A HOLISTIC APPROACH TO AGILE SYSTEMS ENGINEERING:
EQUIPPING SYSTEMS ENGINEERS

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Michael Coughenour
LM IS&GS SE Technologist
Co-Chair INCOSE Agile SE WG

Jim Brake
LM IS&GS MBSE Champion
Sr. System Engineering Manager

Cats Are the Icon of Agility

- We agree that cats are agile. Why?
- Aware. Nimble. Focused on value.

Agile
is more than
Rapid

- But on a hot tin roof they're spastic. Why?
- - Info overload.
  - Lost awareness.
  - Inability to create options.

- Up a tree they're catatonic. Why?
- - Paralyzed with fear.
  - Lost awareness.
  - Inability to create options.

Litmus Test for 'Agility'

- ***Can you make changes without breaking/destroying what has:***
  - *Already been done - Agility of the Engineering*
  - *Already been made - Agility of the System*

Researching the Community

- **Lot of work on the "subject"**
  - The term means **LOTS** of things
- **at least 20 years of publications using the term**
- **Publications largely discuss the 'what' but not the 'how'**
- **Interest growing in the past few years**
- **INCOSE Standing Up and Working Group for Agile SE**

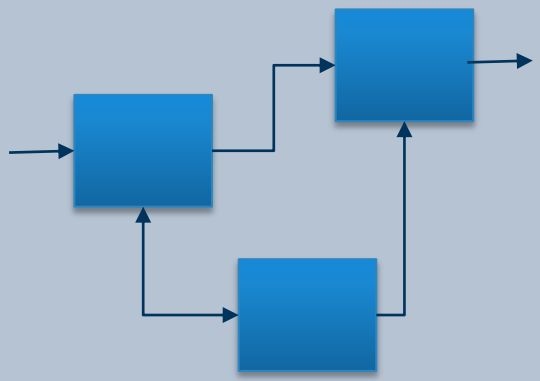
Some Current Drivers Toward Agility

- Increasing Complexity *(next)*
- Increased Operational Tempo
- Rate of Technology Change (Moore's Law)
- Increase Financial Pressure – Affordability
- Massive Amounts of Unstructured Data/Information

Increasing Complexity

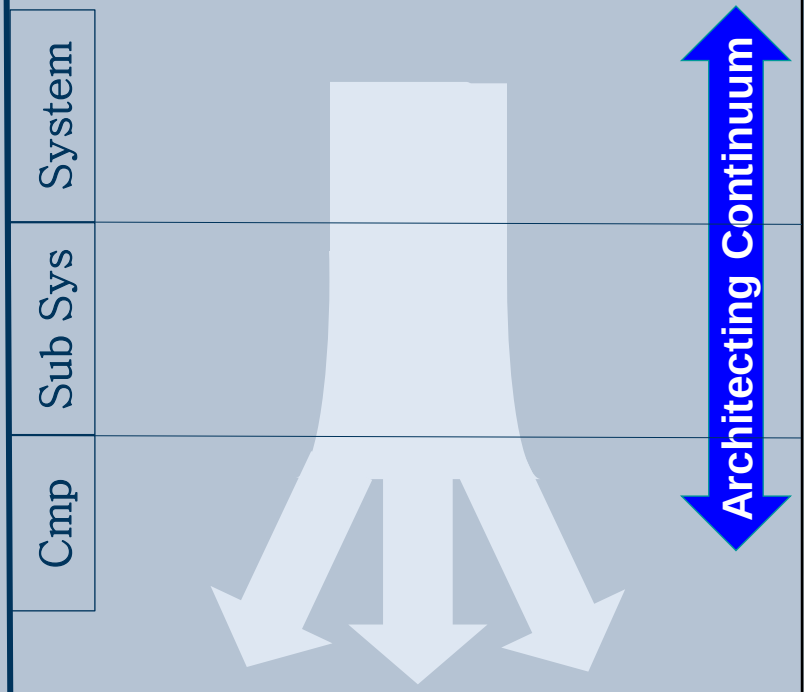
Complex (Dynamic Complexity)

Composable Design



Complicated (Detailed Complexity)

Decompositional Design



Agile SE Approach - Current Landscape

- **'Evolutionary' / Incremental**
  - Early SE bounding – more SE with each 'time box'
  - Often relies on fixed schedule and cost with flexible technical scope
  - Emergent design, emergent architecture
- **'Expedited' / Lean / Right-Sized**
  - SE fit to the program characterization & urgencies
  - Prescriptive architecture
- **Agile SWD with SE (Ad-Hoc)**
  - Organizations & projects driven by Agile SWE but recognizing need for SE.

