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# How a Systems Engineer Starts...

Herman Migliore
*Portland State University*

# How A Systems Engineer Starts .....?

Portland State
UNIVERSITY

# A Systems Engineer? Who Are They? Two Practitioners:

| | |
|---|---|
| **Herm Migliore** | **Portland State University** |
| 1977 - 1997 | Mechanical Engineering Senior Design Projects |
| 1997 – Present | Advisor to Systems Engineering Masters Projects |
| | Often times Not an End |
| | Always a Beginning |

| | |
|---|---|
| **John Blyler** | **Editorial Director at Extension Media** |
| | Editor in Chief, 'Chip Design' and 'Embedded Intel ' magazines |
| 1993 – 1996 | Systems Engineer, Hanford |
| Adjunct Prof | Hardware-Software Integration |
| | Systems Engineering Management |
| Senior Advisor | PSU SYSE program |

# Systems Engineering? What's That?

..... is the practice of creating
the means of performing useful functions
through the combination of two or more interacting elements

Norm Augustine
retired Chairman and CEO, Lockheed Martin Corp
INCOSE "INSIGHT" Oct 2009 Vol 12 Issue 3

# Starts...? What ?

**Project?** **consisting of a team with a purpose, and manager?**

- systems engineer is part of team
- or, may not be a 'systems engineer' on team

**Process?** **what steps for developing an engineered system**

- includes implementation
- development of product, process, or service

**Method?** **how do we perform steps in development process**

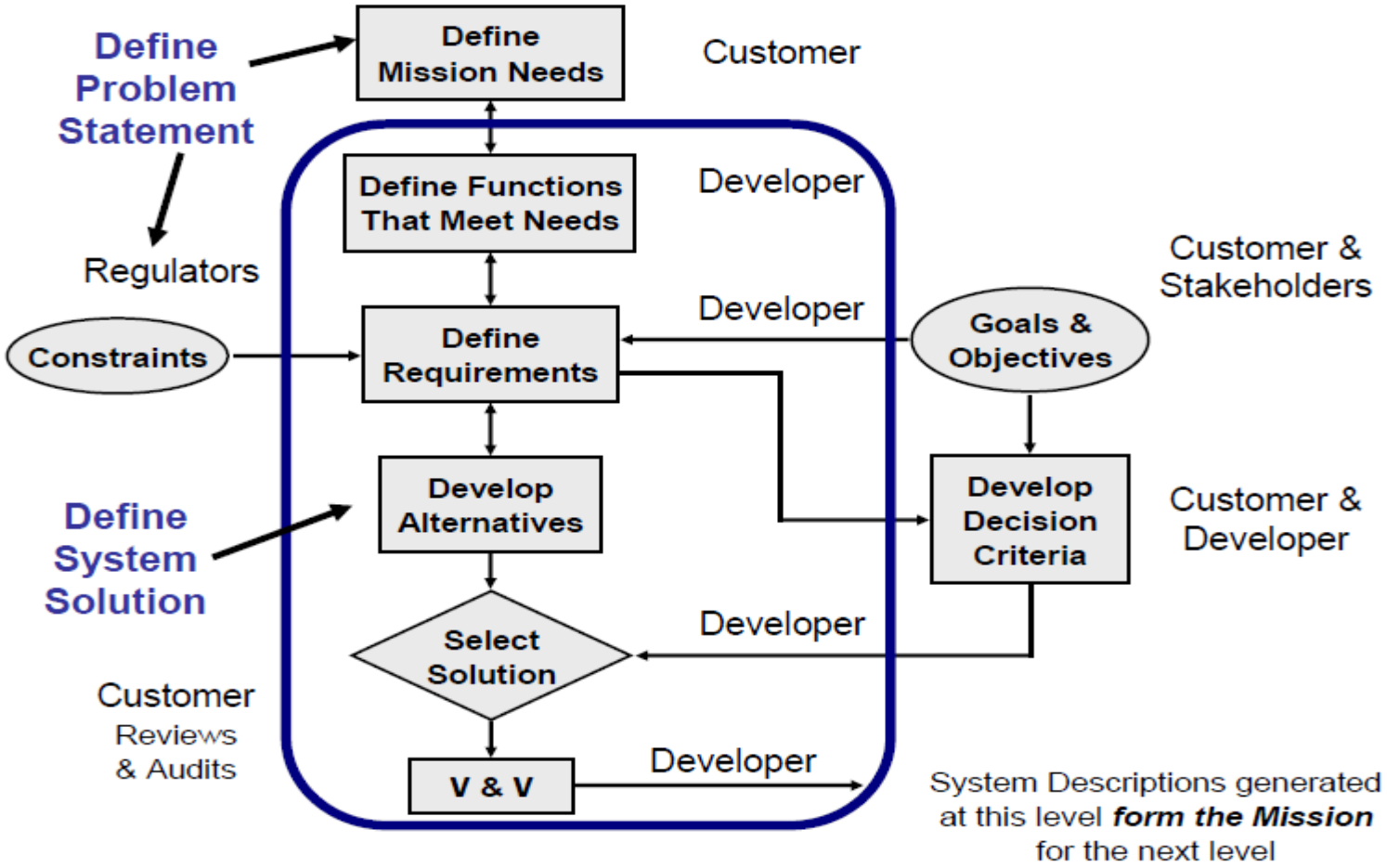
- tailored to the project/product

**Thinking?** **about Fuzzy-Front-End**

- 'as-is' situation is troubling
- stakeholders vision on use of new system
- before functions, before requirements

