

Sense and Respond Logistics Technical Approach

Donald L. Zimmerman
Synergy, Inc.

2 December 2003



Sense & Respond Logistics

Project Objective

Design and implement a logistics system that will be able to support *distributed, adaptive, effects-based* military operations within a larger security operations context.

Sense & Respond Logistics

Technical Approach

- Develop and evolve the **emerging concept** of **Sense and Respond Logistics**
- Perform **Agent-Based Modeling** to study network behavior
- Develop and iterate an **IT prototype** of an S&RL system
- **Test and evaluate**, through broad-based experimentation, the integrated capability
- **Produce rapid, periodic releases** of the evolving S&RL **enhanced capability**
- Develop a **Transition Plan** for the implementation of S&RL
- Integrate diverse project elements and develop a **Co-Evolution Framework** for rapidly influencing change
- **Produce change** using the above capabilities by influencing policy and institutions

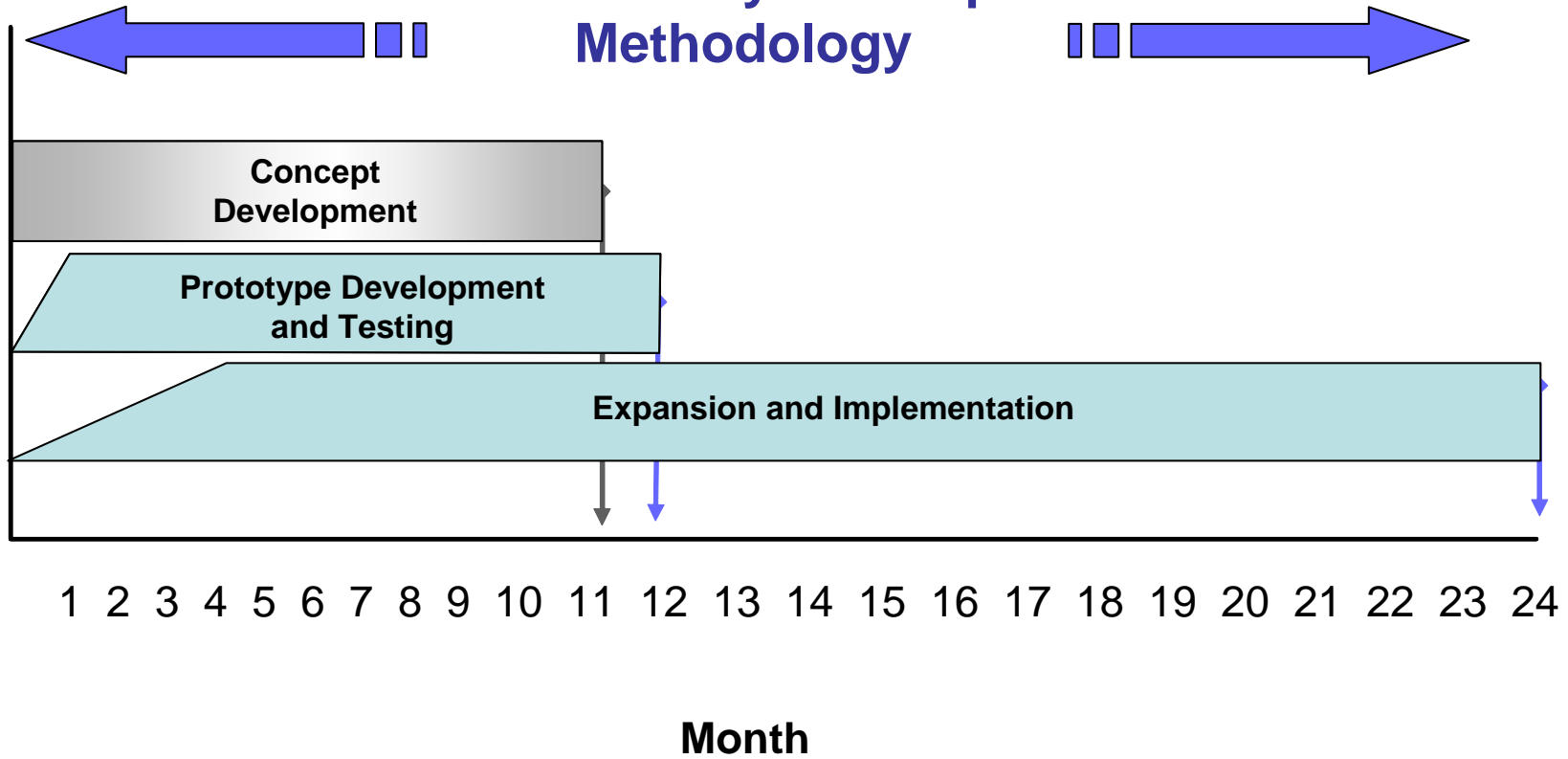
Sense & Respond Logistics

Development Activities for Sense and Respond Logistics

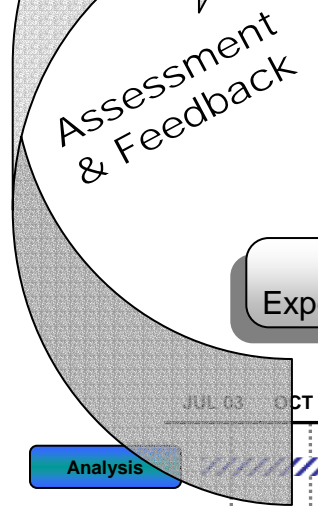
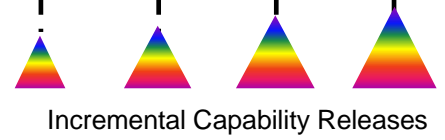
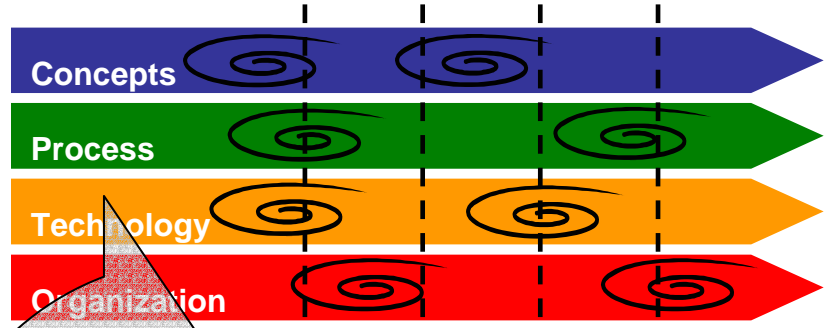
	Concept Development	Prototype Development and Testing	Expansion and Documentation
Activity →			
Tasks →	<ul style="list-style-type: none"> ➤ Develop Project Plan ➤ Develop/document the Concept <ul style="list-style-type: none"> ➤ Multimedia Presentation ➤ S&RL CONOPS ➤ Design the Architecture ➤ Develop: <ul style="list-style-type: none"> ➤ Process Map ➤ System Design ➤ Implementation Plan ➤ Conduct Joint Design Sessions 	<ul style="list-style-type: none"> ➤ Develop POC Prototype <ul style="list-style-type: none"> ➤ Establish Framework ➤ Determine Applications ➤ Deploy Prototype ➤ Initial Deployment ➤ Experimentation Campaign Plan 	<ul style="list-style-type: none"> ➤ Complete Implementation Process <ul style="list-style-type: none"> ➤ 3 Spiral Deliveries ➤ Final Prototype Delivery ➤ Develop S&RL Software Documentation ➤ Expand S&RL across organizations
Deliverables →	<ul style="list-style-type: none"> ➤ Project Plan ➤ CONOPS & Architecture Report ➤ Process Map, System Design, & Transition Plan Tech Report ➤ Monthly Status Reports 	<ul style="list-style-type: none"> ➤ Proof of Concept Operational Prototype ➤ SIPRNET Implementation Strategy & IATO Documentation ➤ Install prototype on SIPRNET ➤ Experimentation Campaign Plan ➤ Monthly Status Reports 	<ul style="list-style-type: none"> ➤ Implement Production S & R Logistics Capability ➤ System Software Documentation ➤ Operational Support ➤ Monthly Status Reports

