

Systems Engineering Concepts Applied to a Hospital Emergency Department

Workshop Summary and Key Outcomes

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INCOSE International Workshop (January 30 – February 02, 2016)

Presentation Outline



- **Origins of the workshop**
 - The PCAST report: “Better Healthcare and Lower Costs: Accelerating Improvement Through Systems Engineering”
- **Goals for the emergency department workshop**
 - Session Overviews
 - Discussion Goals
- **Workshop outcomes**
 - Key challenges for systems engineers in healthcare
 - Workshop recommendations for advancing the application of systems engineering in healthcare

Presentations are publicly available – see links on next slide

Workshop Presentations



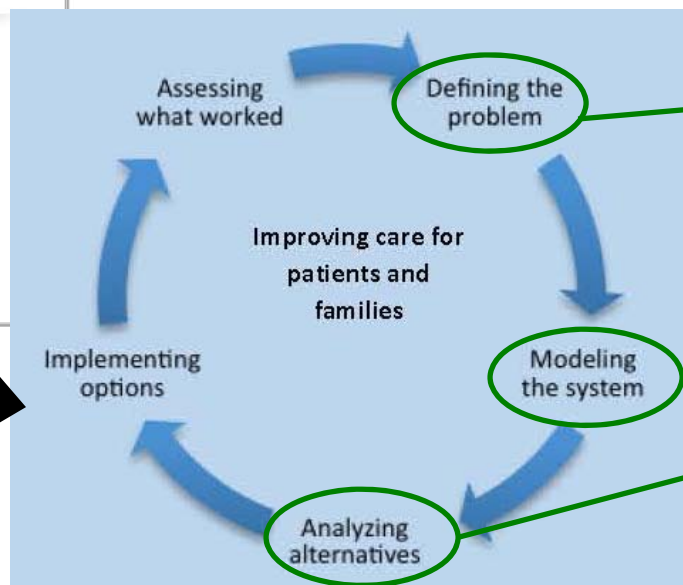
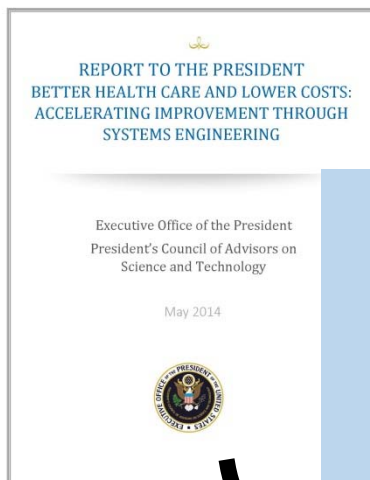
- **Presentations are hosted on the Model-Based Systems Engineering (MBSE) Wiki site**
 - MBSE wiki website for healthcare track of 2016 INCOSE International workshop
 - http://www.omgwiki.org/MBSE/doku.php?id=mbse:healthcare:iw2016_agenda
 - Alternate approach
 - Google “MBSE wiki” – follow the link “start [MBSE Wiki]”
 - Scroll down to “INCOSE International Workshop 2016 MBSE Workshop” – follow the link
 - Scroll down to “Healthcare Working Group: MBSE for Emergency Departments” – follow the link
 - Presentations are on the target page

Presentations are available to the public. The ED workshop final report will be emailed to INCOSE HWG members and will be stored on the INCOSE member site.

Background: IW2015

The overall workshop goal was to gather information to direct, and ensure value-add of, INCOSE activities with respect to alignment with the recommendations of May 2014 PCAST report.

From the PCAST Executive Summary: *“Other industries have used a range of systems-engineering approaches to reduce waste and increase reliability, and health care could benefit from adopting some of these approaches. ... Notwithstanding the instances in which these methods and techniques have been applied successfully, **they remain underutilized throughout the broader system.**”*



- Session 1. Stakeholder Needs – what do healthcare delivery organizations believe are the high payoff applications of the systems approach?
- Session 2. Capabilities – what are the key tools systems engineers can bring to bear to meet stakeholder needs?
- Session 3. Application Context – what approaches should the systems engineering profession pursue to improve healthcare delivery?