*System Integration Frameworks*

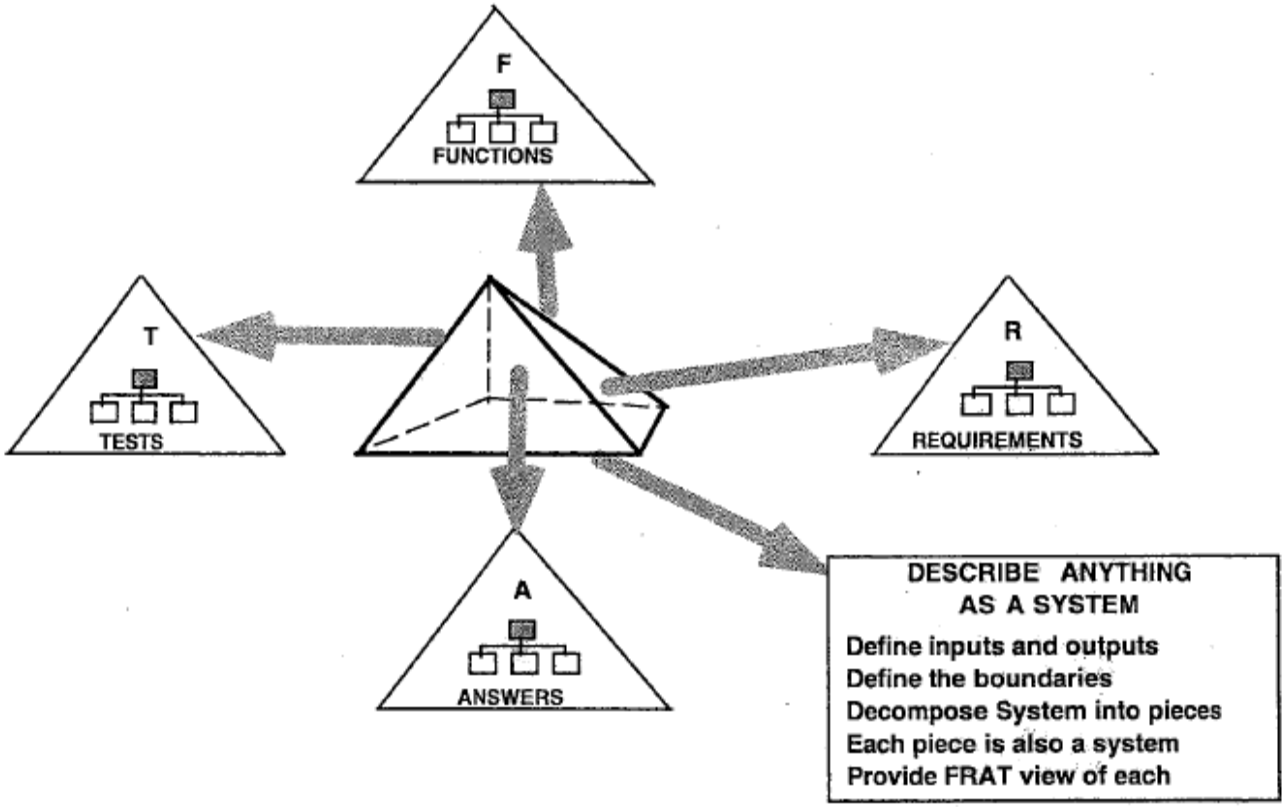
# The FRAT Design Engine





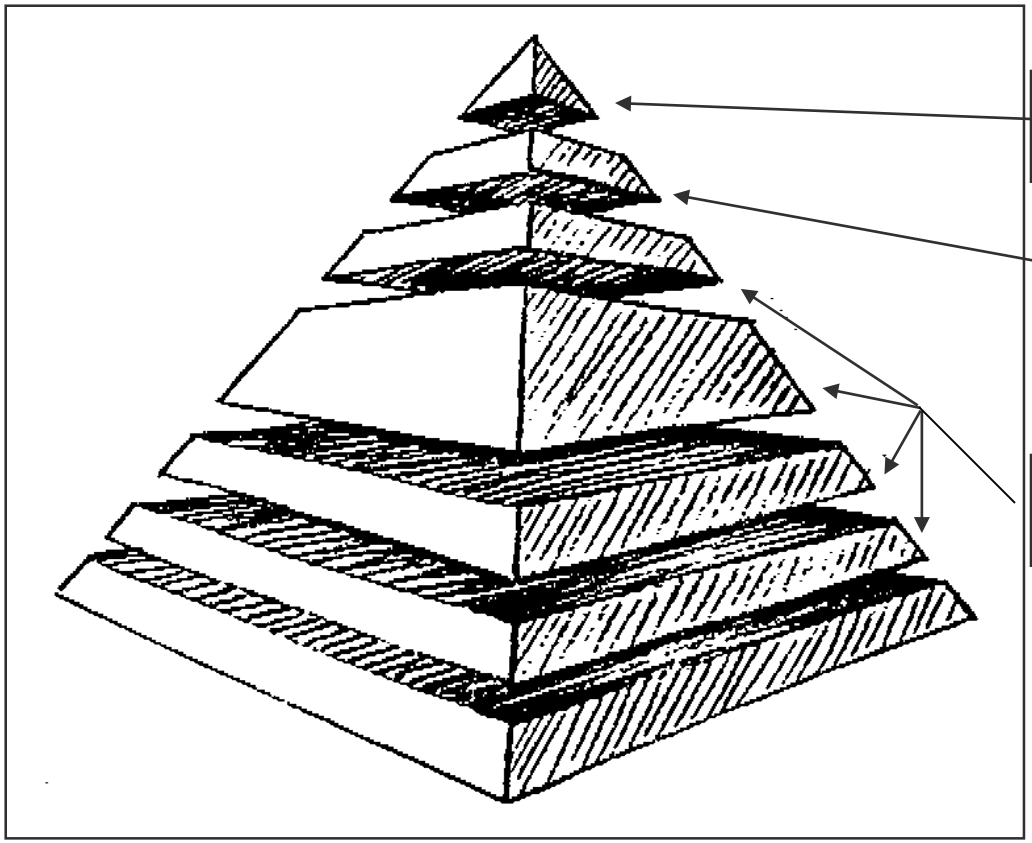

From "FRAT – A Basic Framework for Systems Engineering," Mar & Morais

# THE FOUR VIEWS PYRAMID




The Engineering of Complex Systems