Sense & Respond Logistics

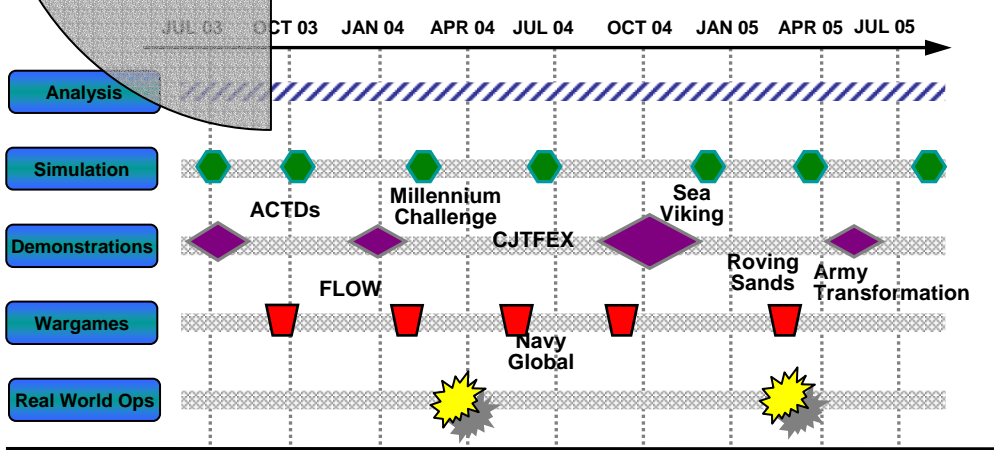
Co-evolutionary Development Methodology



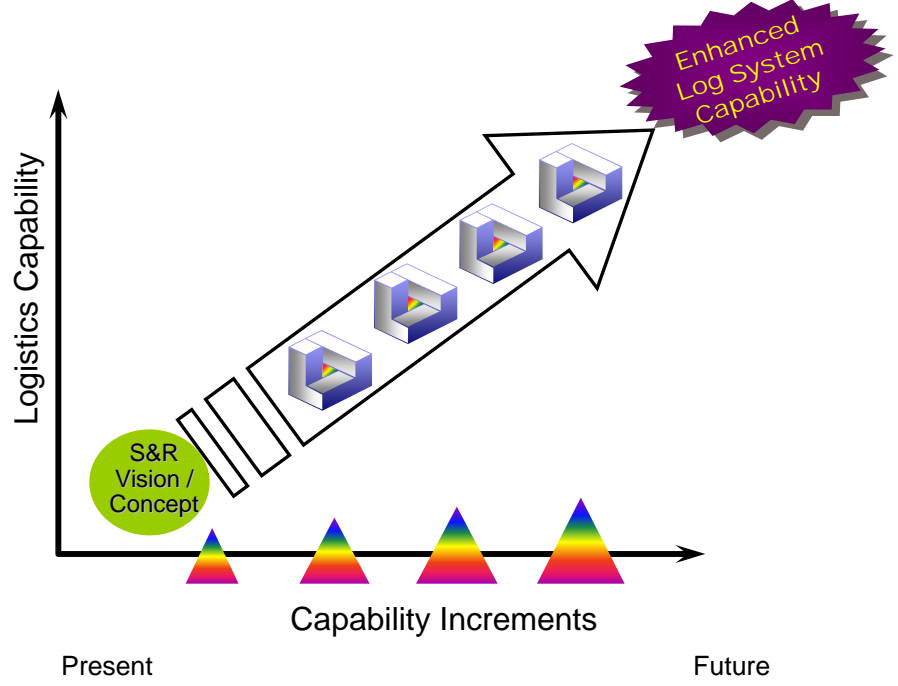
Co-Evolution and Spiral Development



Planned and Event-Driven Experimentation and Operational Evaluation



Rapid, Incremental Sense & Respond Logistics Operational Capability Enhancements



Agent-Based Modeling and the IT Prototype

- Intelligent agents are being used as a research tool and as the key element in the IT Prototype
- We are using Agent-Based Modeling (ABM) to study fundamental network behavior within the context of S&RL
- An agent-based “toy model” is being developed to gain insights into S&RL as a complex adaptive system
- The model is already exhibiting emergent, complex behavior through the simulation of simple agents and simple rules
- These insights, decision rules, and working hypotheses out of the ABM will be used as one source to drive decision rules in the larger Agent-based IT Prototype

