Responsive Cost Estimating

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Agenda

- Responsive Cost Estimating
- Why the Need?
- Enabling Concepts & Effects to the Cost Estimating Process
- Enabling Techniques
- Enabling Tools

Responsive Cost Estimating

- A definition…
- Cost Estimating:
  - The process of collecting and analyzing historical data and applying quantitative models, techniques, tools, and databases to predict the future cost of an item, product, program, or task (Ref: CEBoK)

- Responsive cost estimating is a related concept, where steps with the process or even the process itself can be streamlined, changed or updated, to best accomplish the driving change parameter
- The key enabler is establishing, maintaining and adhering to a well-defined cost estimating process by a technically proficient analyst who has a clear understanding of the cost and cost implications of various technical, schedule and programmatic options

Why the Need?

- Middle Tier Acquisition (MTA) (Section 804)
  - Rapid Feilding
    - Use proven technologies or off-the-shelf capability to field production quantities of new or upgraded systems with minimal development required
  - Rapid Prototyping
    - Use innovative technology to rapidly develop fieldable prototypes to demonstrate new capabilities, meet emerging military needs
- Internal IR&D/OTA
- Spacecraft Operational Model (Class A to D)
  - Accountability, Affordability, Oversight, Contract Type and Schedule
- Agile SW Development

