

On Discovering Fundamentals of a 15288 Compatible Agile Systems Engineering Life Cycle Model for Unpredictable, Uncertain, Evolving SE Environments

15th System-of-Systems Engineering Workshop

Reducing Risk in 2020

ITEA El Paso, 29-Jan-2015

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**Chair, INCOSE Agile Systems & Systems Engineering Working Group
Adjunct Professor, Stevens Institute of Technology**

INCOSE Project Kickoff: Agile SE Life Cycle Model Fundamentals



Rick Dove, INCOSE Working Group Chair:
Agile Systems and Systems Engineering
Adjunct Professor, Stevens Institute of Technology

Addressing SE ...

Uncertainty, Unpredictability, Risk, Variation, Evolution.

Fifteen 3-day “discovery” workshops in US/Europe 2015/16.

- Workshop Hosts in defense and commercial sectors.
- Analyzing SE processes for mixed HW/SW/WW* projects.
- Immediate and long term benefits

Identify/justify necessary & sufficient fundamentals:

- Compatible with ISO/IEC/IEEE 15288.
- Compatible with any agile SE process.
- Compatible with existing organizational cultures.

*WW=Wet Ware: stakeholders, customers, project personnel, operators, maintainers, ...

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The Time Has Come

INCOSE Vision 2025

- ❑ Resilient Systems
- ❑ Composable Design
- ❑ Adaptable and Scalable Methods

Top Five INCOSE CAB Priorities:

- 1) SE Professional development
- 2) Agile/Expedited methods
- 3) Effective Trade Studies
- 4) Product lines, re-use
- 5) Better Value proposal for INCOSE and SE

CAB: Corporate Advisory Board

Proactive
Innovative/Composable
Creates Opportunity
Takes Preemptive Initiative

| | | |
|-----------------------|-------------------------|-----------|
| Proactive Proficiency | Innovative (Composable) | Agile |
| | Fragile | Resilient |

Reactive Proficiency

Reactive
Resilient
Seizes Opportunity
Mitigates Adverse Events

INCOSE Project: Agile SE Life Cycle Model Fundamentals

Addressing SE UURVE: Uncertainty, Unpredictability, Risk, Variation, Evolution.

Objectives – Identified/justified necessary/sufficient fundamentals:

- That can be intuitively embraced and applied.
- Compatible with 15288, any agile SE process, existing organizational cultures.

Fifteen 3-day “discovery” workshops in US and Europe 2015/2016.

- Workshop Hosts in defense and commercial sectors.
- Analyze SE processes dealing with UURVE in mixed HW/SW/WW* projects.
- Immediately apply action-learning to an SE process in need of (more) agility.
- Workshop Hosts must send 2 participants to 2 other-Host workshops.
- Host cost ~\$20k USD, which covers facilitation, synopsis reports, materials, estimated participant travel costs, workshop lunches, and one dinner.

“Tell me and I forget. Teach me and I remember. **Involve me and I learn.**”

Benjamin Franklyn

Active In-Process Workshop Sites: Honeywell, General Dynamics, Lockheed, Northrop Grumman, Rockwell Collins, SPAWAR/MITRE, ...

*WW=Wet Ware: stakeholders, customers, project personnel, operators, maintainers, ...

Diagram of Asynchronous-Stage Agile SE-LCM

Systems and software engineering — Life cycle management — Part 1: Guide for life cycle management

ISO/IEC TR 24748-1:2010(E)

Section 5.5.5 (p. 32):

“... to convey the idea that one can jump from a stage to one that does not immediately follow it, or revert to a prior stage or stages that do not immediately precede it.”

“Further, the text in the model indicates that one applies, at any stage, the appropriate life cycle processes, in whatever sequence is appropriate to the project, and repeatedly or recursively if appropriate.”

“While this may seem to be a total lack of structure, indeed it is not.”

“Rather, the structure has well defined parts that can be juxtaposed as needed to get the job done, flexibly but still in a disciplined manner, just as a real structure would be created.”

