How Has Effective Systems Engineering Benefited Our Defense Programs

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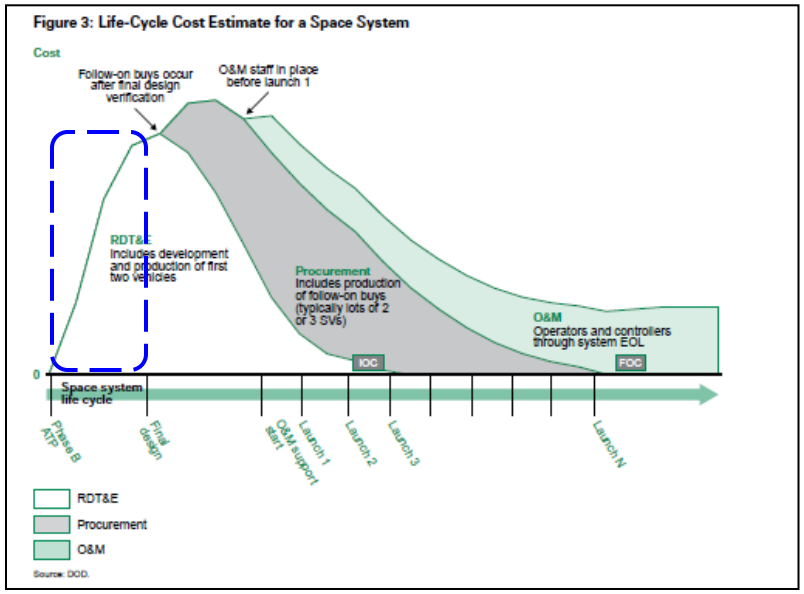
Craig Miller

Vice-President, Systems Engineering

Government Communications Systems

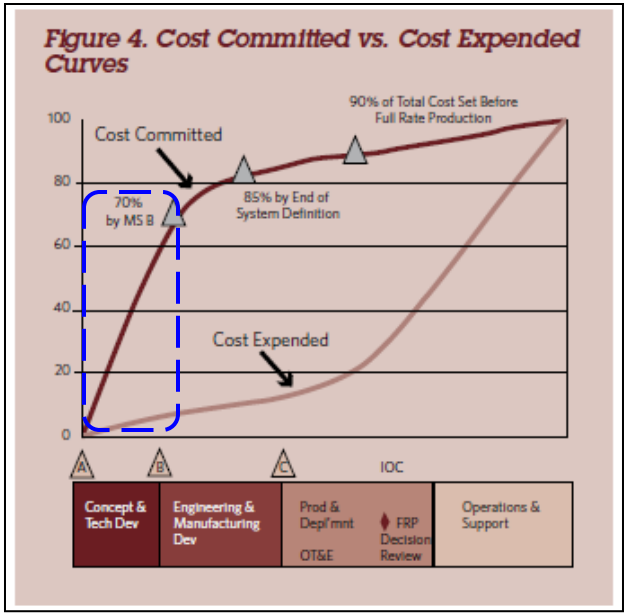
Affordability:
- Capability vs. Cost Tradeoffs



Typically 60-70% of life cycle costs are locked in by early architecture/design decisions.

The ability to influence cost erodes quickly.

Cost committed can be high even while cost incurred to date is low.



Reference: GAO Cost Estimating and Assessment Guide, 2009.
www.gao.gov/new.items/d093sp.pdf

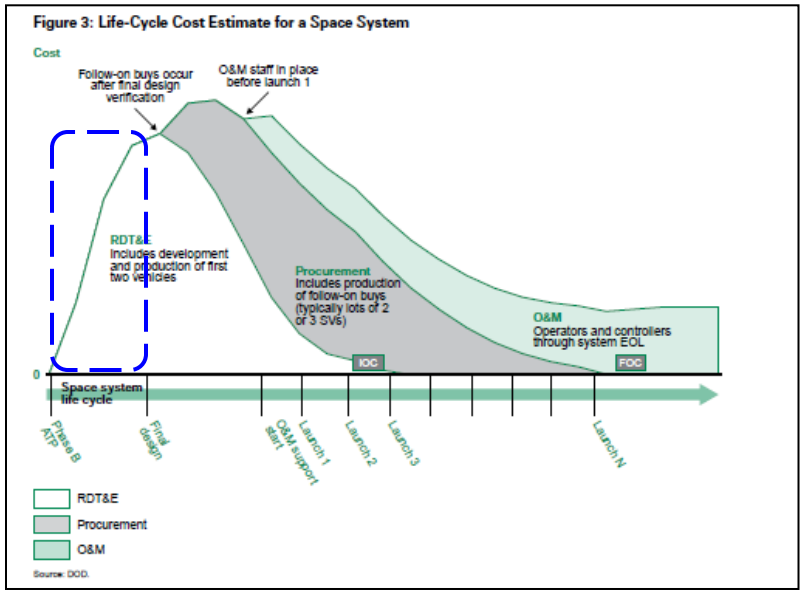
Reference: Defense AT&L: Product Support Issue, Mar-Apr 2012.
http://www.dau.mil/pubscats/ATL%20Docs/Mar_Apr_2012/