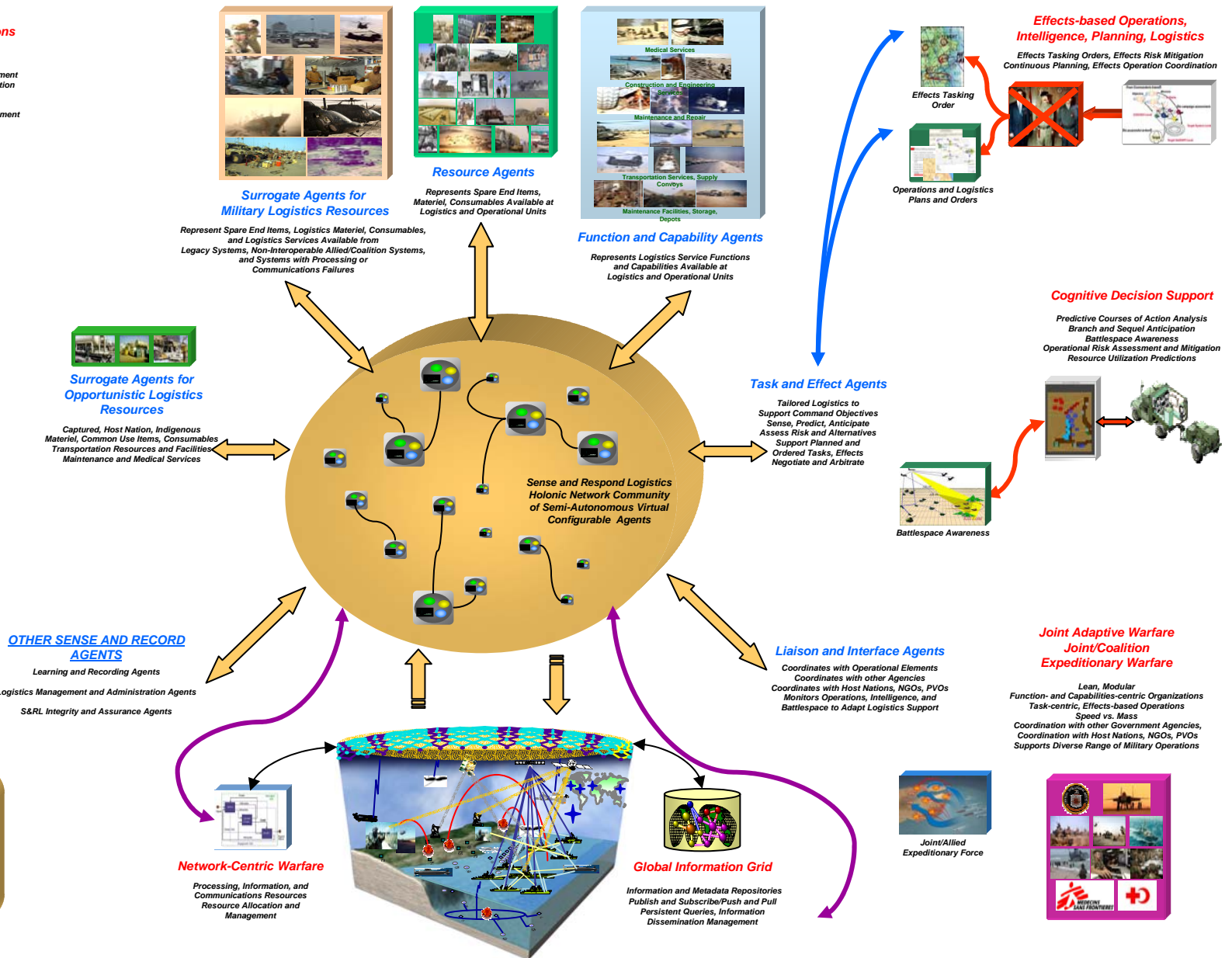
**Sense And Respond Logistics
Transforming Military Logistics .**

**... Achieving Flexibility, Agility, and
Adaptation through a Community of
Agents ...**

**... To Support Armed Forces
Transformation**

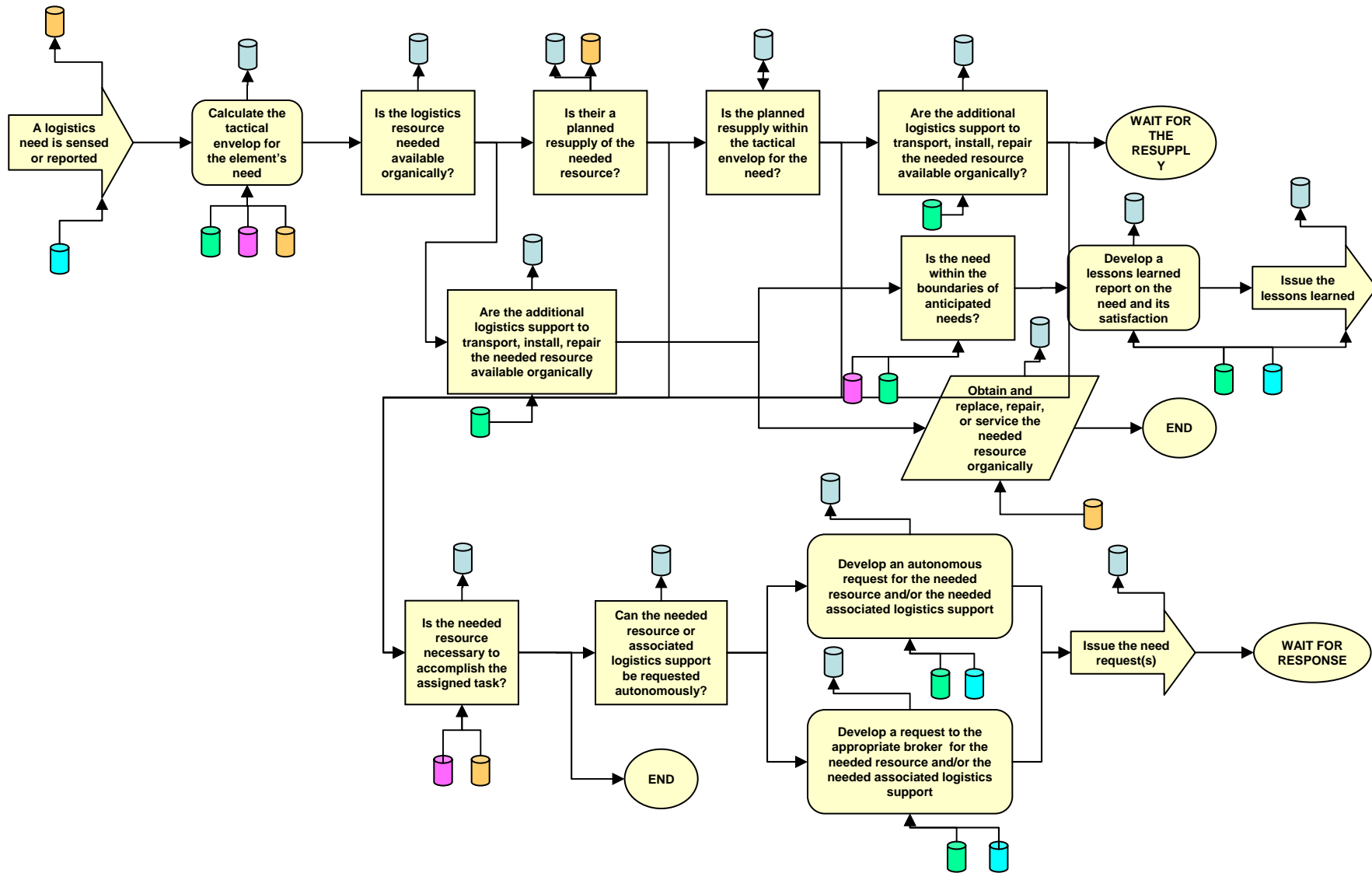
Transforming Military Logistics Operations