A HOLISTIC APPROACH

Criteria-based Application

Driven to be Agile

- There is a Rigorous / Methodical approach to SE at it's roots
- The pace of need is faster now
- Roughly Speaking, there are 2 Agile Flavored SE Camps
  - Evolutionary ASE
  - Expedited / Lean ASE
- Should be a repeatable / reliable way to decide how to approach SE overall (holistic)
  - Decide on Evolutionary, Expedited, or Hybrid – you can plan it so your team will know how to execute.
- For this to be repeatable – need criteria to aid/guide the decision.
- Putting the criteria sets together into a framework aids the decision making process
- Rest of the presentation is to describe the framework at a high level

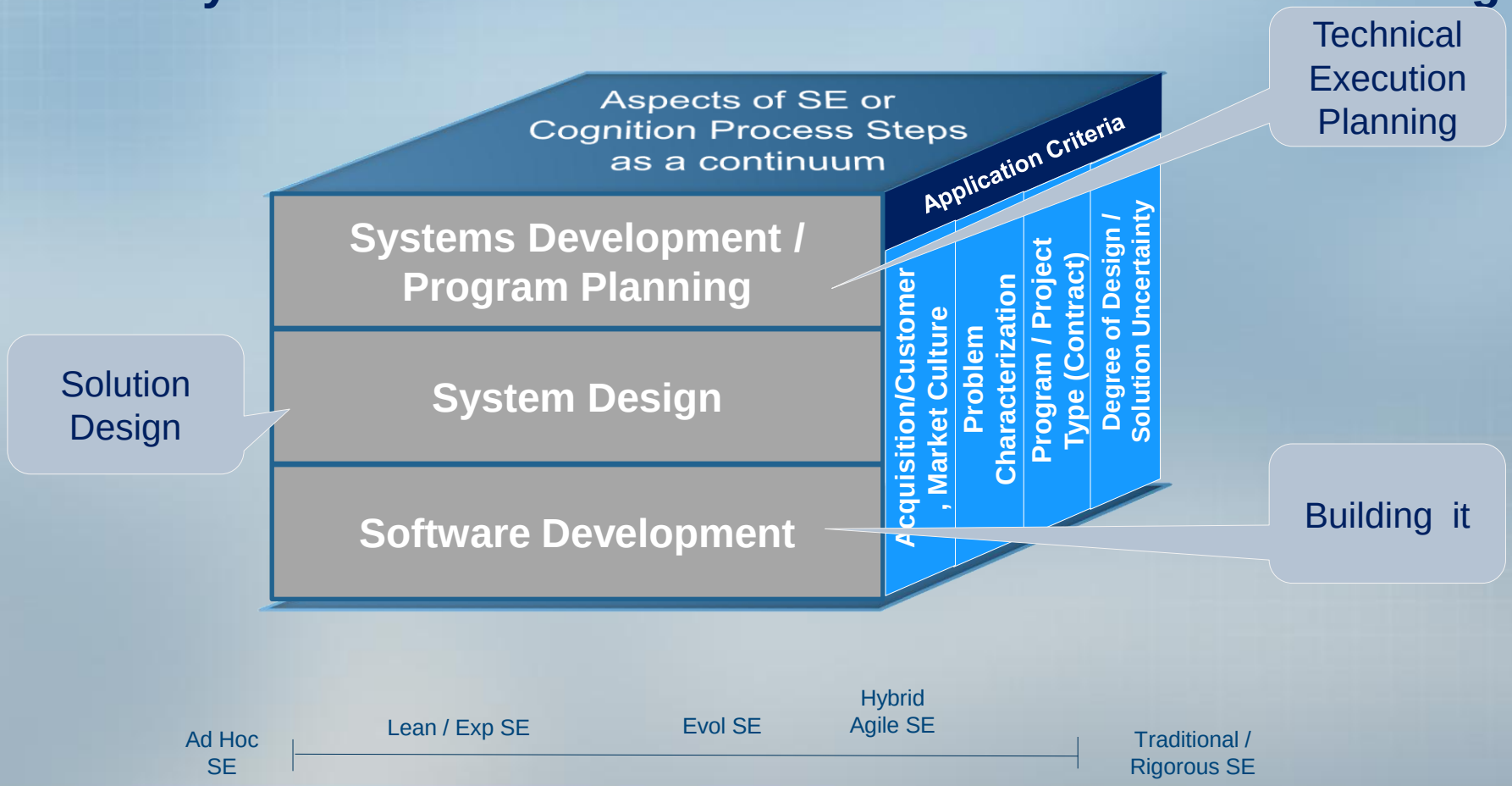
Goal

- ***A Holistic Approach to apply the spectrum of applications of the Practice of System Engineering***
  - The structured way to decide on the application of Agile SE (If, How Much, How)
    - Criteria Based Decisions
    - Judgment Infused & adaptable