Consider potential cost drivers in evaluating and proposing architectural solutions:

- Mission capability
- Requirements
- Performance
- Quality attributes ("ilities")
- Funding profile and constraints
- Make/buy decisions
- DTC / DFx
- COTS, custom, reuse
- LCC / supportability costs

Early system architecture/design decisions have profound impacts on affordability, life cycle cost, and program execution

Affordability:
- Capability vs. Cost Tradeoffs



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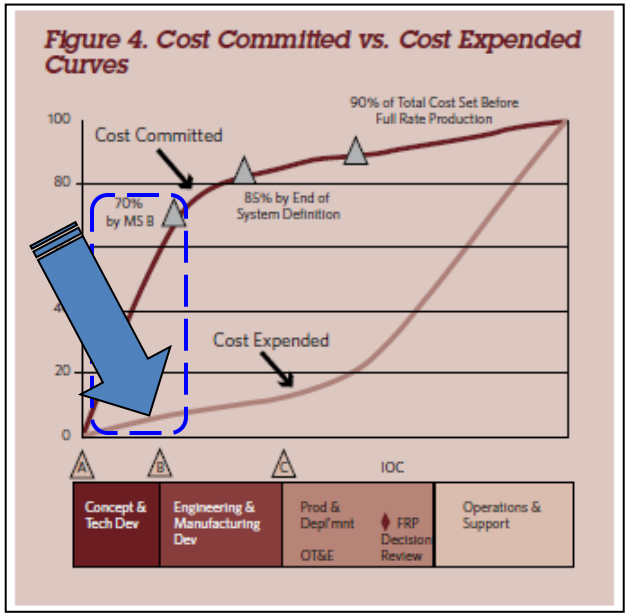

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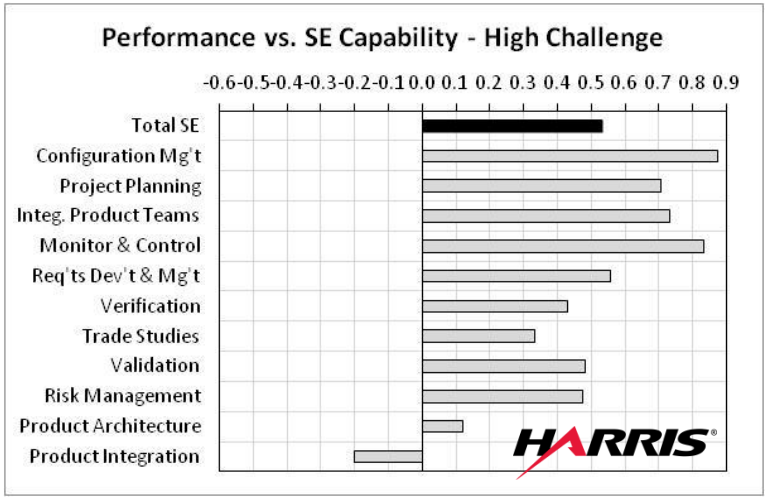
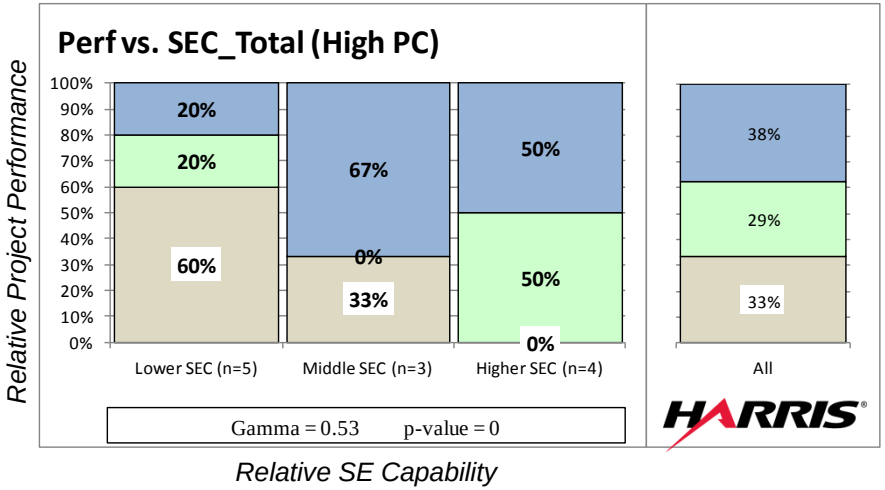
Correlating SE Capability and Project Performance

