Challenges facing the Transportation Industry in embracing Systems Engineering

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INDEC
A sample of Rolling Stock Projects in Australia (last 10 years)

**Victoria**
VLocity DMU *(late)*

**WA**
Perth – Mandurah EMU: Rollingstock + Infra *(late)*

**Queensland Rail**
SMU220s/IMU120s *(late)*

**NSW**
Millennium- M Sets *(late)*
Hunter Rail Cars *(late)*
Outer Suburban Cars- H Sets *(late)*
Waratah- A Sets *(late)*
Typical Rolling Stock Contract

- **Contact Award**: Month 0
  - Requirement Analysis, Design Development, Subcontract engagement, Design Integration, Design Verification, + more

- **Design Freeze**: Month 12
  - Construction, Support Stage enabling works, + more

- **Validation Commence**: Month 18
  - Validation of user requirements, + more

- **Delivery Commence**: Month 24
At a working level, why do design team members (including systems engineers) have to:

- Constantly cut corners in Systems Engineering “enabling” activities in the Technical Process Stage?

- Constantly answer “is Systems Engineering budgeted” or sometimes even “what is Systems Engineering”?

- Constantly work on projects that have unrealistic schedules?

- Constantly work on projects where the Client’s expectations and Contractor’s understanding of Systems Engineering have limited convergence?
THE PROBLEM

Disjoint between Acquisition Strategies & Technical Processes required for successful realisation of the strategies.
Systems Engineering Challenges

PRIMARY REASON

Acquisition Strategies are generally driven by Needs without consideration of other key inputs that have a strong influence over its outcome.

FOCUS on WHEN and to a lesser extent WHAT

Not on HOW
Disjoint…why?

- Lack of awareness of Systems Engineering fundamentals and the benefits that it brings to the overall Acquisition Process.

- General lack of awareness of the value of Systems Engineering in its ability to control, manage and minimise Program risks.

- Lack of commitment to SE across program life cycle: Concept > Development > Production > Utilisation > Retirement

- Lack of SE qualified resources (people/tools) with appropriate authority in the Commercial / Program/ Project Management space who can influence the Acquisition Strategy.
Systems Engineering Challenges

Acquisition Strategy: WHAT, WHEN, HOW
These Disjoints manifest In:

- **Poor Requirements definition.**
- **Compromise on delivering ‘optimal’ solution.**
- **Constant debates over scope, budgets, resources and priorities.**
- **Strong incentive (and pressure) to deliver “on time” rather than “compliance”.**
Systems Engineering Challenges

LEADING TO:
Increase exposure to risk
Contractual disputes
Program delays, amongst others

PROGRAM/MISSION OUTCOMES NOT MET

A LOSE-LOSE RESULT
Increase awareness of SE across all the players/stakeholders in the Acquisition space

- Government agencies
- Financiers
- Insurers
- Legal fraternity
- User groups
- Contractors & Sub-Contractors
Incorporate Systems Engineering practices from ‘Day 0’ of the Acquisition phase. This means:

- Ensuring a disciplined approach to requirement definition.
- Cost & schedule baselines to be realistic from the outset.
- A proactive Risk Management (determination & control) strategy.
- Minimise or eliminate developmental efforts.
Finally, and perhaps most significantly:

- Develop SE competencies in Project Managers
- Develop Project Management competencies in Systems Engineers.

**WHY?**

*Significant OVERLAP in competencies*
SOLUTIONS continued..

Project Management
- Acquisition Management
- Project Implementation
- Program Management

COMMON COMPETENCIES
- Mission Assurance
- Knowledge Mgmt
- Risk Mgmt
- Change Mgmt

System Engg
- Tech Mgmt
- System Design
- Tech Assurance
In conclusion,

Every challenge presents an opportunity for all of us.

Forums like this can play a flagship role: both formally and informally
WHEN IT GOES PEAR SHAPED, WE ARE ALL RESPONSIBLE
Systems Engineering Challenges

- How the customer explained it
- How the Project Leader understood it
- How the Analyst designed it
- How the Programmer wrote it
- How the Business Consultant described it
- How the project was documented
- What operations installed
- How the customer was billed
- How it was supported
- What the customer really needed
References/ Acknowledgements

1. INCOSE Systems Engineering Handbook v3.2.2


3. b2in.wordpress.com (for the cartoon)

4. NASA Brief Project Management-Systems Engineering Competency Model

5. AS/NZS 15288: Systems Engineering- System life cycle processes
Systems Engineering Challenges
THANK YOU!!

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