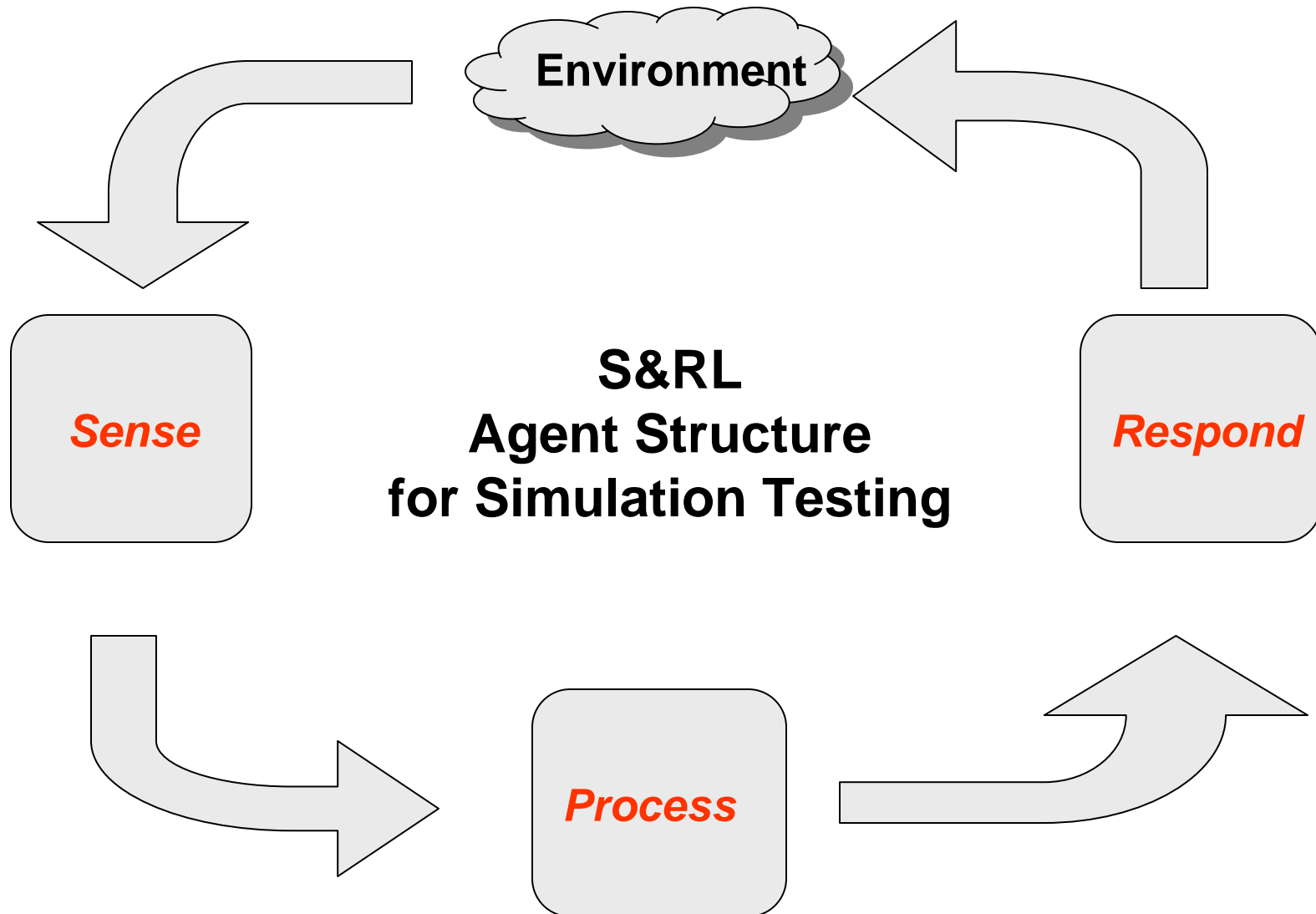
Sense and Respond, Adaptive, Learning Enterprise
Flexible, Agile, and Lean Real Time Support
Factory to Foxhole Adaptation, Supply Chain Event Management
Short Term Inventory, Service, and Transportation Optimization
Resource Utilization Prediction and Anticipation
Risk Assessment and Mitigation
Information, Processing, Communications Resource Management

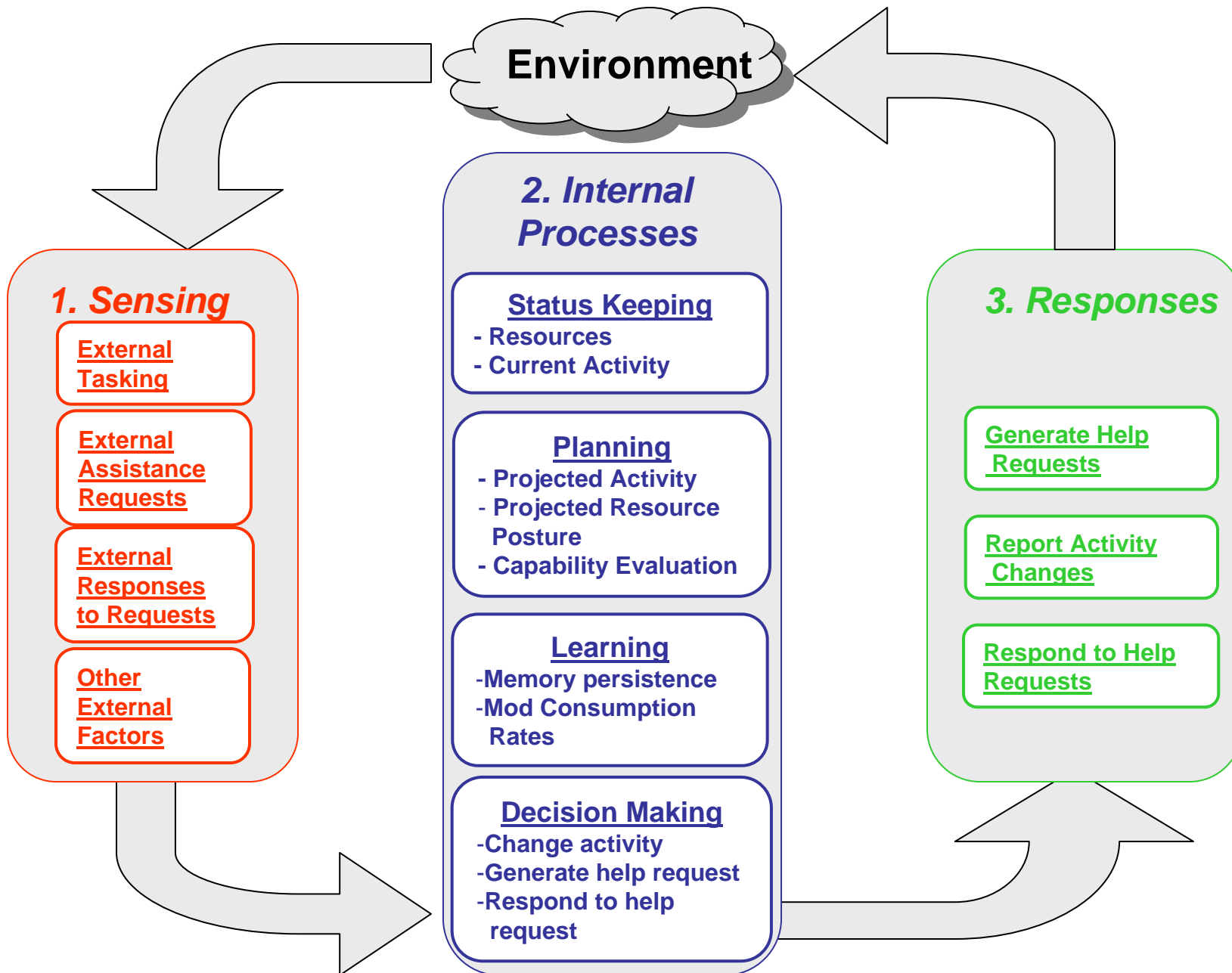


Sense and Respond Logistics:

Agile, Flexible Sustainment
Adapts to Operational Situation
Sustains Effects-based Operations
Considers Entire Battlespace, All Elements as Network of Potential Logistics Materiel, Consumables, Services