Harris Projects in NDIA/IEEE/SEI SE Effectiveness Study

- The NDIA/IEEE/SEI SE Effectiveness Study (2007, 2012) quantifies SE process capability vs. project performance
  - Strongest Harris correlations were observed for the most challenging projects … where SE capability is needed most
- Also provides a convenient way to benchmark Harris projects against industry data sets

Reference: "The Business Case for Systems Engineering Study: Results of the Systems Engineering Effectiveness Survey" (SEI report publication pending)
Acknowledgement to Joe Elm, Software Engineering Institute.





Higher SE Capability is Correlated with Better Project Performance – Especially on the Most Challenging Projects

Measures of Operational Improvement

Define → Measure → Analyze → **Improve** → Control

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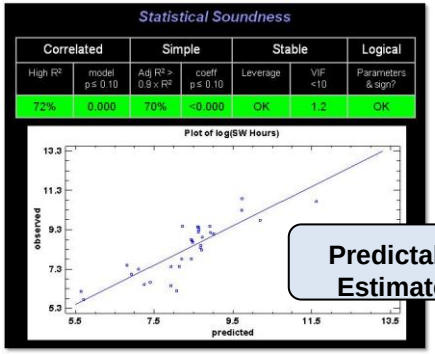
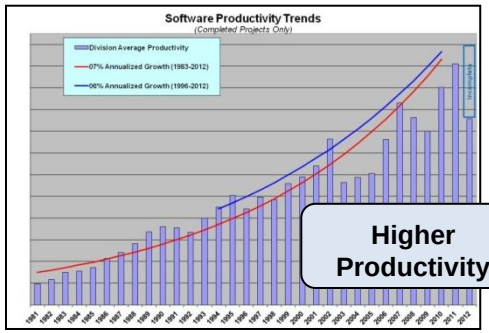
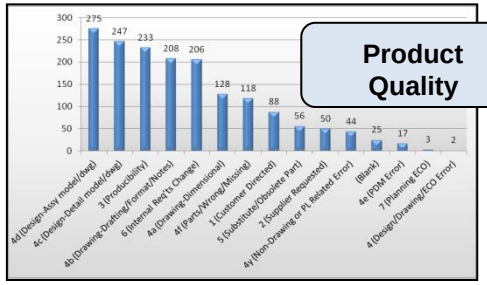
Engineering Performance Improvements



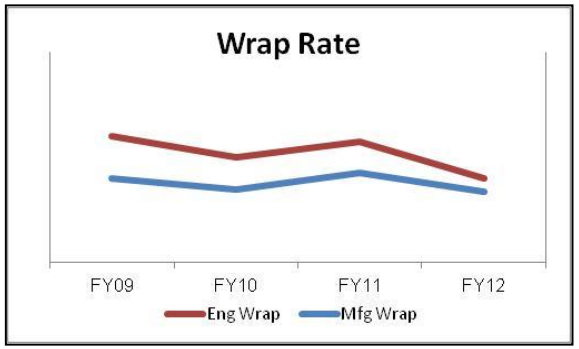
Predictable Estimates



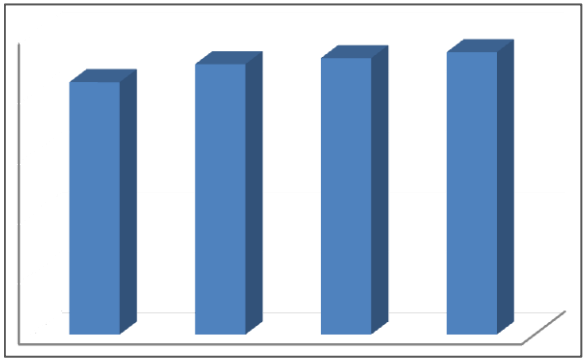
Higher Productivity



Product Quality



Award Fee



Business Results

Sustained Emphasis on Operational Effectiveness and Customer Intimacy Has Produced Positive Business Effects