This workshop did not address specific healthcare problems. It was intended to start the process of defining how INCOSE (as an organization and as a collection of individuals) could make systems engineering more relevant to healthcare.

IW2015 Outcomes



- **Guidance and recommendations received**
 - Healthcare industry has many systems thinkers, but few systems engineers
 - Recommendation: INCOSE HWG outreach to non-SE partners
 - Systems engineers must demonstrate the systems engineering value proposition in a healthcare context
 - Recommendation: SE for Healthcare Value Proposition briefing
 - Recommendation: MBSE Challenge Team example model of a systems engineering model for hospital operations
 - Systems engineers must show MBSE adds value beyond that of on-going non-SE systems modeling and analysis
 - Recommendation: INCOSE HWG members create white paper
 - Recommendation: INCOSE HWG outreach to Society for Simulation in Healthcare

This year's Systems Engineering Concepts Applied to a Hospital ED workshop addresses three of the action items

SE Applied to the Hospital ED



- **Goals**

- Extend IW2015 outcomes by focusing on a specific problem
- Begin addressing the need for healthcare specific examples of systems engineering products
 - Review and discuss stakeholder perspectives
 - Review and discuss multiple systems engineering perspectives
 - Review and discuss systems approaches to process improvement

- **Desired outcomes**

- INCOSE members learn how systems engineering methods can be applied to assist healthcare providers
- Healthcare stakeholders and partners have a better understanding of what systems engineering can offer
- Essential dialogs among INCOSE members, stakeholders, and partners are established

Outcomes of the workshop will guide actions by the Healthcare Working Group in 2016

IW2016 Workshop Agenda



- **Session 1. Stakeholder Session (Sat p.m.)**
 - Scope: presentations by ED practitioners
 - Desired outcomes: identify high priority issues, needs, and constraints from the stakeholders perspective
- **Session 2. Systems Engineers Session (Sun a.m.)**
 - Scope: presentations from on-going and emerging system engineering efforts
 - Desired outcomes: identify the high payoff ED issues that systems engineers can address
- **Session 3. Simulation Session (Sun p.m.)**
 - Scope: presentations on systems approaches to healthcare process improvement
 - Desired outcomes: understand how systems engineering can benefit on-going process improvement initiatives.

Each session was about 1/2 PowerPoint presentations and about 1/2 discussion of issues, gaps, and recommendations

Session 1 – Stakeholders



- **Session goals**

- Identify the most important system issues in hospital ED
- Expand HWG dialogs with healthcare stakeholders

- **Speakers**

- Introduction to the workshop
 - Bob Malins, Co-Lead, INCOSE Healthcare Working Group
- Dr. Ali X. Ghobadi, MD
 - Assistant Chief - Emergency Medicine, Kaiser Permanente-Orange County
- Professor Bohdan "Bo" Oppenheim, PhD
 - Professor of Systems Engineering, Loyola Marymount University

- **Discussion Goals (after the break)**

- Overarching goal: What is your direction and feedback to the HWG on how INCOSE can best contribute to improving Emergency Departments?

Session 2 – Systems Engineering



- **Session goals**

- Explore/demonstrate the application of SE/MBSE to ED
- Examine the state of SE/MBSE maturity against stakeholder issues

- **Speakers**

- Elliot Sloane, PhD, CCE
 - Executive Director, Center for Healthcare Information Research and Policy
- Pat Baird
 - Technical Director, Risk Management, Baxter Healthcare
- Bob Malins, PhD
 - President, Eagle Summit Technology Associates, Inc.

- **Discussion Goals (after the break)**

- Overarching goal: What is your direction and feedback to the HWG on how INCOSE can best contribute to improving Emergency Departments?