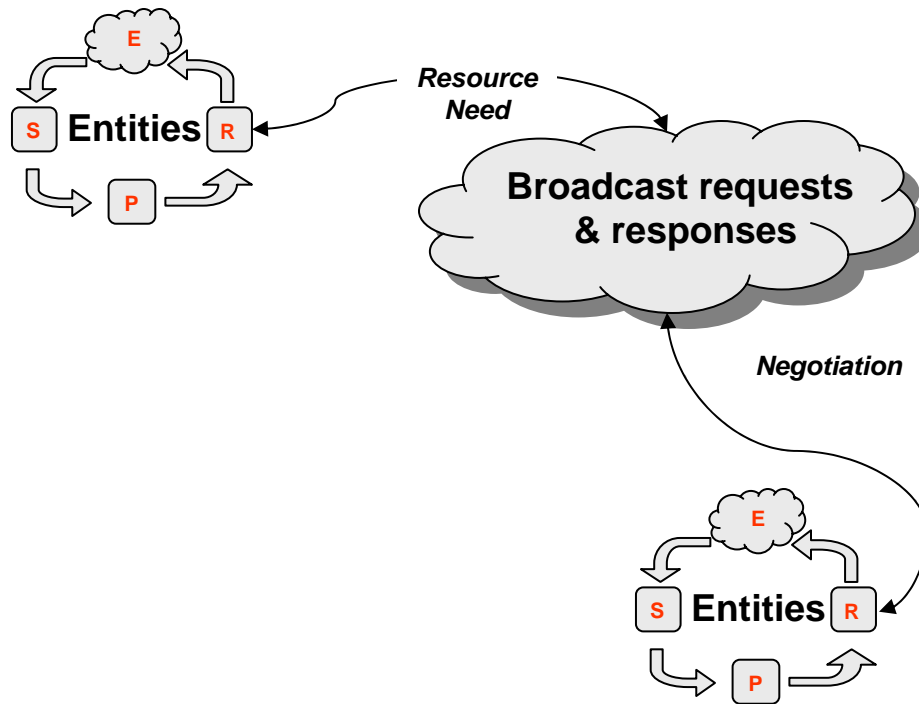






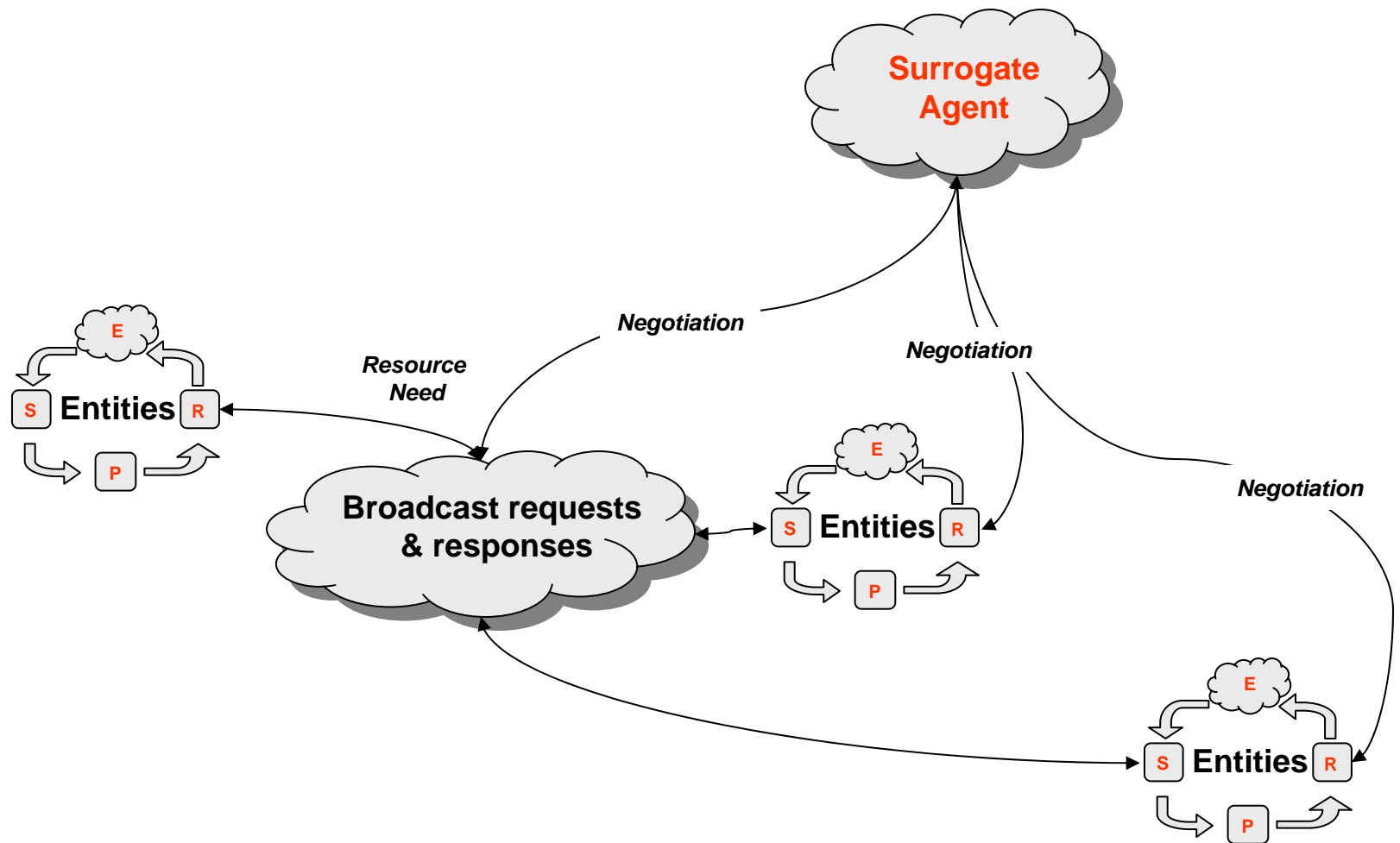
Network Simulation Elements

Simple autonomous need-supply (SRV 01)

