Systems Engineering as Multi-discipline Enabler/Art/Science

Facilitator: Ron Lyells, Honeywell Retired. rlyells@aol.com

Ron Lyells has been a member of INCOSE for over 12 years. He is current Past-President of the Enchantment Chapter, and is co-chair of the Agile Systems & SE Working Group. Retired from Honeywell's Aerospace Group, Ron was part of a team responsible for improving System Engineering development effectiveness across the Aerospace organization. Ron was specifically responsible for developing and promoting MBSE techniques and methods, the roll out of a common system engineering competency framework, as well as individual and team mentoring, and change management facilitation. Ron worked in the Aerospace industry 40 years in various leadership positions involved in product development lifecycle stages ranging from proposal to production support. He holds a B.S. degree in electrical engineering from Arizona State University.

Day-2 Workshop Participants

Mary Compton	**Sandia National Labs**	**mlcompton@sandia.gov**
Sergio De La Rosa	**UTEP (SISE)**	**Sfdelarosa@miners.utep.edu**
Felicia A. Duran	**Sandia National Labs**	**faduran@sandia.gov**
Heidi Hahn	**Los Alamos National Lab**	**hahn@lanl.gov**
Ann Hodges	**Sandia National Labs**	**alhodge@sandia.gov**
Zach Harris	**NMTech**	**james.harris@student.nmt.edu**
Ron Lyells	**Honeywell Retired**	**rlyells@aol.com**
Paul McGoey	**Self**	**pjmcgoey@comcast.net**

Day-1 Intro and Results Poster

SE as Multidiscipline Enabler Art/Science

Facilitator: Ron Lyells
Ph: 505-263-1893
email: rlyells@aol.com

SE as Multidiscipline Enabler/Art/Science

» Day 1 Agenda
  » Introductions
  » Convergence on a concise statement of topic-resolution need, and identify the target Customer(s)
  » Select a short list of topic issues for Day-2 focus
  » Develop 1-slide poster of intended Day-2 focus, for display at reception

INCOSE
International Council on Systems Engineering
®

Issue Framing

» System Engineering, Art, Science - Three Disciplines- Three Goal/Value Systems

» Does one lead and the others follow?

» Or is the interplay more holistic, a system of disciplines to accomplish some purpose?

» How are they coupled? Is there conflict? Is there synergy to be discovered, leveraged?

Dimensions To Consider

» Definitions

» Agents Involved

» Value Systems Of Each Discipline

» Goals and Focus Of Each Discipline

» Language Used By Each Discipline

» What Others Come To Mind?

INCOSE
International Council on Systems Engineering

ART: Oxford Dictionary:
noun
The expression or application of human creative skill and imagination, typically in a visual form such as painting or sculpture, producing works to be appreciated primarily for their beauty or emotional power.

SCIENCE: Oxford Dictionary:
noun
The intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment.

System Engineering:
INCOSE Fellows:

…an engineering discipline whose responsibility is creating and executing an interdisciplinary process to ensure that the customer and stakeholder's needs are satisfied in a high quality, trustworthy, cost efficient and schedule compliant manner throughout a system's entire life cycle. This process is usually comprised of the following seven tasks: State the problem, Investigate alternatives, Model the system, Integrate, Launch the system, Assess performance, and Re-evaluate