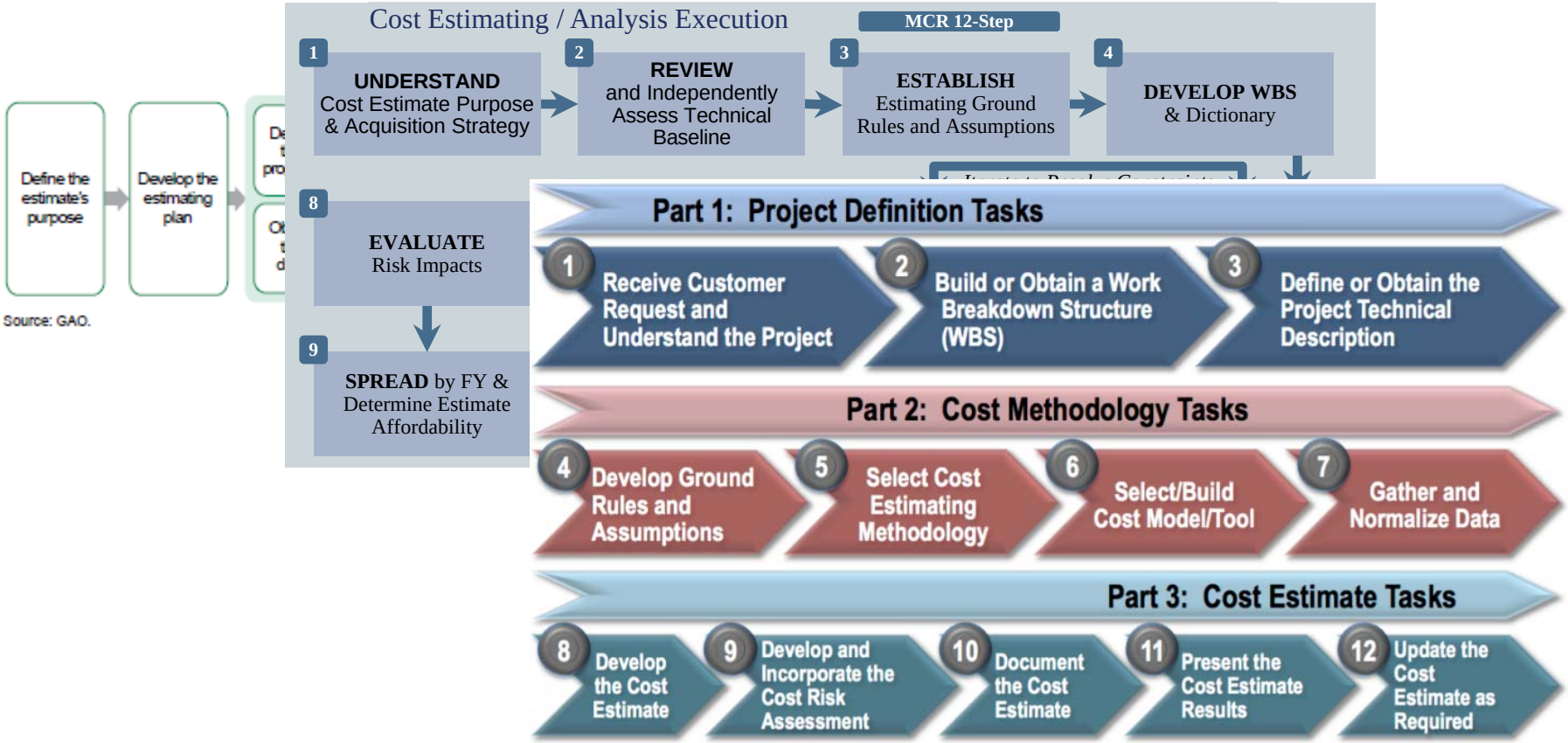
Cost Estimating Process

Initiation and research
Your audience, what you are estimating, and why you are estimating it are of the utmost importance

Assessment
Cost assessment steps are iterative and can be accomplished in varying order or concurrently

Analysis
The confidence in the point or range of the estimate is crucial to the decision maker

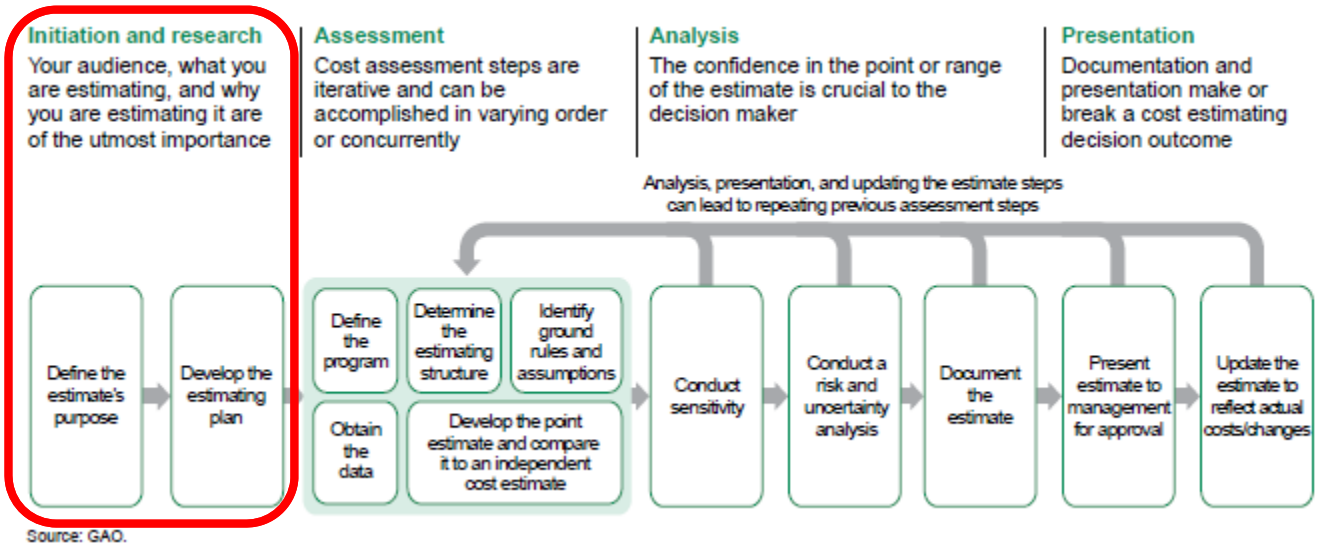
Presentation
Documentation and presentation make or break a cost estimating decision outcome



Source: GAO.

