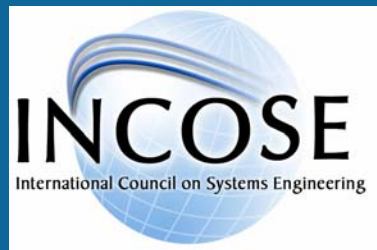


# Lean Enablers for Systems Engineering

LAI Conference  
April 24, 2008  
Boston Hyatt Harborside Hotel

Professor Earll Murman



INCOSE Lean Systems Engineering Working Group

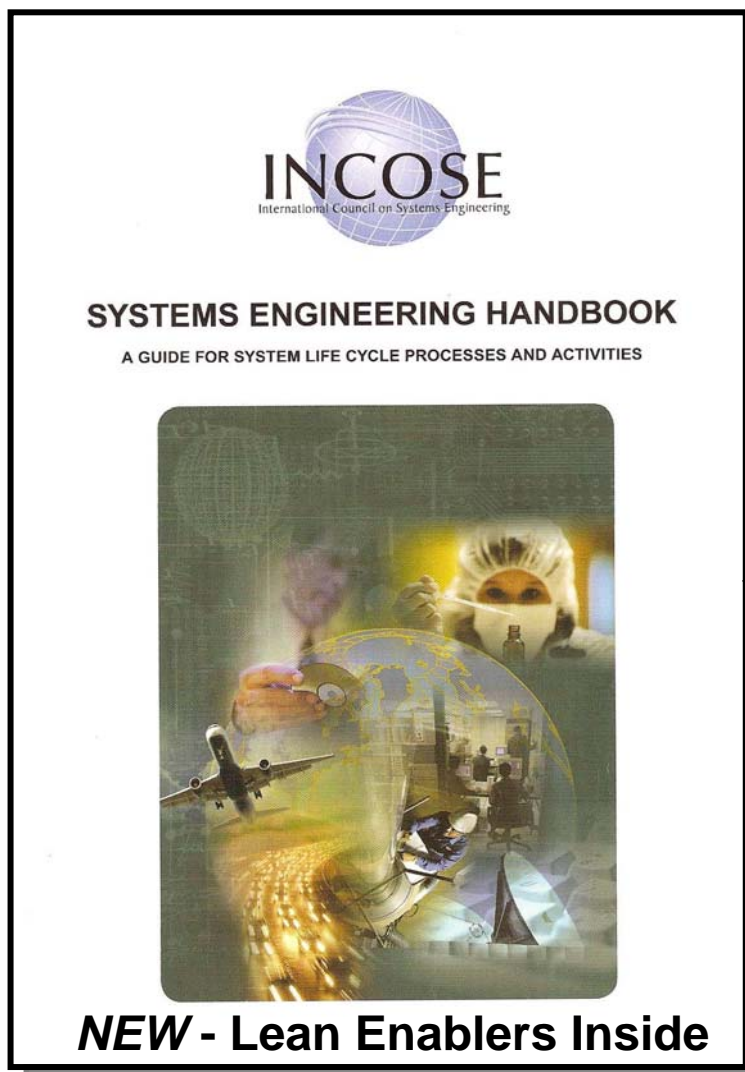
# INCOSE Lean SE Working Group

- **Initiated in Jan. 2006 in ABQ**
  - Outgrowth of a LAI EdNet working group
- **June 2006: 60 participants in Orlando**
- **April 2008: 89 names and growing**
- **WG Core Team (all volunteers, working in spare time.)**
- **Co-chairs identified with asterisk:**
  - **Dave Cleotelis\***, Raytheon, FL
  - **Ray Jorgensen\***, Rockwell Collins, IA
  - **Earll Murman**, MIT, ret.; **WG Core Team Member Emeritus**
  - **Bo Oppenheim\***, LMU, Los Angeles
  - **Deb Secor\***, Rockwell Collins, IA

# Overall Strategy for the Lean Enablers I

- Audience: Industrial Systems Engineering practitioners
- The underlying philosophy is to apply Lean Thinking to capture the wisdom of best Systems Engineering (SE) practices, the do's and the don'ts of SE, an asymptote of excellence in SE, the way to make Systems Engineering as Value driven and as Waste free as possible.
- The grammatical form selected is a checklist of “do’s and don'ts”
- Lean Enablers for Systems Engineering (LE for SE) are formulated under the headings of the classical Five Lean Principles plus the Sixth "People" Principle.
- The Enablers are not intended to become a regulation or mandatory procedure. Thus, if a particular program or organization falls short of one or more of the Lean Enablers, this is not a reason yet to reject or resist the Enablers.