Agents Involved

System Architect

System Engineer

Project Engineer

Artist

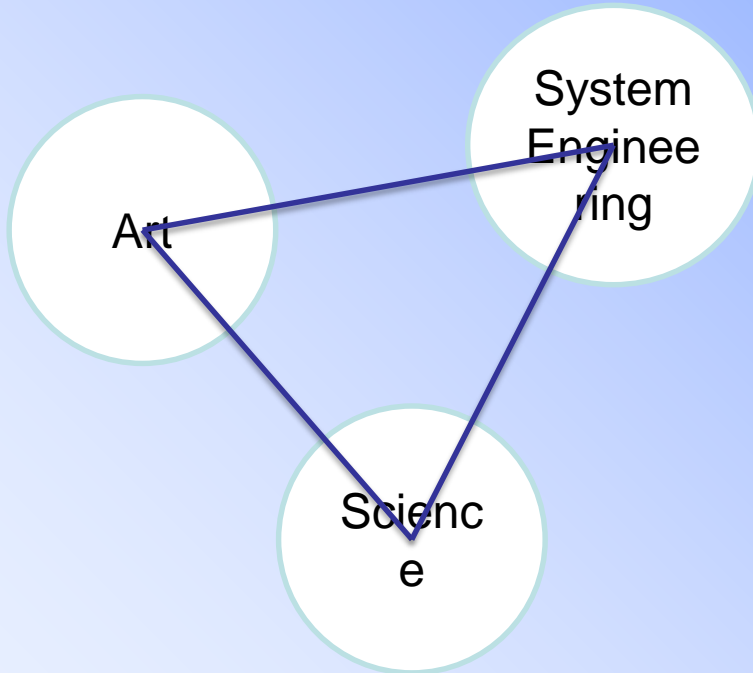User

Owner

Scientist

Funder

????
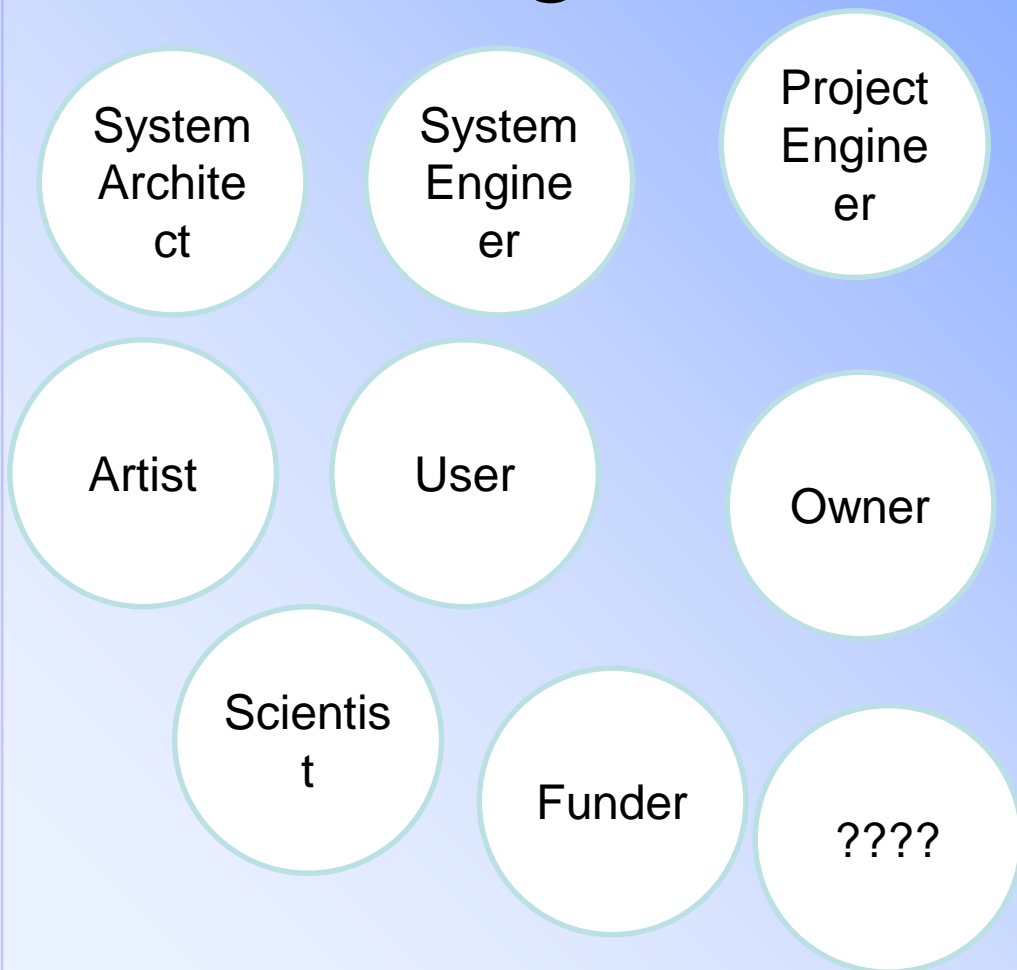
What Is The Actual Agent List For The Problem Frame We Want To Address?

Agent Characteristics
- Motives
- Value System
- World View
- Learning Style
- Practices
- ????