Enabling Concepts

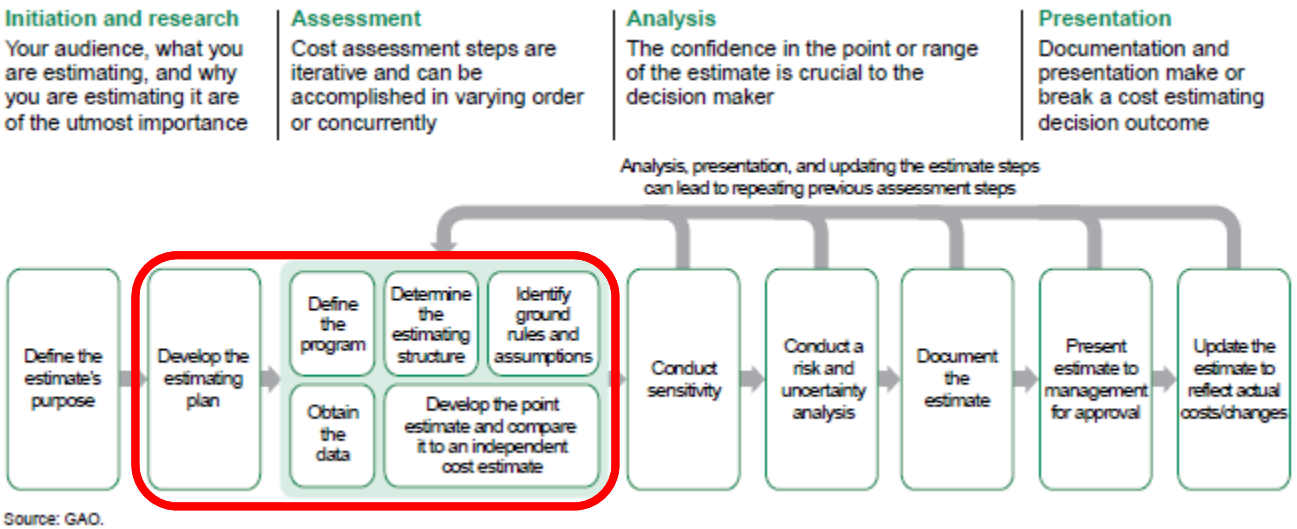
- Establishing and maintaining a culture of continuous improvement
- Understanding the purpose and timeline for the current cost estimate/analysis and where the program is in its acquisition lifecycle



Source: GAO.

Enabling Concepts

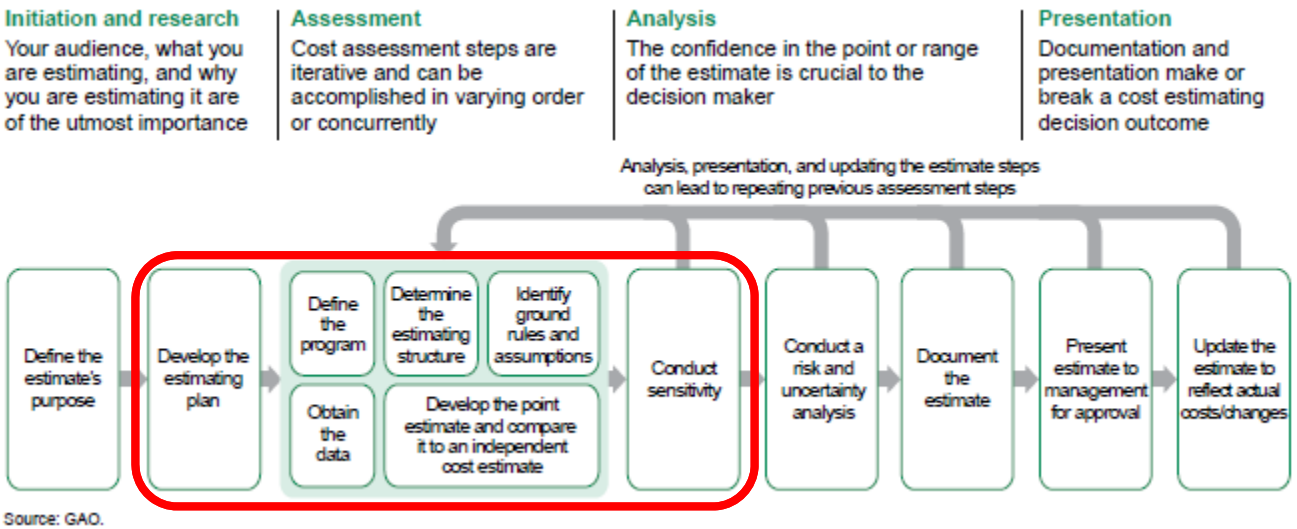
- Review and understanding the current technical baseline and the cost estimating methodologies that have been used to estimate similar or analogous programs and well as anticipating new or emerging data sources what would improve the responsiveness of the estimate to “what if” analysis



Source: GAO.