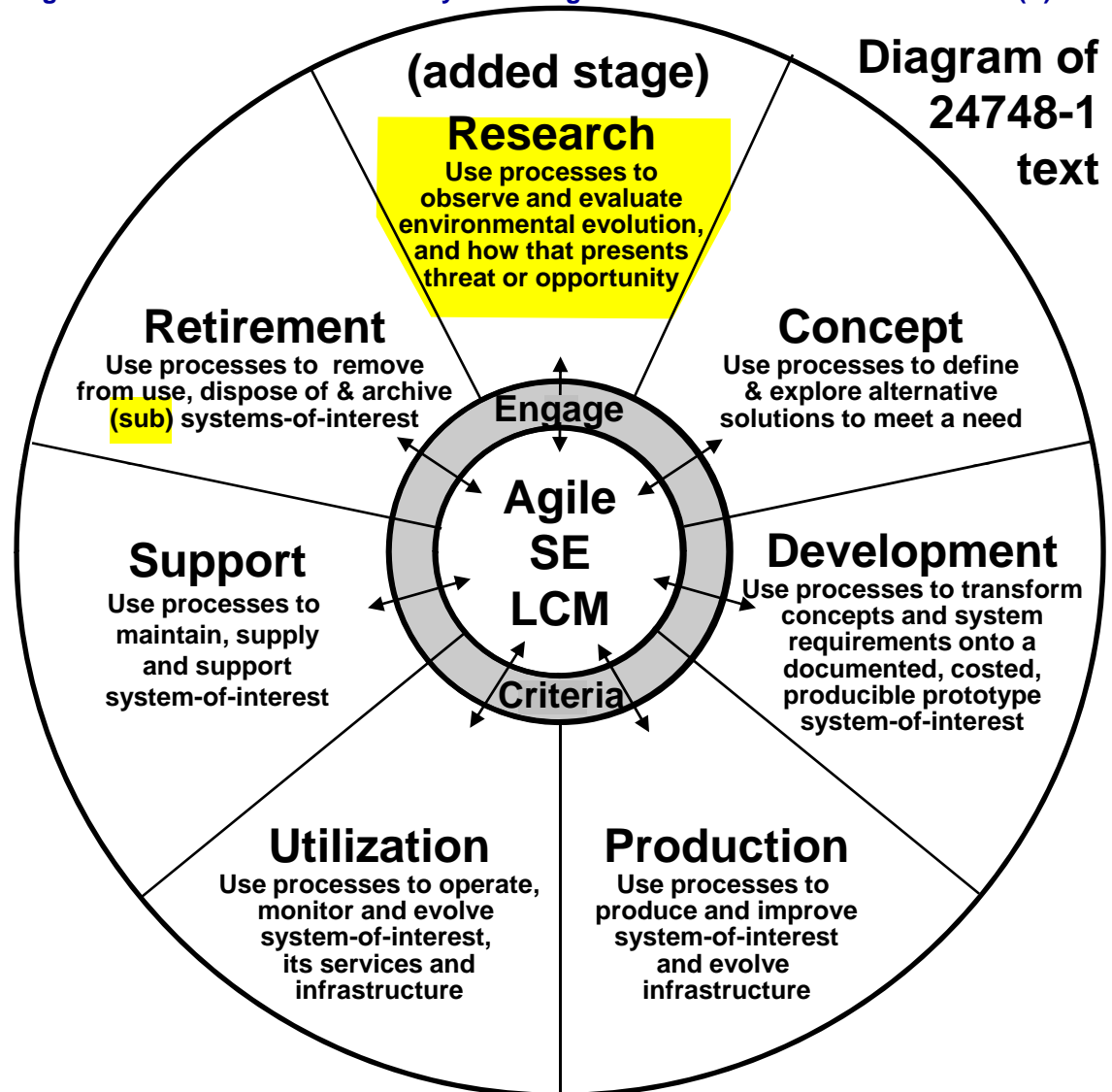
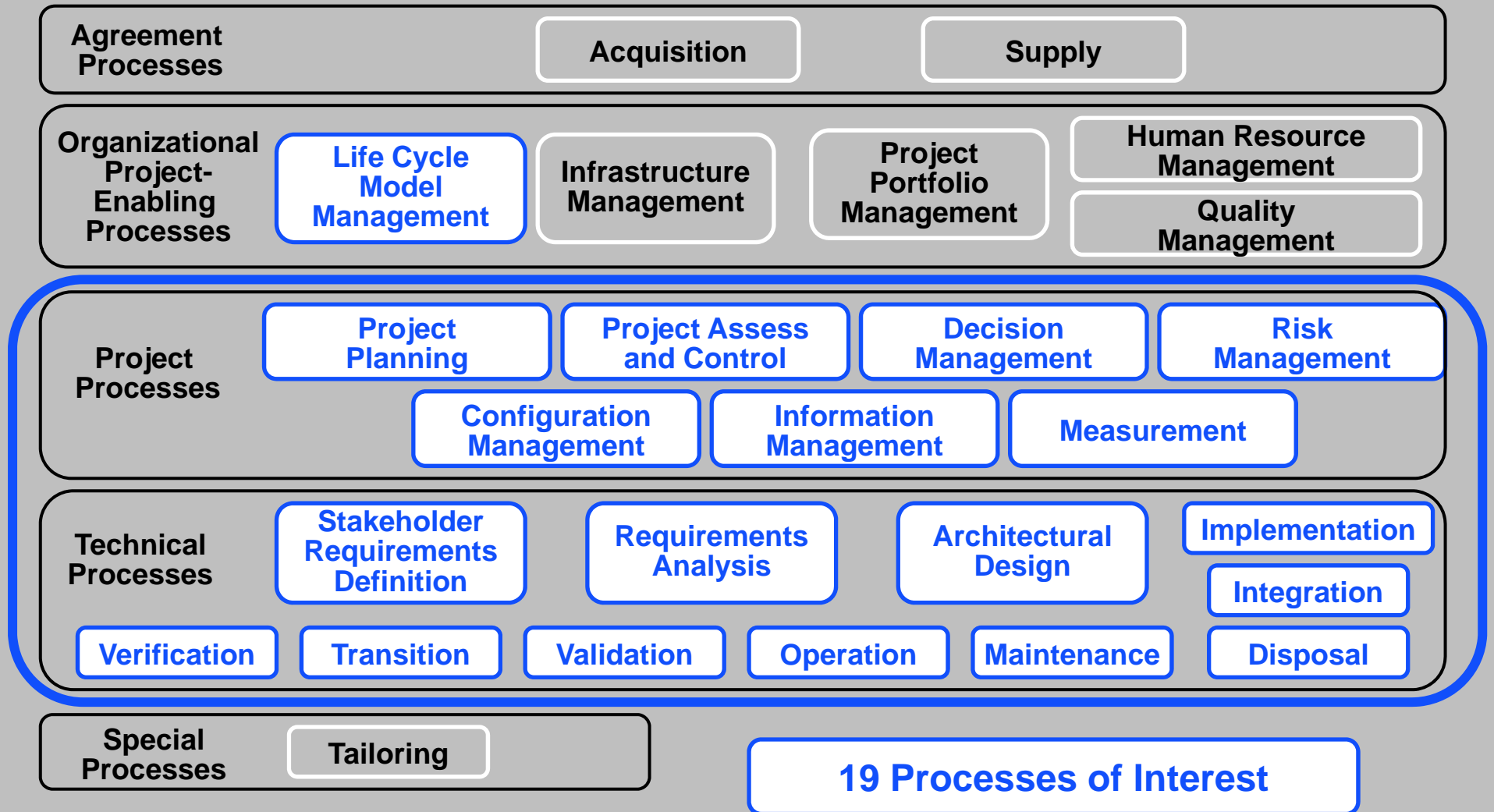