Achieving the Benefits of Effective Systems Engineering

Best Practice Successes:

- Early Program Engagement
  - Affordability
  - Program Startup Teams ("Boots on the Ground")
- Early SE Emphasis
  - Mission Analysis, Partnerships
  - "Left Side of the Vee" (Architecture, Reqts, Design)
  - SE Process Discipline
- Early Proactive Action
  - Leading Indicators (Measures)
  - Risk Management
  - Non-Advocate Reviews (Design Reviews, Peer Reviews, IRTs)

Opportunities:

- Shaping Successful Programs (Development Planning)
- Realizing "80% Solutions"
- Aligning Investments (S&T, IR&D)
- Enterprise Architectures, SoSE
- Model-Based Engineering / Platform-Based Engineering
- Concurrent Engineering
  - DTC, DFx, Mfg, LCC, O&S, …
- Growing SE Capabilities, Pipelines

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Innovation. Performance. Anytime. Anywhere.

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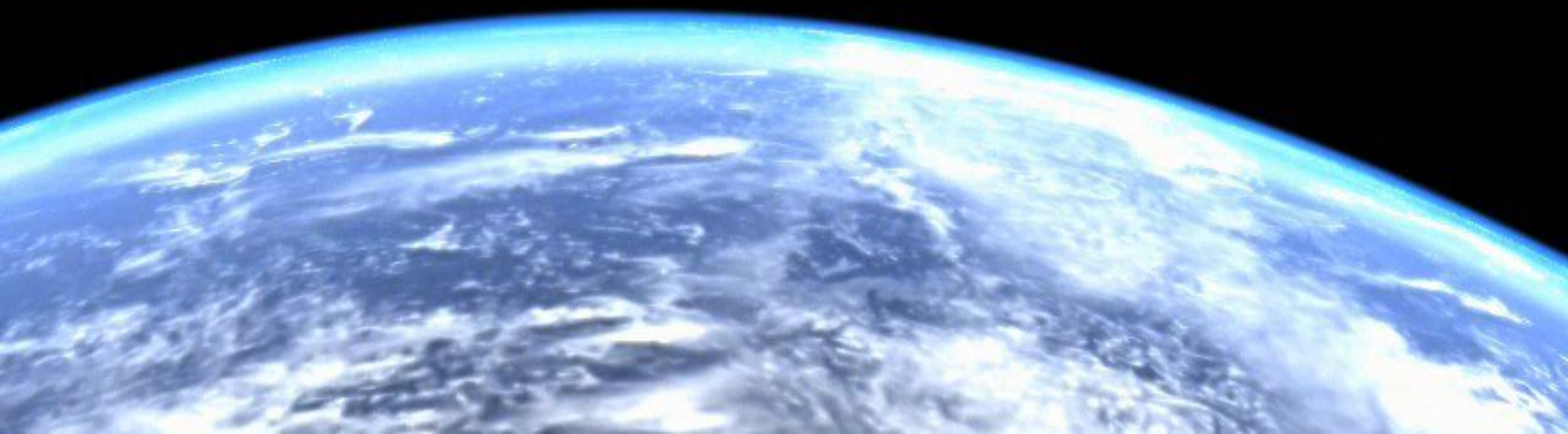


Engineering Organization

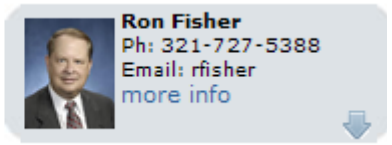
•GCS Division VP-Engineering

Operations Focused

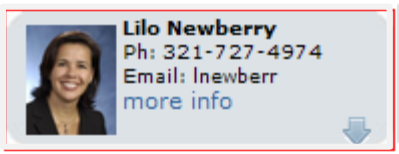
VP-Engineering Operations

9 Verticals
30 Departments (EMs)
2550 Employees

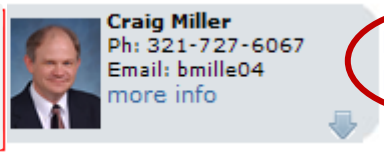
- Antennas, RF, Photonics
- Software
- Mechanical
- System Support/CM
- System I&T
- Digital
- Advanced Sys & Technology (AS&T)
- Mission Critical Networks
- Eastern Region