Enabling Concepts

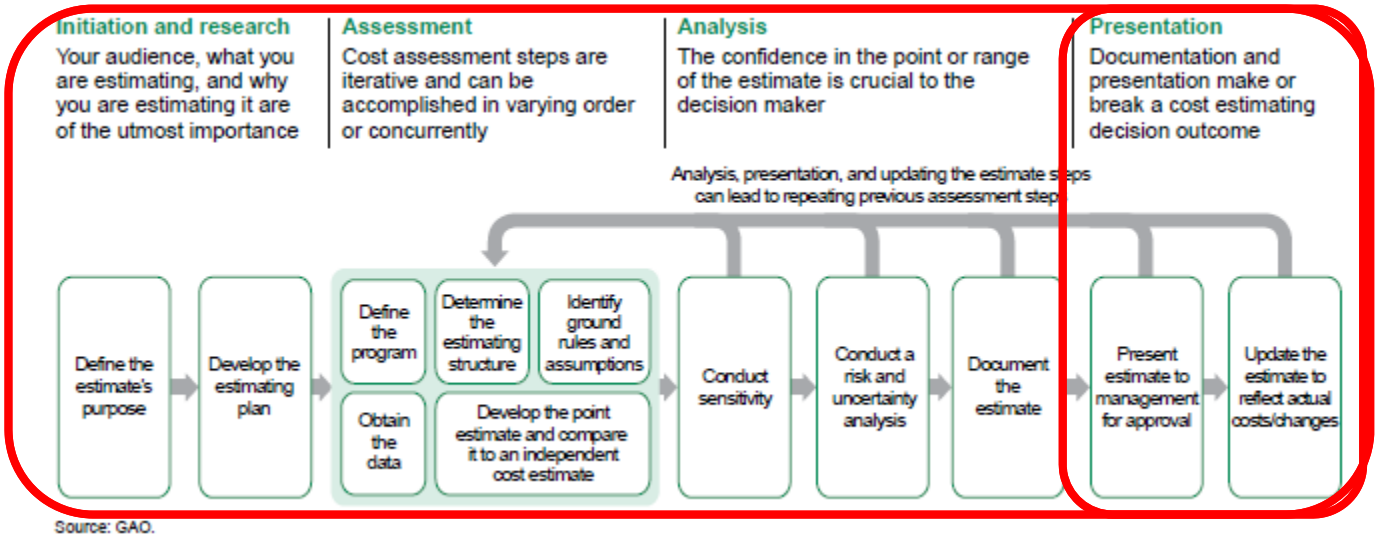
- Depending on the estimate's purpose and timeline, identify the most appropriate primary estimating methodology and appropriate (WBS) level of estimating
- Understanding the cost drivers in appropriate detail when compared to the WBS level of the estimate and the responsive requirements of the cost estimate



Source: GAO.

Enabling Concepts

- Ensuring final documentation, analysis and results are used to feedback and improve the cost estimating process
- Identifying where the cost estimating process itself may be streamlined and how best to accomplish the streamlining



Source: GAO.

Enabling Techniques

- Our tried-and-true methods of data collection, visualization and regression analysis are being enhanced by advanced data analytics, machine learning and continuous research
- Data Analytics
  - Better data visualization/analysis with tools like Power BI, R and Python
  - Extensive (and free) libraries and visualization tools on these platforms enable better analysis and communication to be performed faster
  - WebApps (e.g. developed with R Shiny) enable quick, credible analysis
- Machine Learning
  - Leverage machine learning when we encounter relatively large datasets
  - Value predictive accuracy over model interpretability (at least initially)
- Continuous Research
  - Anticipate new cost estimating problems and continuously develop/innovate new methods and approaches
  - Research will ensure the right tools/methods are available at the right time

Some Tools that Enable Responsive Cost Estimating

Responsive Cost Estimating

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How can we be responsive?