Diagram of
24748-1
text

Seven asynchronously-invoked stages
can be engaged repetitively and simultaneously
to achieve benefit when engagement criteria are met

ISO/IEC/IEEE 15288–2008 Processes



Project Artifacts (Products)

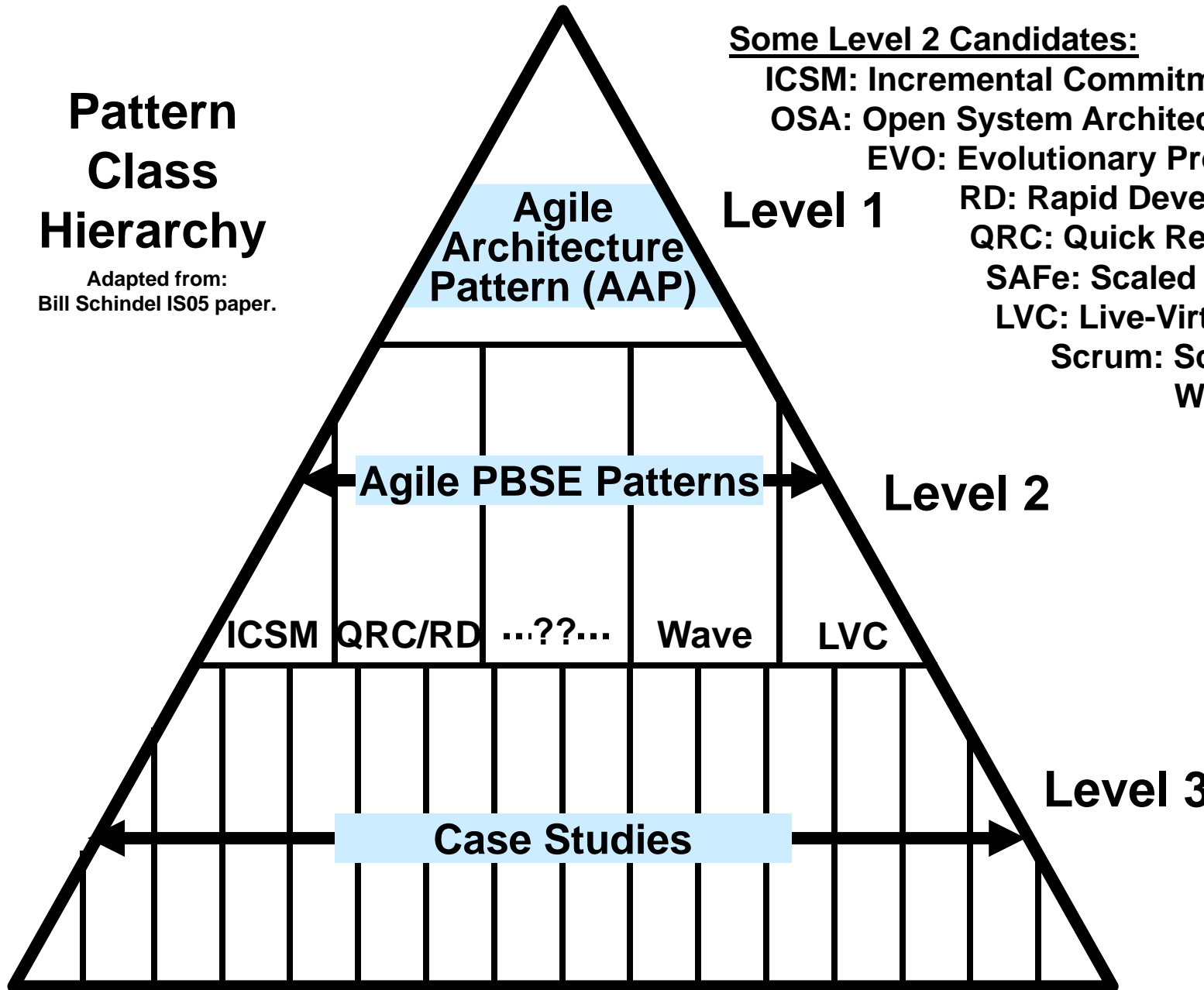
- 1. An instructive technical report describing a generic Agile SE Life Cycle Model with supporting exemplar case studies. The model will support rather than supplant common agile systems-and-software SE processes.**
- 2. Pattern Based SE Modeling (PBSE) will illustrate configurations aligned to the case studies (next slide).**
- 3. Supplemental guidance for application and/or tailoring of SE processes contained in ISO/IEC/IEEE 15288 (potential future Annex or part of guides) and INCOSE SE Handbook.**
- 4. Collateral technical information in briefer form and focus is anticipated as papers targeted for relevant SE journals and conferences.**