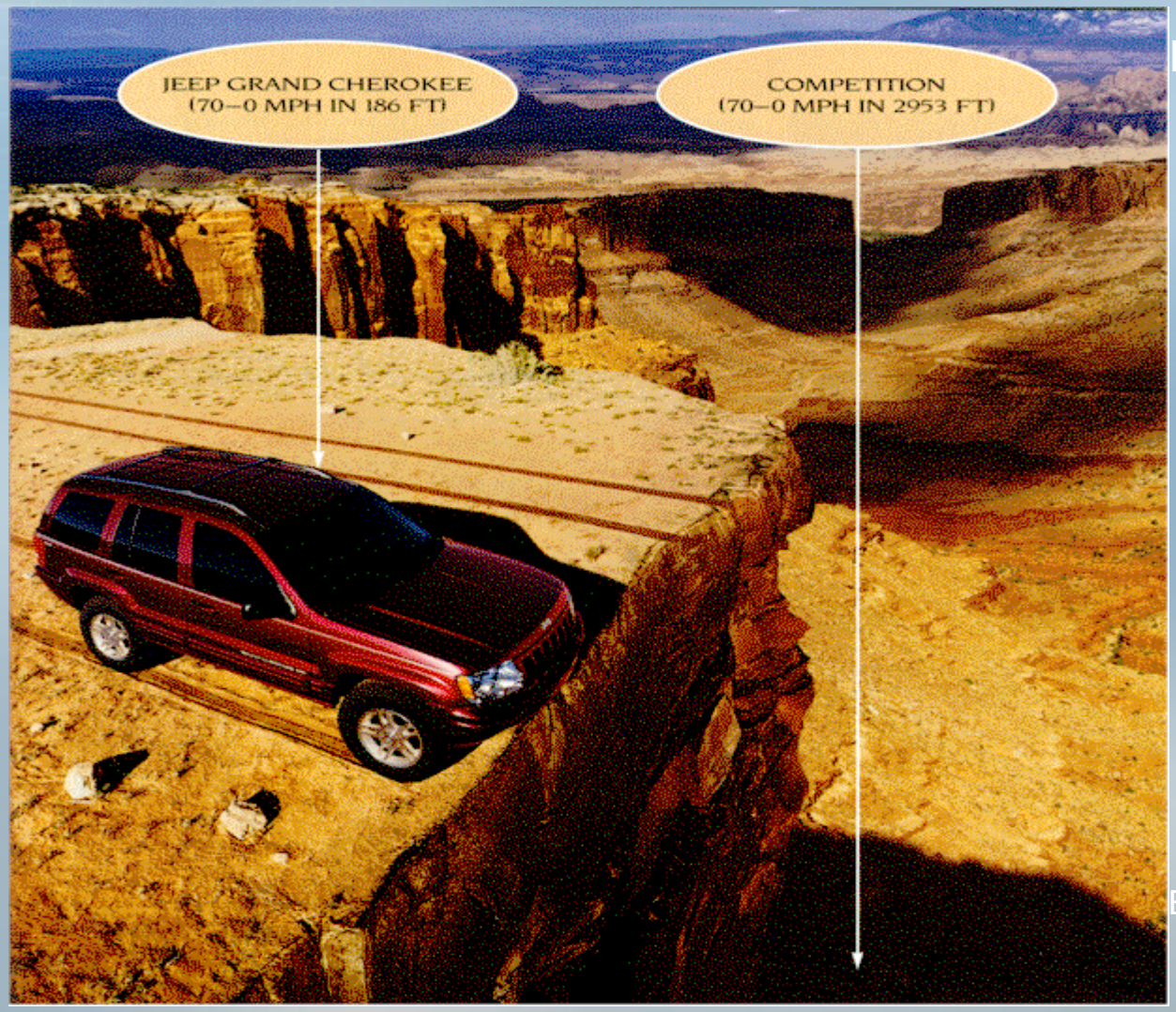
- **Enable quick decision making and eliminate decision constipation - without eliminating judgment**

What Are We Really After?

- **Help in knowing how much and how to apply SE in a wide variety of contexts/environments – and accommodate change**



Inability to Change (Inertia) – The Bane of Agility



Being able to recognize and stop doing something of little or no value is just as important as being able to quickly start doing something new.