Parametric Cost Modeling is an Enabler to Responsive Estimating

Multi-function parameters

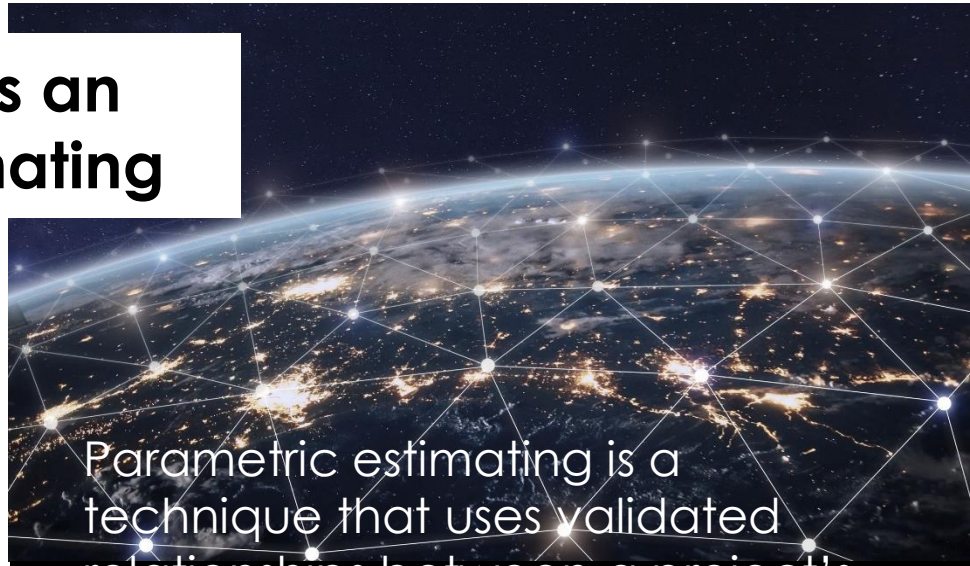
- The parametric model must be comprehensive with visibility into all functions

Multi-parameter impact

- Typically the model is statistically multi-variate

Near or Real-time results

- Assessment of impacts to changes must be quick turn to be meaningful – including monte-carlo based risk assessment



Parametric estimating is a technique that uses validated relationships between a project's known technical, programmatic, and cost characteristics and known historical resources consumed during the development, manufacture, modification, deployment, and/or disposal of an end item. 1

1. International Cost Estimating and Analysis Association (ICEAA) 2014

2015

THE SEER SUITE

Predictive Analytics for Various Domains

SEER-SEM

Software/application development, maintenance, integration and testing for Total Ownership Cost

SEER-H

System, hardware and electronics development, production and support for Total Ownership Cost

SEER-IT

IT infrastructure, services and operations including Service desk, Tier 1-3 support, and ongoing support

SEER-MFG

Hardware manufacturing and assembly with automated CAD to Cost

SEER-SYS

Systems Engineering cost estimation for systems of all sizes and complexities

SEER-SPACE

Estimates entire lifecycle cost for key instruments and spacecraft subsystems

Industry and Government Cost and Non-Cost Data collected and analyzed over many years and packaged into a user friendly tool to predict costs in a probabilistic manner and can be implemented into any organization for a responsive cost estimating solution

KNOWLEDGE BASES

SEER-H uses *knowledge bases* to derive and **preset** initial parameter settings based on industry experience

Choose knowledge bases for:

The Standard Knowledge Base can be used to emulate a Rapid Prototype/Fielding Construct (OTA/804)

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Parametric Estimation for Agile Projects

Features

Project Characteristics

Description
Fraud Portal

Platform
Web Based Development

Application
Customer Relationship Management

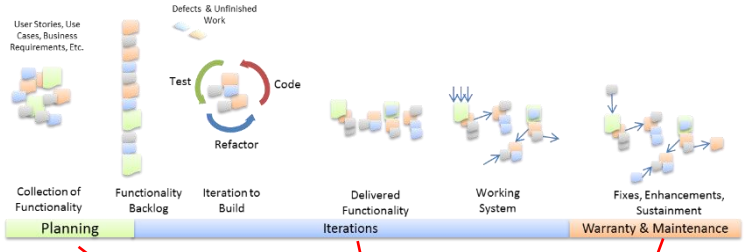
Acquisition Method
!~New Development

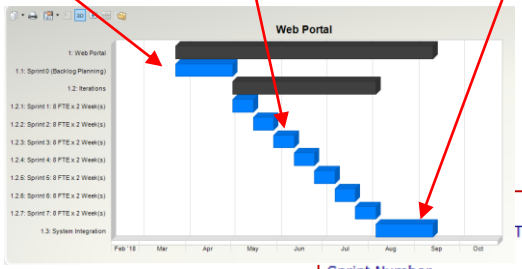
Agile Framework
Agile Full

Development Standard
Commercial

Team Dynamics

Development Team





Estimate	
TE x 4 Weeks	
	Team A
Sprint Number	1
Sprint Duration Months	0.92
Sprint Effort Months	6.46
Sprint Effort Hours	981
Sprint Labor Cost	134,290
Sprint Velocity (UFP)	103.00
Team Size	7.00
Start Date	12/27/2018
End Date	1/24/2019