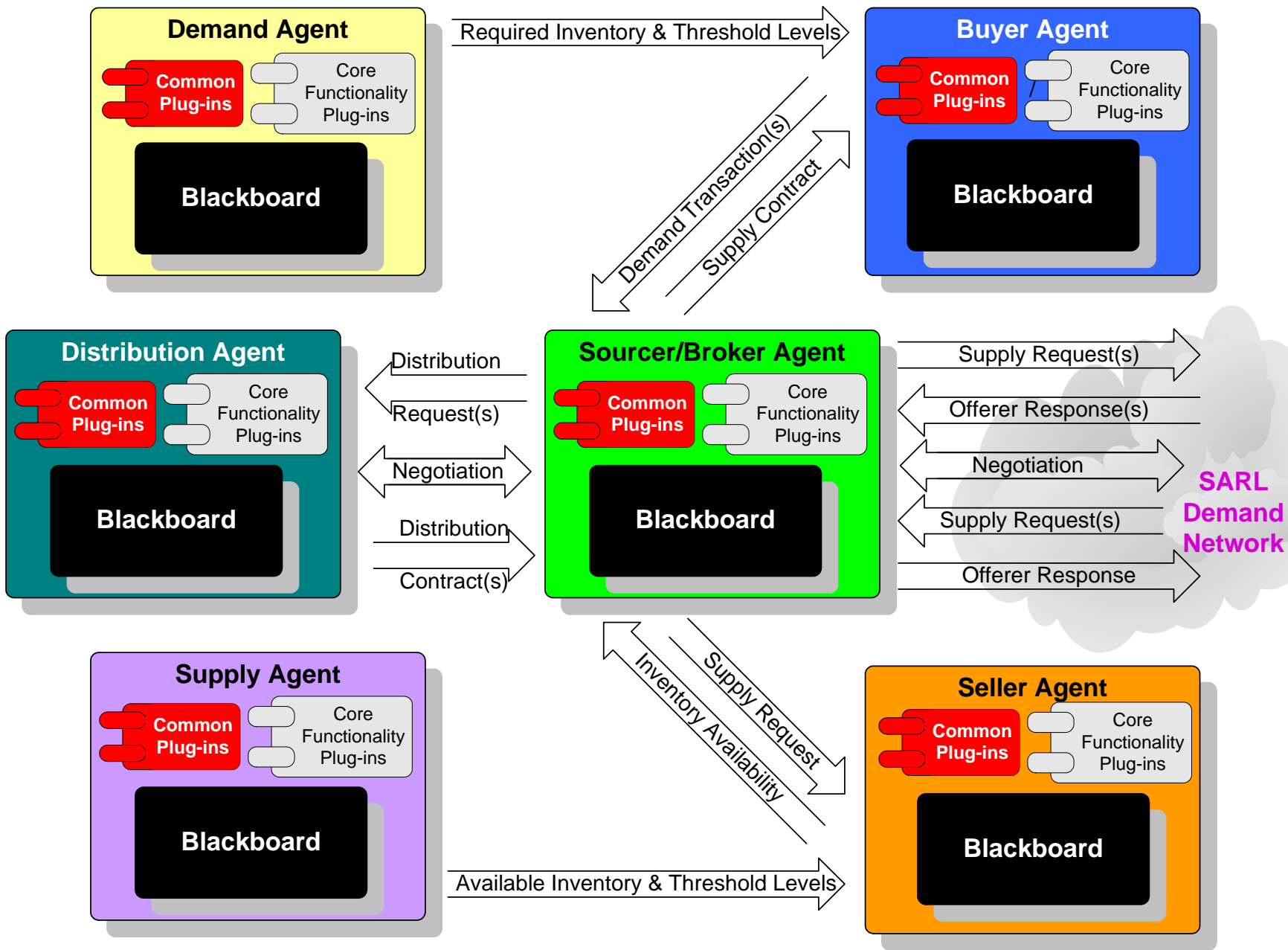


Network Simulation Elements

Simple autonomous need-supply, using surrogates-SRV-01a



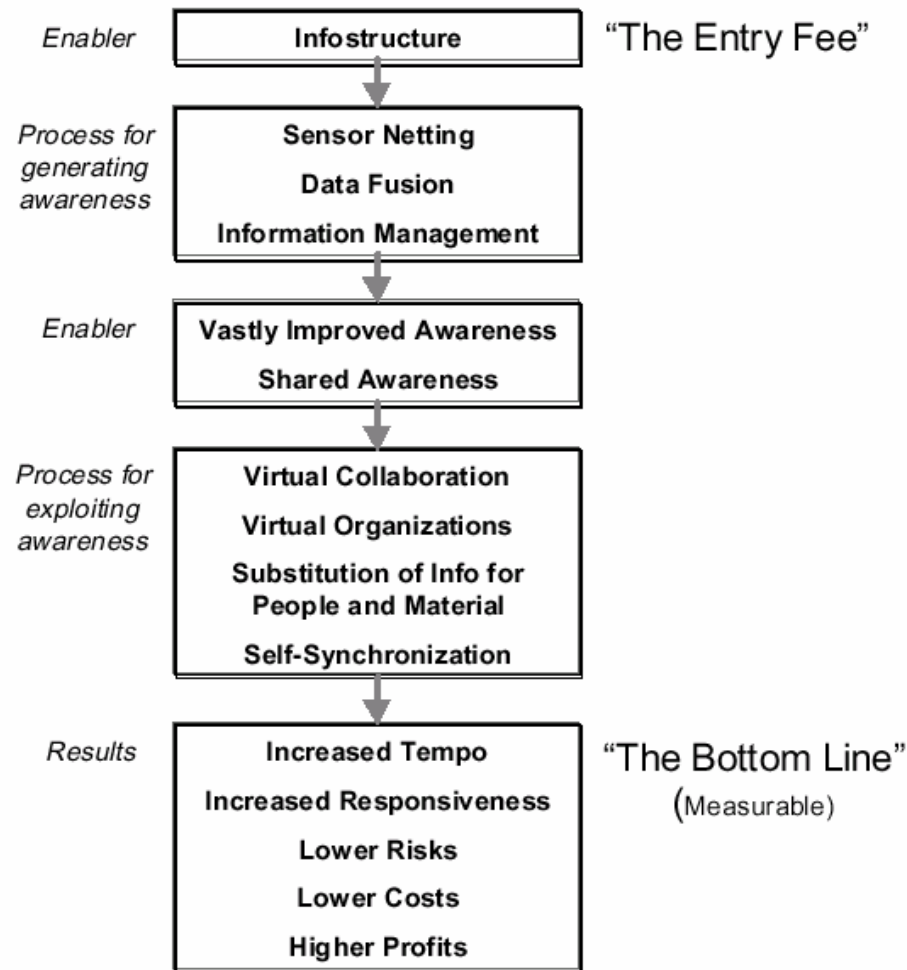
Typical SARL Demand / Support Node



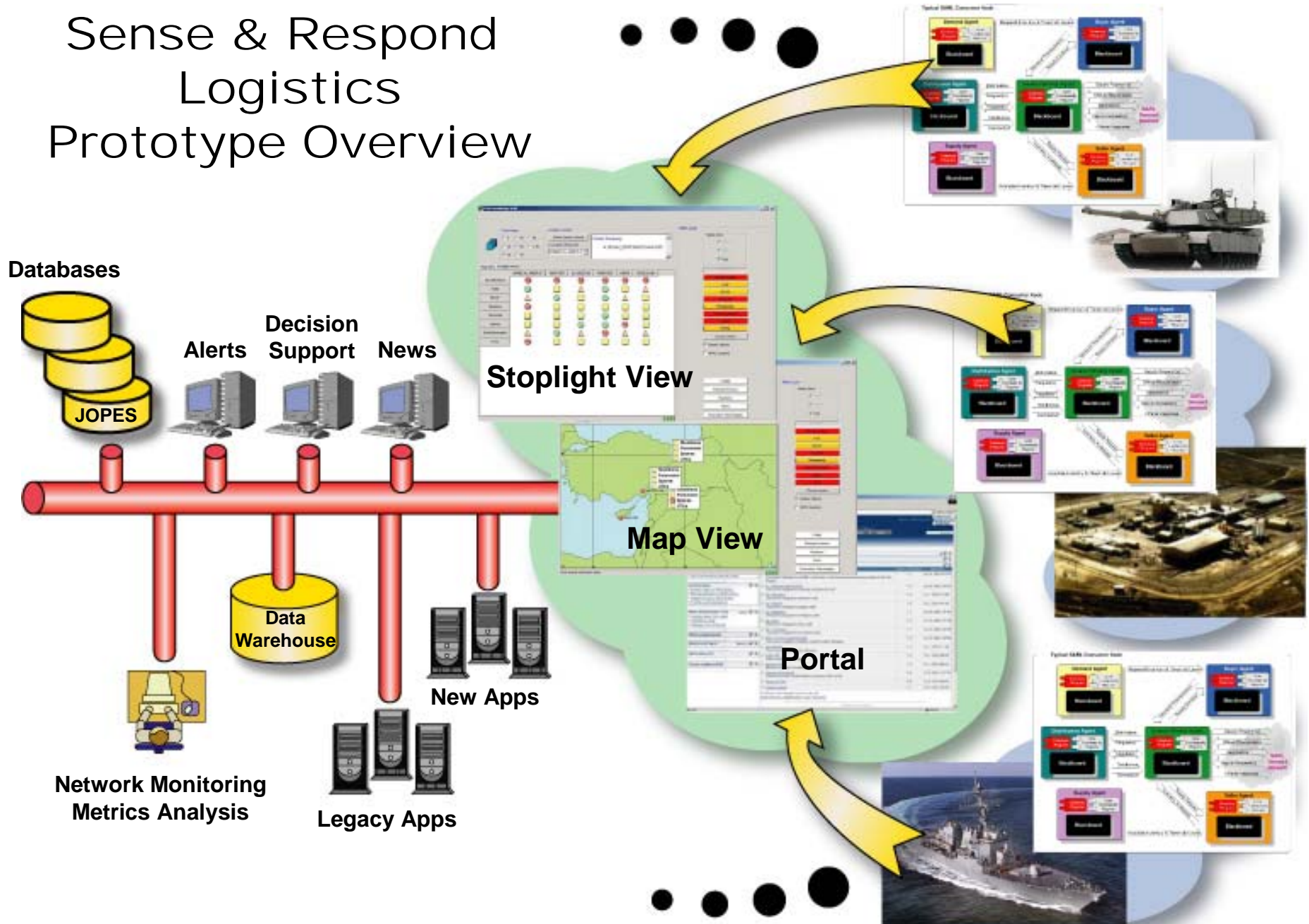
Demand / Support Node Overview

- Each Node will be comprised of six Agents
- Cougar / UltraLog “Plug-ins” and their associated Business Rules define each Agent’s “personality”
- S&RL Hybrid Architecture accommodates a variety of input mechanisms indicating a demand via of a specifically designed Plug-in(s):
 - ⇒ Human issues a demand via some sort of S&RL IT device
