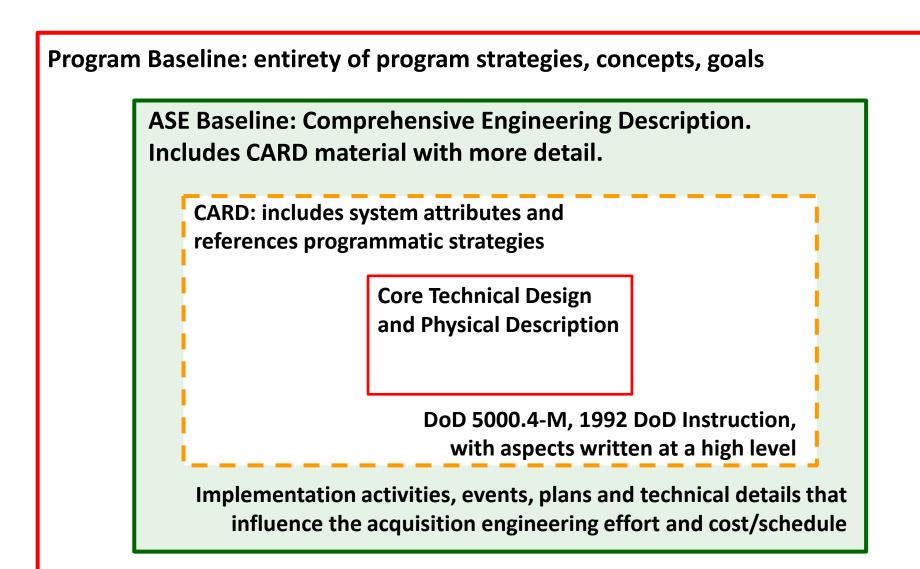
Acquisition Systems Engineering (ASE) Baseline

- The system description and characteristics, program definition, and acquisition approach that account for all aspects of a program relevant to cost and schedule
- Developed by a cross-functional program team
- Used to perform engineering trade-offs and estimates of all types in support of acquisition decisions

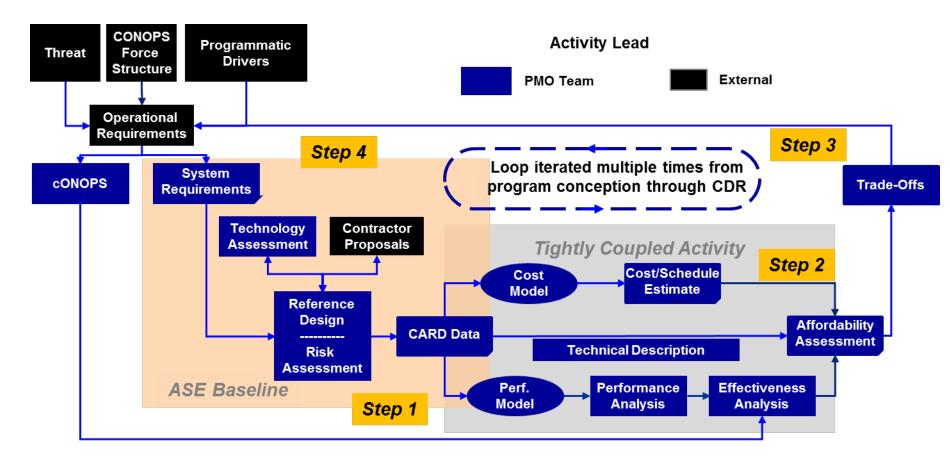


Being matured via the Affordability Engineering Framework (AEF) Capstone Project

Relative Scope of the ASE Baseline



AEF Example



Reference design" is key to coherency

"Tightly coupled activity" permits rapid projection of performance, cost, schedule, and risk to support definition and refinement of system requirements

Lessons Learned from R-TOC Program

- Reduction in Total Ownership Cost (R-TOC) was a 1999 DoD initiative.
- 2008 IDA R-TOC Lessons Learned Memo
 - Involve command cost investment analysis personnel as part of the program IPT.
 - Accurate and timely data are essential to identify savings.
 - Try to understand the lifecycle implications when making decisions.
 - Large savings requires large investment.