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SEER-SYS

Understanding what is NOT being done is critical

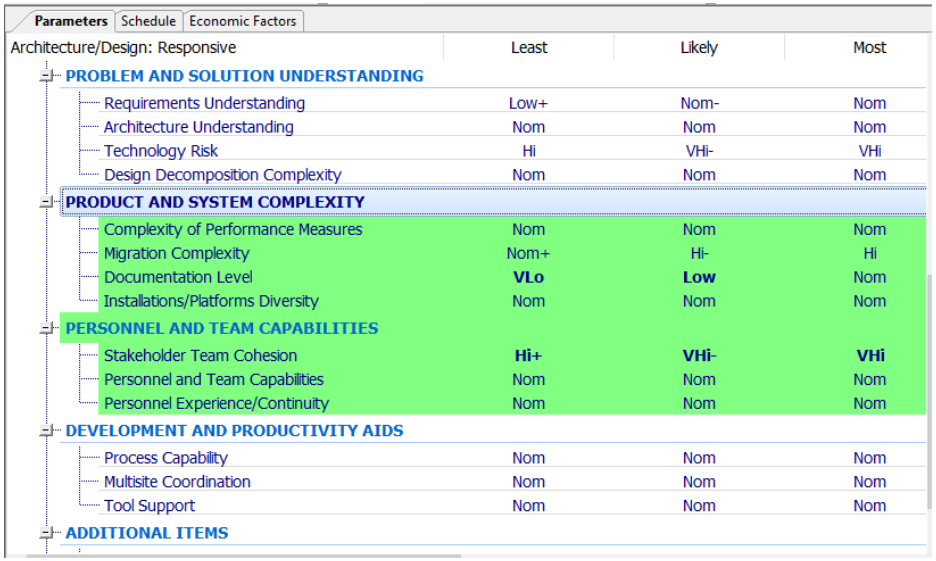
Typically, in an 804/OTA/IRAD development the requirements are waived or relaxed

Deep Dive into the SE Content

Segmentation of the systems engineering process to determine what requirements are being relaxed and the corresponding cost impacts

Non-linear, multi variate relationships

How do all these parameters collectively affect the systems engineering estimate?



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Impact on Program Office

Understanding what is NOT being done is critical

Typically, in an 804/OTA/IRAD development the requirements are waived or relaxed

Deep Dive into the PM Content

What are the requirements of PM in terms of reporting, contract terms and conditions, or any other documentation.

Be mindful of OGCs

Recall with 804 acquisition policy the JCIDS and DoDD 5000 are not applicable

Parameters

PROJECT: Computer	Least	Likely	Most	Note
SYSTEM LEVEL COST ANALYSIS		YES		
System Engineering and Integration (SEI)		YES		
SEI Development Complexity	Nom	Nom	Nom	
SEI Development Experience	Nom	Nom	Nom	
SEI Production Complexity	Nom	Nom	Nom	
SEI Production Experience	Nom	Nom	Nom	
Integration, Assembly and Test (IAT)		YES		
IAT Development Complexity	Nom	Nom	Nom	
IAT Development Experience	Nom	Nom	Nom	
IAT Production Complexity	Nom	Nom	Nom	
IAT Production Experience	Nom	Nom	Nom	
System Program Management (SPM)		YES		
SPM Development Complexity	Nom	Nom	Nom	
SPM Development Experience	Nom	Nom	Nom	
SPM Production Complexity	Nom	Nom	Nom	
SPM Production Experience	Nom	Nom	Nom	
System Test Operations (STO)		YES		
STO Complexity	Nom	Nom	Nom	
STO Experience	Nom	Nom	Nom	
System Support Equipment (SSE)		YES		
SSE Complexity	Nom	Nom	Nom	
SSE Experience	Nom	Nom	Nom	
<<Rollup Weight(lb)>>	23.95	29.95	34.95	
PROBABILITY		50.00%		