Estimated project report completion is later half of 2016

Pattern-Based System Engineering (PBSE)

Pattern Class Hierarchy

Adapted from:
Bill Schindel IS05 paper.



Some Level 2 Candidates:

ICSM: Incremental Commitment Spiral Model

OSA: Open System Architecture PM concept

EVO: Evolutionary Project Management

RD: Rapid Development/Fielding

QRC: Quick Reaction Capability

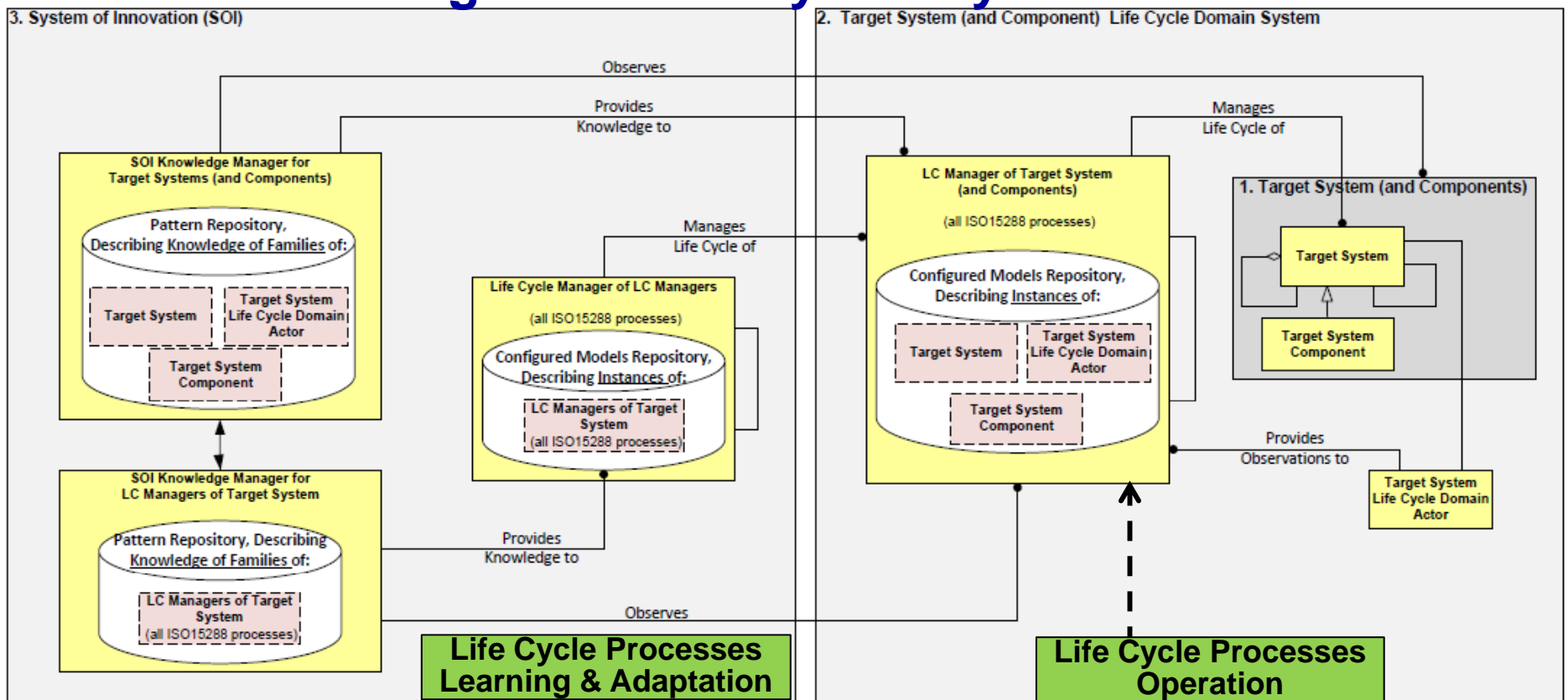
SAFe: Scaled Agile Framework

LVC: Live-Virtual-Constructive

Scrum: Scrum PM concept

Wave: Wave model

Pattern Framework for the Three High-Level Agile SE Life Cycle “Systems”



- **System 1 Features:** Stakeholder capabilities of the Target System—the system we ultimately want to respond (with help from Systems 2 and 3) in agile fashion.
- **System 2 Features:** Stakeholder capabilities of the Target System Life Cycle Management System. This includes all aspects of its LC, a subset of which are relevant to the Agile Systems LC Pattern.
- **System 3 Features:** Stakeholder capabilities of the three subsystems of System 3—concerned with observing and learning about the Target System and its Environment, and about the Target System LC Manager; also responsible for managing the LC of the Target System LC Manager.