 - ⇒ Database threshold breached
 - ⇒ Sensor input, etc.
- Network viewable components (Portal, Map Interface, Digital Dashboard Stoplight tools) support
 - ⇒ Network and Agent behavior monitoring
 - ⇒ Decision support aids
 - ⇒ Capture Nodal Arcs to facilitate trend and performance analysis

The Adaptive, Event-Driven Enterprise



Sense & Respond Logistics Prototype Overview





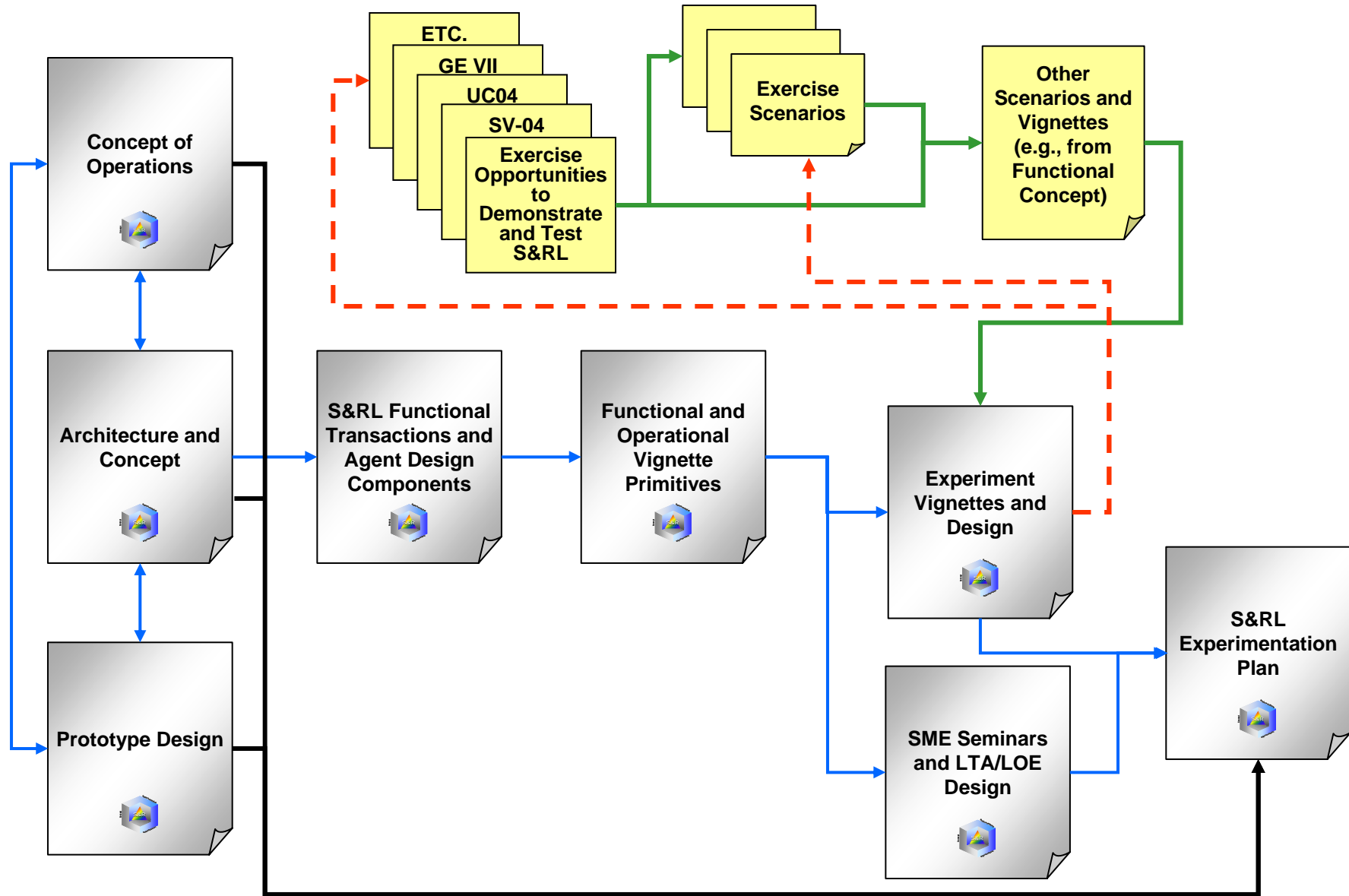
Sea Viking-04: Mission



The Marine Corps conducts the Sea Viking 04 Experimentation Campaign to inform decisions and strategies for achieving 2015 transformational goals