Bane: a cause of death, destruction, ruin (Webster)

Adapted from Rick Dove: Steven's Institute of Technology

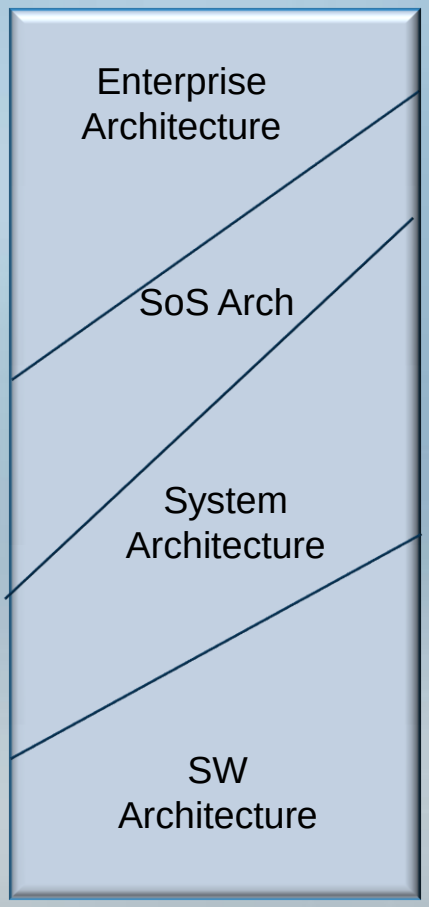
Criteria-Based Decision Making

- **Goal of the Agile SE Application Framework:**
  - Give empirically-based practical guidance on the nature and amount of SE to employ given the complex set of variables we have to deal with across programs and environments
- **In so doing - Accommodate the variety of SE approaches available – traditional, expedited, evolutionary, hybrid**
- **Provide in a decision framework for program planning and execution**

The Architecting Continuum

➢Ex. Criteria

- EA is concerned with the ecosystem – SA fits a solution into the ecosystem
- SOS A focuses on collaboration of systems – SA focuses on creating a system/solution
- SA determines the right mix of technologies for a solution – SWA creates the behaviors allocated to SW/services
- SA handles analysis of alternatives
- SA allocates aspects of sol'n to TTPs, people, technologies (HW/SW)
- SWA: performance, functionality …



Application to:
- Agile Sys Dev
- Agile SE
- Agile SW Dev

Other work is fleshing out the Continuum

Application Criteria Sets Agile SE

Acquisition / Customer Culture	Problem Characterization	Program / Project Type (Contract)	Degree of Design / Solution Uncertainty (Unknown)
Push Vs Pull Paradigm	Low Difficulty (Simple)	Extent of **User** Involvement (Actual User or Representative)	Enterprise (Is EE in scope of this Framework?)
Extent of Customer **Involvement** (Range)	Medium Difficulty (Complicated or moderate complexity)	Program Constraints / Flexibility: Technical / Cost / Schedule	SoS / System Development (not much prescription of solution)
Environment Volatility (degree of change: high/rapid vs low/stable)	High Difficult (Wicked Problems)	Degree of Program Tolerance for Change	SoS / System (High prescription, unknown mix of technologies. e.g. HW vs SW)
Market Characterization (rate of change)	Type of Complexity Detailed or Dynamic?	Life Cycle Model Type (if a driver)	SW (e.g. known Platform unknown SW design)

Additionally:
- ❖ Application guidance.
- ❖ Composable / Nondeterministic
- ❖ Degree of Technical Debt Accommodation (recovery from)

Integrated with Arch Continuum

EQUIPPING AGILE SYSTEMS ENGINEERS: LESSONS FROM EXPERIENCE

Key Aspects To Training SEs (somewhat obvious)

- Knowledge transfer (learning the espoused practice)
- Skills Development (getting experience & true understanding)
- Equipping with techniques (specifics for performing day-day work)

The Approach

- **Intentional architecting of training experience**
  - Applying the SE principles to the creation of the experience
  - Change/instill perspective through a combination of knowledge and experience.
- **Immerse in exercises that combine information, perspective and exercises**
  - Espoused exercise on creating a product / performing a process
  - Flow of exercise (Thought process used - Analyze / Synthesize / Evaluate)
  - Specific agile techniques exemplified (performed for exercise)
  - Accomplishment focused not product or process

Key to Effectiveness

- Connect some dots for them in class material and individual exercises
- Instill understanding of the relationship of products through the exercises (use them together)
- Make *them* connect dots

Emphasize Integrated Nature of Practice