INCOSE
International Council on Systems Engineering

Value Systems/Reality View

System Engineering

Art

Science

View of Reality
- Objectively (Science, Engineering, Math)
- Subjectively (milieu of Artistic Expression)

Focus Bias
- Engineers - Physical Things
- Artists/Architects - Human Interface w/ Physical Things (e.g. Experience)
- Scientists - ?

Reaction To Learning or Problems ???
Knowledge and Knowing Acquisition???
Impact of zeitgeist???

Then There Is Language

Parti

Feeling

Dynamic

Static

Emotions

Beauty

System

Decision Making

Hypothesis

Relationships

Form

Process Oriented

Methods

Specificity

Quality

Tools

Model

Theory

Goal Driven

Rules

Composition

Perspective

Components

Subtractive

Requirements

Abstraction

Function

Additive

Quality

Need:

- System engineering needs to be broadened to address the artistic concerns of a system
- Should system engineering address artistic needs?
- Capturing experience need as a requirement

Customers:

- Business, transport, general purpose users
- Students

Impediments to Focus On:

- How v&v an artistic consideration?
- System engineering in the context of a market driven demand
- Facilitate communication between artists and engineers working on the same program
- Meshing the individual needs and life-cycles on a single program
- Shaping the culture early

Day-2 Workshop

SE As Enabler Art/Science
Participants:

Mary Compton	Sandia National Labs	mlcompton@sandia.gov
Sergio De La Rosa	UTEP (SISE)	Sfdelarosa@miners.utep.edu
Felicia A. Duran	Sandia National Labs	faduran@sandia.gov
Heidi Hahn	Los Alamos National Lab	hahn@lanl.gov
Ann Hodges	Sandia National Labs	alhodge@sandia.gov
Zach Harris	NMTech	james.harris@student.nmt.edu
Ron Lyells	Honeywell Retired	rlyells@aol.com
Paul McGoey	Self	pjmcgoey@comcast.net

SE As Enabler Art/Science

- ## Need:
  - System engineering needs to be broadened to address the artistic concerns of a system
  - Should system engineering address artistic needs?
  - Capturing experience need as a requirement

- ## Customers:
  - Business, interior designers, human factors, general users
  - Students

- ## Impediments to Focus On:
  - Meshing the individual needs and life-cycles on a single program
    - How v&v an artistic consideration?
    - System engineering in the context of a market driven demand – we don't know how to convey and manage a systems solution to achieve an experience objective
  - We don't practice artistic expression in the SE work that we have
  - Facilitate communication between artists and engineers working on the same program
  - Shaping the culture early

INCOSE
International Council on Systems Engineering

SE As Enabler Art/Science

- Participants:
  - Ron Lyells, Paul McGoey, Mary Compton, Heidi Hahn, Sergio De La Rosa, Ann Hodges, Felicia A. Duran, Zach Harris

- Impediments Discussed:
  - Facilitate communication between artists and engineers working on the same program
    - Need to be clear, tailor communication to audience
    - Feedback: active listening
    - Proactive Worldview Dumpster diving:
      - Preferred Media, Realist/Abstractionist
      - Start learning what's important, values
      - A solution must characterize your discipline for the customer
        - To use your customer's terms to describe your discipline to the customer
        - Why, How, Who

SE As Enabler Art/Science

– Facilitate communication between artists and engineers working on the same program (cont.)

- During program discussions:
    - You need to discuss information exchange and decision authority
    - Have to know Why, When, for Whom, What

SE As Enabler Art/Science

– Interdisciplinary culture is not shaped early enough to be effective or persistent

- Communication bias exists
- Must provide interdisciplinary education and experience that includes both art, science, and engineering early
    - Requires practice and experience
- When to start: as early as possible, no later than High School
- Should include practice/skills on communicating visually complex information
- Art – a way to explore the abstract
- Example: NM International School and other Abq based charter schools

SE As Enabler Art/Science

– Awareness plan, possible actions

- Reference Heidi's LEGO learning engineering systems class
- Invite appropriate charter school teachers to guide workshop classes for SE workshops (New Mexico based)
- Encourage and develop opportunities for SE practitioners to show off their artistic and non-technical abilities
- Orchestrate a workshop with SE, Scientists, and Artist practitioners to explore the lifecycle process meshing issue
- Look at the way Toyota product dev system uses artistic artifacts in their lifecycle development (use of a common model to align interdisciplinary efforts)