General Info

- **Hosts will prepare a discussion presentation covering the processes to be analyzed and synthesized.**
- **Structured discussion and analysis templates are provided,**
- **Workshops will have max of 20 participants, plus briefers. Participants from Hosting organizations are favored.**
- **Within 30-days of each workshop: a results-synopsis, an evolving synthesis of accumulated discovery, and a case study write-up.**
- **No system-functional details need revealed, only SE life-cycle process and activity procedures. No problem for proprietary/classified projects.**

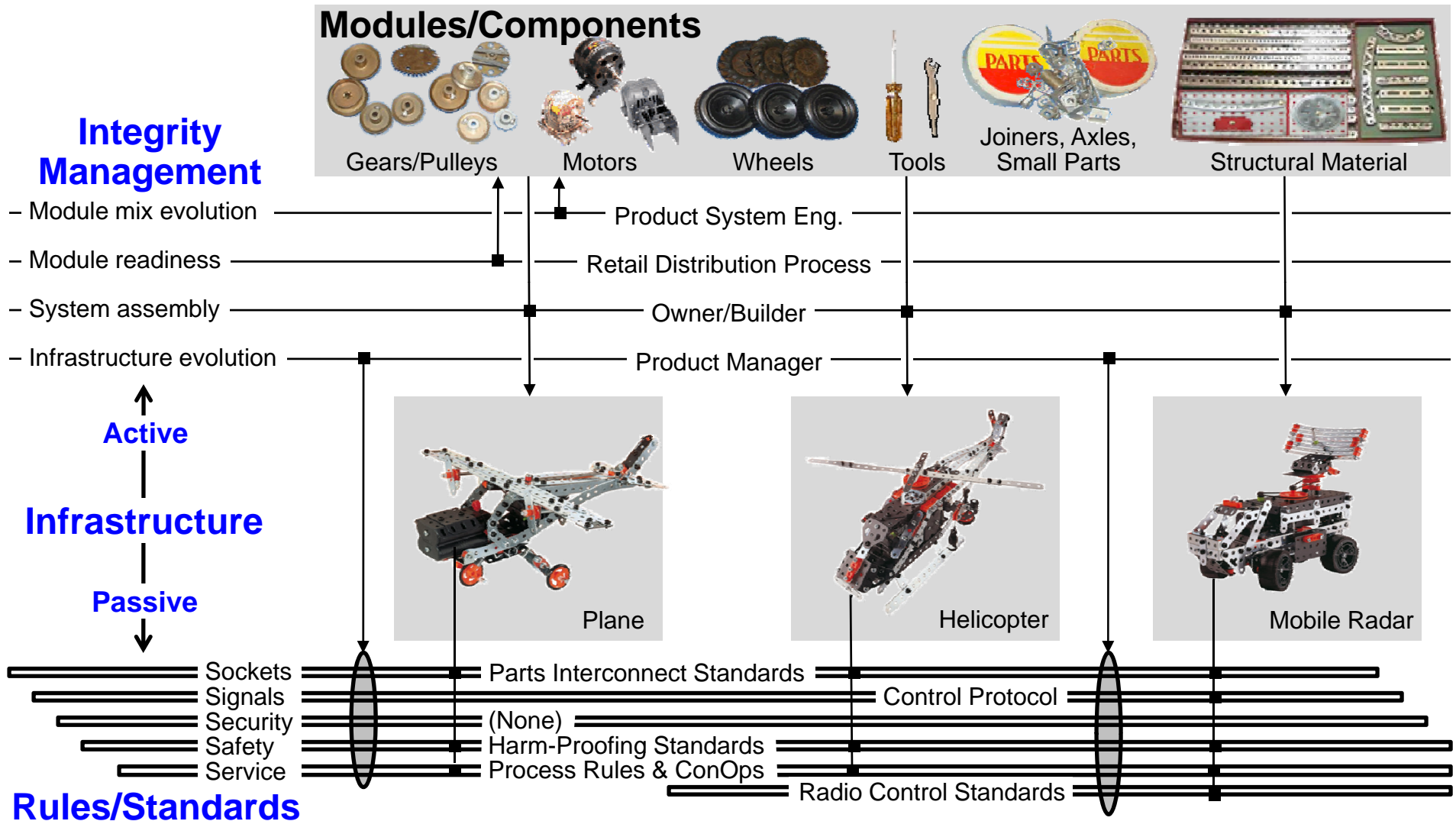
Hosting and workshop details at:

www.parshift.com/ASELCM/Home.html

Notional Concept: Agile Architecture Pattern (AAP)