# Selected Approach



**New Chapter  
or Appendix**

**Lean Enablers for  
Systems Engineering**

**Lean Enablers are not a  
tool or a process, but a  
way of Thinking!**

# Overall Strategy for the Lean Enablers II

- The prototype should fit seamlessly into a future INCOSE Systems Engineering Handbook, expanded from bullet to text form, either as an Appendix or a Chapter, per INCOSE choice, with all Lean terms and Principles defined, explained, and with numerous examples.
- **LE for SE should not:**
  - repeat information already covered in the handbook, e.g. requirements management, risk management, IPTs
  - require considerable editing of the Handbook
- The present draft is based on the Handbook version 3.1
- LE for SE should be framed in a broad enough way that it would fit into other SE reference sources such as company handbooks.

# Organization of the Lean Enablers for Systems Engineering into the Six Lean Principles

1. Customer defines value
2. Map the value stream: plan all end-to-end linked actions and processes necessary to realize value, streamlined, after eliminating waste
3. Make value flow continuously: without stopping, rework or backflow (valid iterations OK)
4. Let customers pull value: Customer's "pull/need" defines all tasks and their timing
5. Pursue perfection: all imperfections become visible, which is motivating to the continuous process of improvement
6. Respect people

# Lean Principle 1: Value

- 1. Follow all practices for the requirements capture and development in the INCOSE Handbook. In addition:**
  
- 2. Establish the Value of the End Product or System to the Customer**
  - 1. Define value as the outcome of an activity that satisfies at least three conditions:**
    - a. The external customer is willing to pay for “Value”**
    - b. Transforms information or material or reduces uncertainty**
    - c. Provides specified performance right the first time**
  - 2. Define value-added in terms of value to the customer and his needs**
  - 3. Develop a robust process to capture, develop, and disseminate customer value with extreme clarity**
  - 4. Develop an agile process to anticipate, accommodate and communicate changing customer requirements**
  - 5. Do not ignore potential conflicts with other stakeholder values, and seek consensus**
  - 6. Explain customer culture to Program employees, i.e. the value system, approach, attitude, expectations, and issues**

# Lean Principle 1: Value

## 3. Frequently Involve the Customer

1. Everyone involved in the program must have a customer-first spirit
2. Establish frequent and effective interaction with internal and external customers
3. Pursue an architecture that captures customer requirements clearly and can be adaptive to changes
4. Establish a plan that delineates the artifacts and interactions that provide the best means for drawing out customer requirements.



## **Lean Principle 2: Map the Value Stream (Plan the Program)**

- 1. Plan the Program according to the INCOSE Handbook Process. In addition:**
- 2. Map the SE and PD Value Streams and Eliminate Non-Value Added Elements**
- 3. Plan for Front-Loading the Program**
- 4. Plan to Develop Only What Needs Developing**
- 5. Plan to Prevent Potential Conflicts with Suppliers**
- 6. Plan Leading Indicators and Metrics to Manage the Program**

## Lean Principle 3: Flow

1. Execute the Program according to the INCOSE Handbook Process. In addition:
2. Clarify, Derive, Prioritize Requirements Early and Often During Execution
2. Front Load Architectural Design and Implementation
3. Systems Engineers to accept Responsibility for coordination of PD Activities
4. Use Efficient and Effective Communication and Coordination
5. Promote Smooth SE Flow
6. Make Program Progress Visible to All
7. Use Lean Tools

## **Lean Principle 4: Pull**

- 1. Tailor for a given program according to the INCOSE Handbook Process. In addition:**
- 2. Pull Tasks and Outputs Based on Need, and Reject Others as Waste**

## Lean Principle 5: Perfection

1. Pursue Continuous Improvement according to the INCOSE Handbook Process. In addition:
2. Strive for Excellence of SE Processes
3. Use Lessons Learned from Past Programs for Future Programs
4. Develop Perfect Communication, Coordination and Collaboration Policy across People and Processes
5. For Every Program Use a Chief Engineer Role<sup>[1]</sup> to Lead and Integrate Development from Start to Finish
6. Drive out Waste through Design Standardization, Process Standardization, and Skill-Set Standardization [Morgan & Liker]
7. Promote All Three Complementary Continuous Improvement Methods to Draw Best Energy and Creativity from All Employees

# Lean Principle 6: Respect for People

1. Pursue People Management according to the INCOSE Handbook Process. In addition:
2. Build an Organization Based on Respect for People
3. Expect and Support Engineers to Strive for Technical Excellence
4. Nurture a Learning Environment
5. Treat People as Most Valued Assets, not as Commodities

# Credits for the Work on Lean Enablers

Beta version was developed from Oct 07-Jan 08 by the INCOSE Lean SE WG  
Core Team:

- Earll Murman\*, MIT, Core Team Co-lead
- Col. Jim Horejsi, SMC
- Mike Schavietello, Boeing
- Jim Zimmer, Toyota
- Larry Earnest, NGIS
- Deb Secor, Rockwell Collins
- Ray Jorgensen, Rockwell Collins
- Bo Oppenheim\*, LMU, Core Team Co-lead
  - \* Prepared Alpha and Beta versions

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The Prototype was Versions 0-2 and Final were developed during Jan. 28 and April 1, 2008 by the Prototype Subgroup of INCOSE Lean SE WG:

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