- Examine Sea Basing & OMFTS within the Joint context
- Provide a foundation for Naval Transformation
- Establish main effort of Marine Corps Service Experimentation
- Provide hard data to inform planning and programming decisions
- Examine Sense and Respond Logistics

Experimentation Plan Development Process



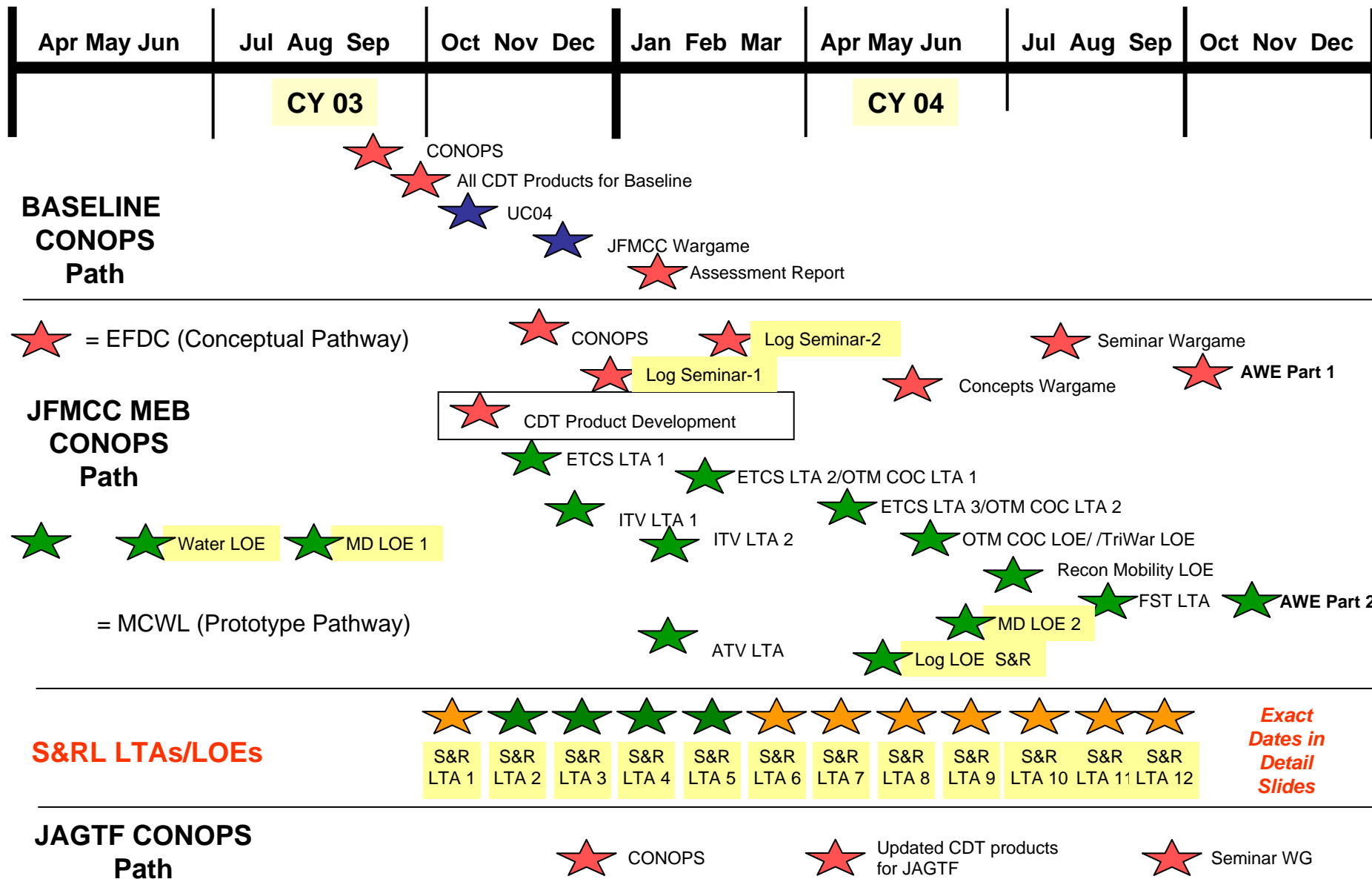
Experimentation Framework Components

Tab	Title	Description
I	Overview	Structure of workbook and definitions of Tabs of Experimentation Framework
II	S&R Vignettes	Primitive functional elements required to demonstrate S&RL. Stand-alone, and basis for other vignettes. Includes LTAs. Includes cross-reference to military transformation elements
III	Operational Context	Operational assumptions and context overall, and related to specific experiments
IV	SV-04 S&R LTAs/LOEs	Sea Viking 04 S&RL Limited Technical Assessments, Limited Operational Experiments, and insertion of S&RL objectives
V	UC-04 S&R Play	Unified Course 04 insertion of S&RL objectives
VI	GE VII S&R Play	Global Engagement VII insertion of S&RL objectives
VII	Use Cases	How user will interact with system given a specific operational Vignette. Gives detailed descriptions that gives operational relevance to S&RL Devised to communicate requirements for system interface of transactions, reports, and screens Must prove tenets of S&RL
VIII	Lessons Learned & LTA/LTE Results	Lessons Learned from Exercises, Demonstrations, LTAs, LOEs. Inputs from SMEs in LTAs/LOEs

S&R Primitive Vignettes: Examples of Increasing Complexity

SRV-01-01	Autonomous need-supply from logistics element, using supplier transportation	Demonstrate autonomous S&RL operations, within service, from logistics element supplier, using logistics element transportation.	An element requires consumables that may be in supply at other elements (e.g. fuel). Its ruleset permits the issuance of an autonomous need for fuel. A single logistics element, whose ruleset permits responses to autonomous requests, responds that it has a sufficient amount of fuel to supply within its tasking and resupply situation. A simple negotiation occurs to select a rendezvous. Assumes that the supplier is an element of the same military service as the requestor. Assumes that transportation to the rendezvous is available organically, in the logistics element. Assumes that the supplier's tasking does not require brokering with other operational/logistics or intelligence agents relative to the use of spare fuel.
● ● ●			
SRV-01-06	Autonomous need-supply between two units in same service and in different organizations	Demonstrate autonomous S&RL operations, within service, unit-to-unit, in different organizations, where logistics support elements are not involved.	An element requires consumables that may be in supply at other elements (e.g. fuel). Its ruleset permits the issuance of an autonomous need for fuel. A single element, in the same service but in a different organization, whose ruleset permits responses to autonomous requests, responds that it has a sufficient amount of fuel to supply within its tasking and resupply situation. A simple negotiation occurs to select a rendezvous. Assumes that transportation to the rendezvous is available organically at the requestor. Assumes that the supplier's tasking does not require brokering with other operational/logistics or intelligence agents relative to the use of spare fuel.

Linking SV04 and S&R Experimentation



Near Term Areas of Focus

- Building an S&RL Road Map and Transition Plan
- Working with OSD-ATL, JFCOM, Services, and other DoD organizations to implement and instantiate capability as it evolves
- Leveraging S&RL approach and applying to Joint Adaptive Command and Control and Joint Intelligence, Surveillance, and Reconnaissance