Morais and Mar, 1997

# Method/Process Flow
# Function - Requirements - Architecture - Test



**Upper Level FRAT Data Provides Scope For Next Level**

**Lower Level Must Roll - Up and Map to Upper Level**

**Each Level of FRAT Establishes a BASELINE**

**Simulation Models Provide Dynamic Views of FRAT**

***Community Has Problem Symptoms from As-Is Situation:***
***Unacceptable and Preferable Aspects***

***ConOps***
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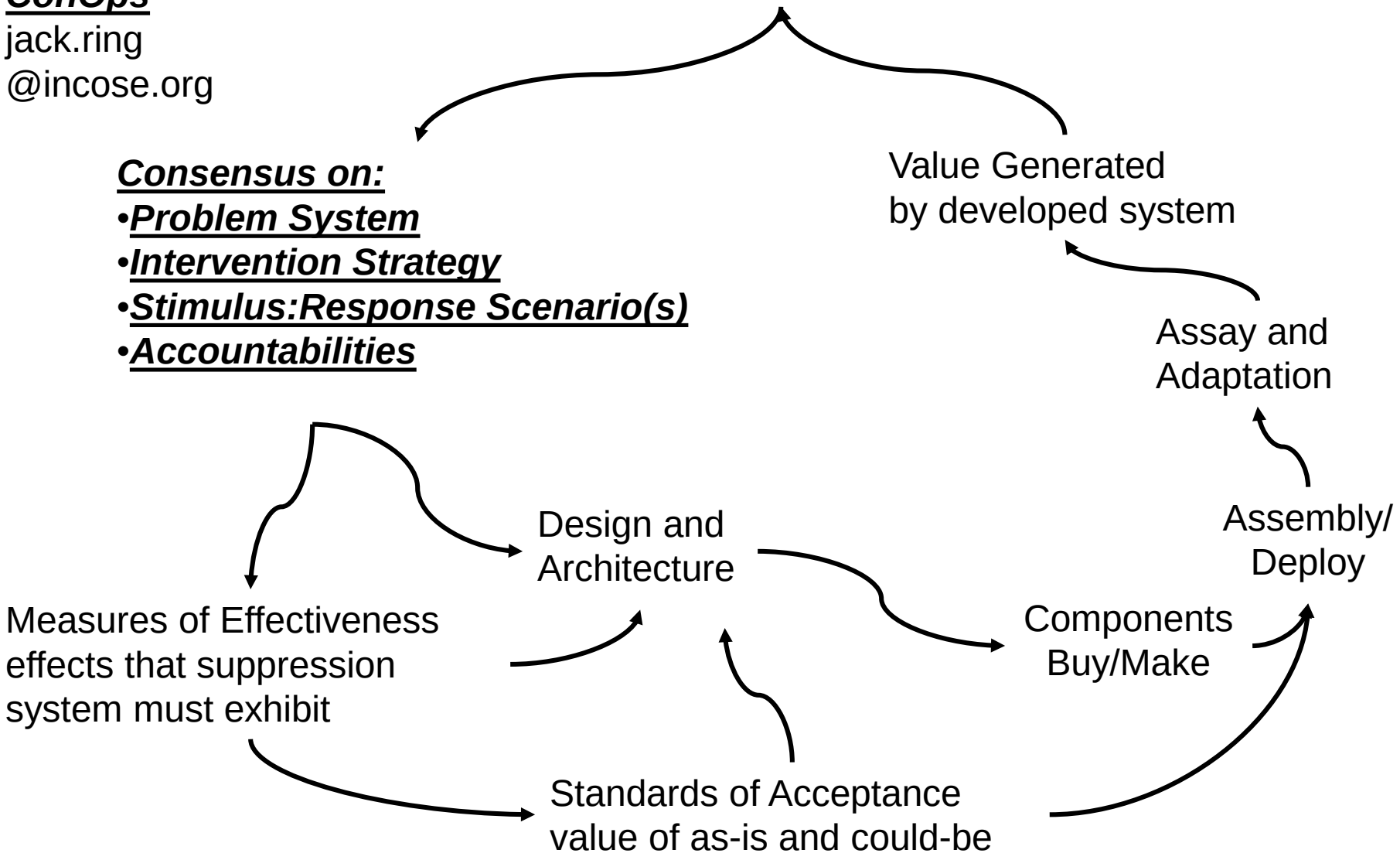
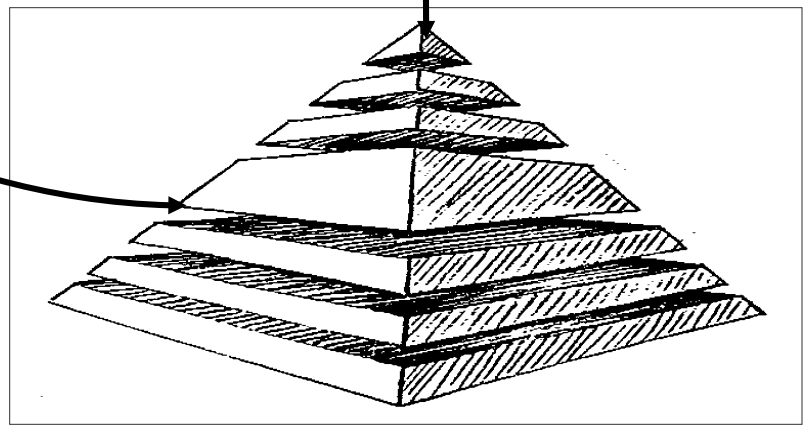