System Response-Construction Kit

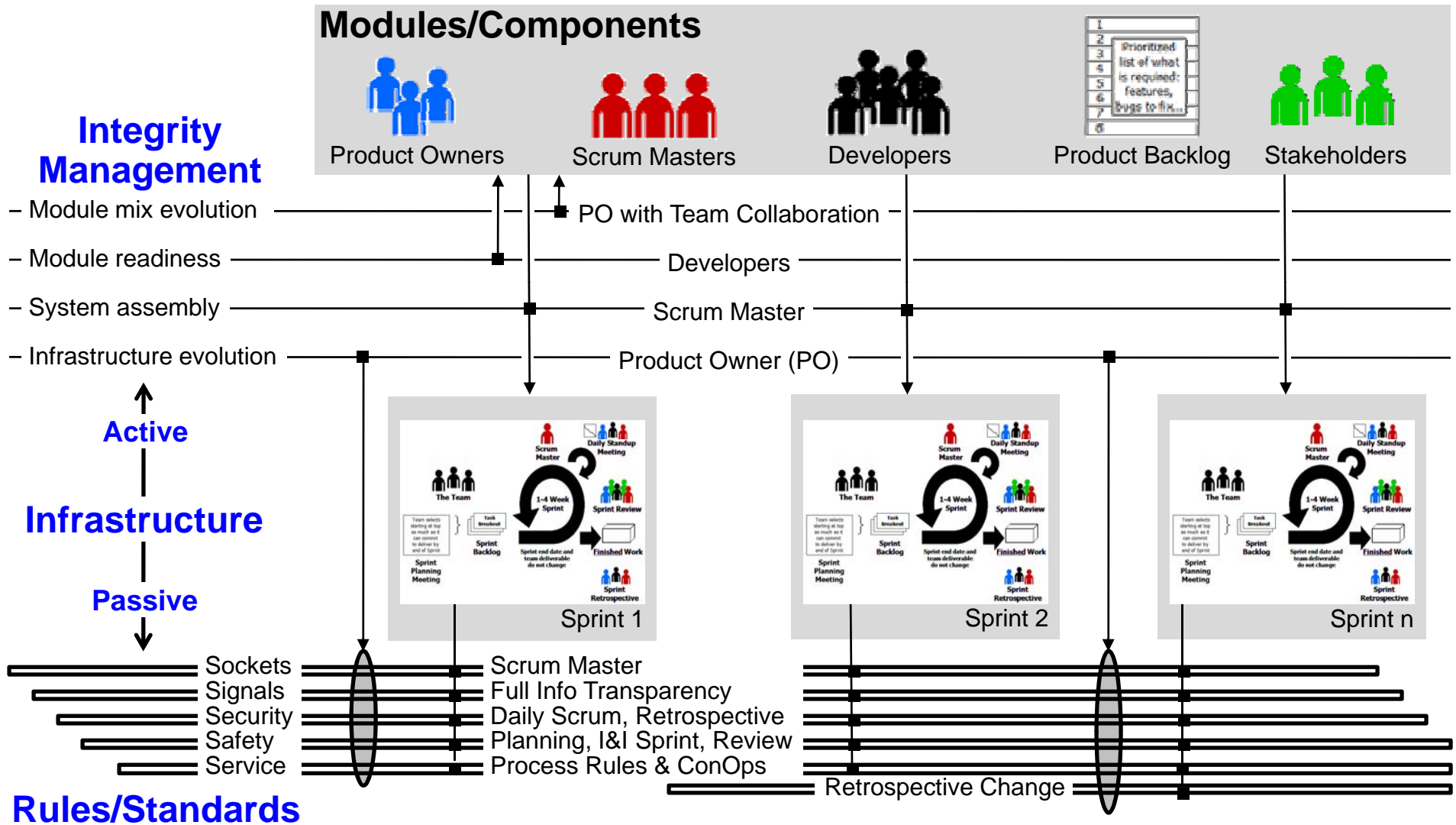
Details in www.parshift.com/s/140630IS14-AgileSystemsEngineering-Part1&2.pdf



Participants will construct AAP from Host discussion

Example: Scrum Agile Architecture Pattern (AAP)

Details in www.parshift.com/s/140630IS14-AgileSystemsEngineering-Part1&2.pdf



Pro forma only – not expected to survive the project analysis work

Participants will construct RSA from Host discussion

Example: Scrum Response Situation Analysis (RSA)

Details in www.parshift.com/s/140630IS14-AgileSystemsEngineering-Part1&2.pdf

| Change Domain | | Pro forma only – not expected to survive the project analysis work | |
|---------------|-------------------------------------|---|--|
| Proactive | Creation (and Elimination) | <ul style="list-style-type: none"> • requirements • experiments • next sprint activity | <ul style="list-style-type: none"> • shared team knowledge • customer satisfaction |
| | Improvement | <ul style="list-style-type: none"> • process effectiveness • risk/uncertainty reduction | <ul style="list-style-type: none"> • effort estimating • completion to schedule |
| | Migration | <ul style="list-style-type: none"> • new technology/tools that will impact infrastructure • lean SE process principles | |
| | Modification (of Capability) | <ul style="list-style-type: none"> • new team member unfamiliar/uncomfortable with agile SE • new environmental situation | |
| Reactive | Correction | <ul style="list-style-type: none"> • wrong requirement • wrong design • inadequate implementation | <ul style="list-style-type: none"> • non-compliant supplier • inadequate developer |
| | Variation | <ul style="list-style-type: none"> • expertise and skill levels among team members • allowable deliverable performance range • customer availability, interaction, involvement expertise | |
| | Expansion (of Capacity) | <ul style="list-style-type: none"> • 2x (or half x) project scope change • x to y engineers distributed across n to m locations | |
| | Reconfiguration | <ul style="list-style-type: none"> • unanticipated expertise requirement • development activity-sequence priority change • system/sub-system design change | |