Session 3 – Systems Simulation



- **Session goals**

- Explore/demonstrate how SE/MBSE models can integrate with (“collaborate with”) process simulations to improve healthcare

- **Speakers**

- Dr. Eric Goldlust, MD
 - Emergency Medicine Physician, Kaiser Permanente Northern California
- John Edwards
 - C/O Chair Simulation Task Force, Torrance Memorial Medical Institute
- Prithviraj "Raj" Mukherji, PhD
 - President/Founder, Mukherji Consulting

- **Discussion Goals (after the break)**

- Overarching goal: What is your direction and feedback to the HWG on how INCOSE can best contribute to improving Emergency Departments?

Key Outcomes (1 of 4)



- **Stakeholder perspective and the systems engineering value proposition**
 - Key challenges for systems engineers in healthcare
 - Primary stakeholders are unaware of systems engineering
 - Emergency department operations vary widely
 - Recommendations for systems engineers
 - Continue to obtain first hand knowledge
 - Work with healthcare organizations
 - Work with Lean practitioners already in healthcare
 - Continue to perform outreach to expose stakeholders to systems engineering approaches and methodologies
 - Create “generic” systems engineering models that hospitals can adapt to their needs and unique characteristics
 - Buy down the initial investment in applying systems engineering

Key Outcomes (2 of 4)



- **Including people and cultural issues in the systems engineering model**
 - Transitioning emergency department operations to a systems approach requires a culture change
 - Systems engineering is a different way of doing business
 - There are many ED performers (MDs, NP/PA, RNs, EMTs, techs, ...) and many stakeholders (medical, administrative, financial, ...)
 - Each group has its own concerns that must be addressed
 - Each group has its own way of doing business
 - Recommendations for systems engineers
 - Leverage developments in other fields for incorporating human behavior in systems engineering models
 - Focus on the socio-technical aspects of the emergency department to capture performer and stakeholder concerns

Key Outcomes (3 of 4)



- **Emergency department nominal operations and expected variations**
 - *“If you’ve seen one emergency department, you’ve seen one emergency department”*
 - Generic or nominal process flows are useful starting points
 - Systems engineers must learn what is common and what is unique to each ED
 - A broadly applicable systems engineering approach must synthesize a reference architecture that can be tailored to organizational specifics
 - Recommendations for systems engineers
 - Incorporate multiple perspectives into systems engineering products and systems engineering models
 - Work with healthcare practitioners, managers, administrators, etc. to understand how to tailor products to expected variations

Key Outcomes (4 of 4)



- **Key healthcare challenges and systems engineering opportunities**
 - Healthcare information technology
 - Healthcare IT is having a major impact on healthcare (see ACA requirements for meaningful use)
 - IT is readily amenable to systems engineering methods
 - Indications suggest HIT would benefit from systems engineer's focus on the user
 - Device interoperability
 - Major issue for care providers (see for example the many studies of alarm fatigue)
 - Systems engineering methods for interoperability are well developed in other industries
 - Methods require tailoring to healthcare needs
 - Cybersecurity
 - An increasing concern for care provider organizations (see HIPPA privacy requirements)
 - Systems techniques being developed in other fields

Getting Involved in INCOSE Healthcare Activities



- **Biomedical-Healthcare MBSE Challenge Team**

- Team leads: Ajay Thukral (ajay.thukral@cientivegroup.com); Michelle Lott (michelle@leanraqasystems.com), Bob Malins (rjmalins@eaglesummittech.com)
- Bi-weekly telecons to ...
 - Continue developing the ED model
 - Extend previous MBSE applications to address medical device compliance approaches

- **Joint AAMI-INCOSE Workshop on Systems Engineering and the Operating Room**

- Team leads: Carol Herman-AAMI (cherman@aami.org), Jason Amaral-INCOSE (jason@emeraldwise.com)
- When: April 27-28, 2016
- Where: AAMI Headquarters, Arlington, VA