**Unacceptable Discomfort felt by Stakeholders**

***Consensus of All Responsible and Affected Parties:***

- ***Problem System*** – generates problem symptoms
- ***Intervention Strategy*** - comprehensive view of intended use
- ***Stimulus:Response*** – all possible scenarios of 'To Be' system, that suppresses problem symptoms, intervention system
- ***Accountabilities***- what are we/you willing to do to make problem go away



# Tom

## As-Is Situation

- Viable recycling - Legacy hospitals
- Contacts with suppliers/recyclers
- Active recycling in Portland
- Cost gasoline -up $4.25 down $2.50
- Tom wants help with promotion
- Masters student- Fuzzy Front End

# Urine Bottles and Sorting Operation

Blue wrap polypropylene film used for sterilizing surgical instruments

# Recycling Bags

## Legacy Waste Expenses (Labor not included)

| | With Recycling | Without Recycling |
|---|---|---|
| Standard Waste Disposal | $500,000 | $1,000,000 |
| Medical Waste Disposal | $500,000 (using an autoclave) | $1,000,000 |
| Recycling Income | ($15,000) | $0 |
| ***Approximate Annual Expenses*** | ***$1,000,000*** | ***$2,000,000*** |

# Problem Suppression Systems – Intervention Systems

| COST | | | | |
|---|---|---|---|---|
| | High | | Business Practices | Recycling Center Design |
| | Medium | Plastic Alternatives | Source Reduction | |
| | Low | | | Education |
| | | Low | Medium | High |
| | | IMPACT | | |

Neil's Guidelines for Starting a Healthcare Recycling Center

Motivate Recyclers and Manufacturers

Tom Now a Consultant

Neil Earns Masters Degree

Synthesis - Write the story

Were stakeholders' knowledge and motivation changed?

# Systems

**Engineering**

Body of Knowledge, Handbooks, Past Publications, Certification
Structured and experienced development processes
Customer Requirements and management
Technical and Organizational Interface management
Tailored development processes, adaptive
Stakeholders part of development and use

**Thinking**

Guidelines but not Overly Specified (FRAT)
Stakeholders active part of problem definition (ConOps)
Combination of established and other perspectives
Uncertainty and risk
Change and evolution

**How Do System Scientists Get Started?**