Participants will construct Reality Factors from Host discussion

Example: Scrum Environmental Reality Factors

RSA exercises often assume a reasonably behaved and supportive environment, and tend to focus on the system's internal functional response situations. This framework tool moves the analysis into the external environment.

| Reality Factors | Pro forma only – not expected to survive the project analysis work |
|--|--|
| Human Behavior: Non-team behavior, error, expediency, uncommitted customer rep, ... | |
| Organizational Behavior: Change in stakeholders, organizational priorities, resource access, ... | |
| Technology Pace: Evolving technology, testing trade-offs, ... | |
| Complexity: Large project with many involved simultaneously, emergent interaction affects, ... | |
| Globalization: Partners/teams with different ethics, cultures, infrastructures, ... | |
| Partially-Agile Enterprise Concepts: Outsourcing, COTS affects, COTS supply/supplier affects, agile software practice-thinking dominance on HW/SW project... | |
| Agile Customers/Competitors/Adversaries: Continuous external-knowledge evolution, continuous external innovation, ... | |

Planned (Roughly) Workshop Agenda

----- Day 1 – 8 hours of structured work starting at 8:00am, room open at 7:30.

2.00 – Introductions, objectives, workshop agenda structure, tools and processes, accumulated learning review.

2.00 – Host process presentation/discussion of SE UURVE situation and SE process (guide provided to host, analysis forms provided to participants).

Lunch(one hour lunch allows informal conversation)

2.00 – Break-out analysis of RSA/RF/AAP (two separate teams doing identical analysis on total SE process overview).

2.00 – Brief-out: Analysis results, discussion, and refinement.

Dinner (host-funded for all participants) at time TBD.

----- Day 2 – 8 hours of structured work starting at 8:00am, room open at 7:30.

1.00 – Review of yesterday's salient learning.

3.00 – Host presentation and Q&A of 19 processes (guide and discussion templates provided to host outlining the points we need to hear and discuss).

Lunch(one hour lunch allows informal conversation).

2.00 – Break out ties 19 processes to RSA/RF with issue closure, and refines AAP of SE process overall.

2.00 – Brief-out: Analysis results and discussion.

----- Day 3 – 8 hours of structured work starting at 8:00am, room open at 7:30.

1.00 – Review/discussion of yesterday's salient learning (with process/issue closure relations).

2.00 – Host presentation/discussion and Q&A of process challenge (in any form wished).

1.00 – Break out synthesis exercise – Synthesis exercise at overall process level – converge on key RSA issues with suggested process activity closure relations and general AAP elements.

Lunch(one hour lunch allows informal conversation).

2.00 – Break out cont. – Synthesis exercise at overall process level – converge on key RSA issues with suggested process activity closure relations and general AAP elements.

1:30 – Brief out and wrap up.

0:30 – Reflection on the workshop process, tools, learning, and results

Action Plan

- ~15 (TBD) three-day structured workshops will be conducted at host sites in the US and Europe to analyze a variety of different types of agile SE experiences.
- Workshops to begin March/April of 2015, approximately one/month.
- Traveling participants must participate in at least 3 workshops. Host sites must provide at least two participants that will attend 2 additional workshops.
- Host sites will include both defense and commercial organizations.
- Workshops will analyze a host life-cycle experience, and then use accumulated learning to synthesize a host-chosen SE approach in need of more agility.
- Hosts will be expected to prepare a discussion presentation covering the processes to be analyzed and synthesized.
- Workshops will have up to 20 “working” participants plus briefers/observers. Working participants are favored to be mostly from various Hosts.
- Within 30-days of each workshop: a results-synopsis write-up, an evolving synthesis of accumulated discovery, and a case study write-up.
- **No system-functional details need be revealed, only SE life-cycle process and activity procedures. Proprietary and classified projects should not be a problem.**

Pre-Workshop Host Preparation

- **Get budget approved: estimated at \$20k, to cover facilitation, synopsis reports, materials, estimated participant travel costs, workshop lunches, and one dinner.**
- **Identify principal point of contact, phone(s), and email address**
- **Reach agreement on process to be analyzed, process to be synthesized, and date of workshop**
- **Identify in advance any special sign-in/registration needs for participants including nationality constraints if any**
- **Recommend hotel(s) for traveling participants, means to travel from hotel to workshop facility, and provide map of facility location**
- **Identify host participants that will attend host workshop plus two more workshops, limit 2-3 at any one additional workshop, with email addresses**
- **Identify others that will present/participate in host workshop, limit 6-8, with email addresses**
- **Identify who will review post workshop results synopsis, phone and email address**
- **Schedule workshop facilities for full group (20 people max) and 1-2 additional break out team rooms that could accommodate two sub-groups**
- **Arrange suitable place for Day 1 evening dinner, one large (U preferred) table or smaller tables in proximity accommodating 4-8 people, and provide map**
- **Arrange morning and 2 break refreshments including coffee/soft drinks**
- **Arrange box lunch for three days served in workshop facility (preferred)**
- **Prepare Day 1 presentation**
- **Prepare Day 2 presentation**