Director, Engineering Information Technology



VP-Operational Excellence
DPG, EPG, Lean Six Sigma



Programs Focused

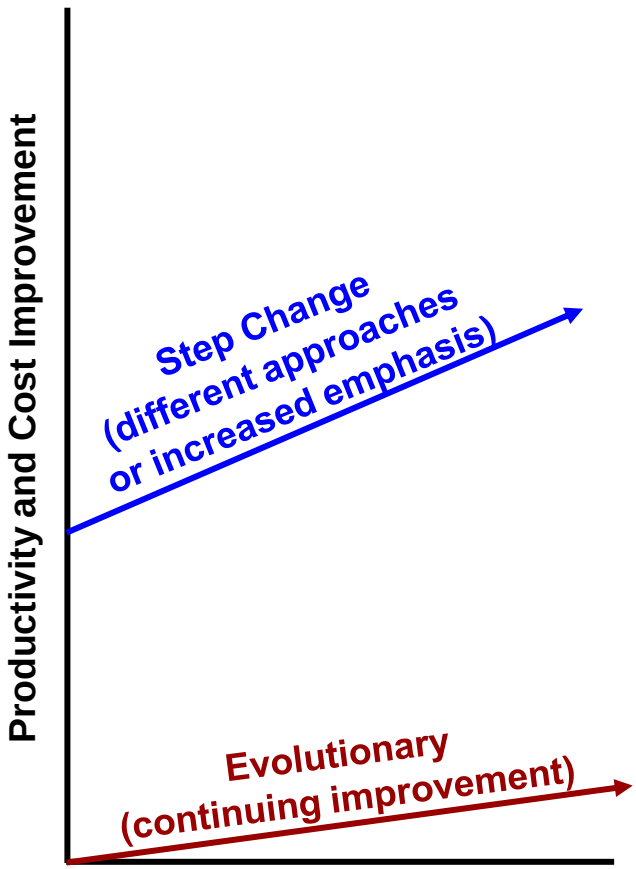
VP-Systems Engineering

6 Business Areas
6 Eng Directors
6 SE Depts (EMs)
500 Employees

- Aerospace Systems (AS)
- Advanced Information Solutions (AIS)
- C4ISR Electronics
- Mission Critical Networks (MCN)
- Mission Information Systems (MIS)
- Proprietary Programs
- Western Region

Harris GCS Engineering is Organized to Maximize Systems Engineering Direct Support to Programs

Engineering Strategies for Operational Excellence



Front End (Affordability)
- Common architectures, parts
- 80% solutions
- Design to Cost (DTC)
- Risk assessments
- Probabilistic risk-based bids

Back End (Efficiency)
- Engage Eng Mgmt in program cost reduction efforts
- Year-over-year productivity
- Eng/Mfg integration (DFx)

Defect Reduction
- Reduce waste, rework
- Design review effectiveness
- Lean Six Sigma projects

People & Culture
- Develop front-end leaders (APEs, CSEs, PEs)
- Mission specialists
- Products, IDIQ, Agile, …

Sustain the Core (Incremental Efficiencies)
- Year over year trends, cost models
- Operational efficiency (assets, labs, capital, …)
- Tools, licensing, open source
- People: training, hiring, staffing, apprenticeships

Engineering Strategic Initiatives are Prioritized on Affordability, Cost Effectiveness, and Finding Key Program Issues Early

Tailoring

- **Program Types**
  - Development
  - Production
  - Operations and Maintenance
  - Study
  - Quick React Contract
  - IR&D
  - Short Delivery Cycle Program
  - Agile

- **Typical Tailoring Decisions:**
  - ***Processes:*** *What applies? What does not?*
  - ***Standards:*** *Harris? Commercial? DIDs?*
  - ***Org Structure****: Functional? IPTs? Co-located?*
  - ***Architectures:*** *MBSE? Custom? COTS? Reuse?*
  - ***Teaming:*** *Suppliers? Subs? Vendors?*
  - ***Tools:*** *Standard tools? Program directed?*
  - ***Reviews:*** *What? When? Who? How often?*
  - ***Metrics:*** *Info needs? More? Less? TPMs?*
  - ***Risks:*** *Prototypes? Models? Mitigation?*

Think out of the box!

Tailoring adapts standard processes, assets, and tools to fit the objectives, mission needs, and constraints of the program – almost anything is tailorable!