Outcomes and Benefits

Workshop Hosts:

- **Diagnostic analysis of an agile SE process experience for fundamentals that enable effective response in uncertain, unpredictable, evolving SE environments.**
- **Action-learning synthesis applied to a host situation in need of more agile capability.**
- **Understanding of necessary and sufficient enabling principles for any type of agile SE process on any type of project.**
- **Insightful competency developed among at least a few host participants for knowledgeable internal leadership.**
- **Influence where things are going, compatible with your environment.**

Traveling Participants:

- **Insightful competency for transformational leadership.**
- **Bench-mark exposure to HW/SW/WW agile SE processes.**

Systems Engineering Community:

- **Generic principle-based framework for knowledgeably evaluating, choosing, tailoring, integrating, and evolving agile SE.**
- **Means to address SE dynamics with resilient & composable processes.**
- **Clarified agile-SE compatibility with 15288 and INCOSE Handbook.**

Status

INCOSE-PROJ-2014-01 Technical Project Plan approved 13-Oct-2014.

Next

Host identification and scheduling

Attention to balance with commercial sector and Europe.

Workshops will occur about one per month, with ~Mar/Apr start.

Project Leadership:

- **Rick Dove, prior agile-fundamentals workshop series involvement**
- **Kevin Forsberg, V diagram and INCOSE Handbook involvement**
- **Bud Lawson, systems engineering text-book involvement**
- **Jack Ring, prior agile-fundamentals workshop involvement**
- **Garry Roedler, 15288 involvement**
- **Bill Schindel, PBSE concept involvement**

Active In-Process Workshop Sites: Honeywell, General Dynamics, Lockheed, Northrop Grumman, Rockwell Collins, SPAWAR/MITRE, ...

Ask for Project Contact Card if you are a Host candidate

INCOSE-PROJ-2014-01
Discovering Domain Independent
Agile Systems Engineering
Life Cycle Model
Fundamentals

3-Day Action-Learning Workshops
USA and Europe, 2015-2016
For hosting details:
www.parshift.com/ASELCM/Home.html

Analyzing defense and commercial SE process experience
on mixed HW/SW/WW projects under
uncertain, unpredictable, evolving development situations

To Inquire About Hosting or Web Presentation:

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Garry Roedler, garry.j.roedler@lmco.com

Bill Schindel, schindel@ictt.com

Abstract

For many, the word Agile, with a capital A, is used as a noun, referring to a family of software development processes based on principles published as the Agile Software Development Manifesto. To the INCOSE Agile Systems and Systems Engineering (AS&SE) working group, the word agile has a small a, and is an adjective referring to a capability for operational adaptability in an uncertain and unpredictable evolving environment. This presentation will review fundamental architecture and design principles that enable agile capability, relate these fundamentals to domain-independent agile systems engineering, and review the nature of an INCOSE project that is structured to produce an agile systems-engineering life cycle model compatible with ISO/IEC/IEEE 15288 life cycle model standards and encompassing a variety of agile SE approaches such as LVC, Wave, Rapid Fielding, Quick Reaction, ICSM, and others.

Systems engineering is a disciplined activity that delivers engineered solutions to problems and opportunities – often involving multiple stakeholders, coordination across multiple engineering disciplines, and complexity in both problem and solution. Unlike other engineering disciplines, systems engineering also deals with the social, political, and technical aspects of managing projects that span multiple disciplines. Here the argument is against the continued notions of non-repeating life cycle stages and of single-state existence; instead, a life cycle framework that employs progressively concurrent simultaneous stages is shown to be compatible with ISO/IEC/IEEE 15288 standards.

BIO

Rick Dove was co-PI on the DoD funded project at Lehigh University that gave birth to the global interest in agile systems and enterprises in the early nineties. He subsequently led the broad industry research activity as Director of Strategic for the DARPA/NSF funded Agility Forum in the mid-nineties. His ongoing research focuses on necessary and sufficient fundamental design principles for systems of any kind that would be agile. He has employed these principles in pioneering agile factory control system design tools; the creation of agile enterprise IT systems; rapid metal-parts manufacturing; and resilient enterprise security systems.

He is a Fellow of the International Council on Systems Engineering (INCOSE), where he founded and chairs the working groups on Agile Systems and Systems Engineering and on System Security Engineering.

He teaches basic and advanced graduate courses in agile and self-organizing systems at Stevens Institute of Technology. He is CEO/CTO of Paradigm Shift International, an applied research firm specializing in agile systems concepts and education, and leads agile self-organizing system security research and development on DHS and OSD funded technology development projects. He is a partner in Kennen Technologies, and was the PI on the DHS funded projects that showed proof of concept and built prototypes for applying Kennen's patented VLSI pattern processor technology to advanced Bio-inspired agile security applications.

He is author of Response Ability – the Language, Structure and Culture of the Agile Enterprise; and Value Propositioning – Perception and Misperception in Decision Making. He holds a BSEE from Carnegie Mellon University.