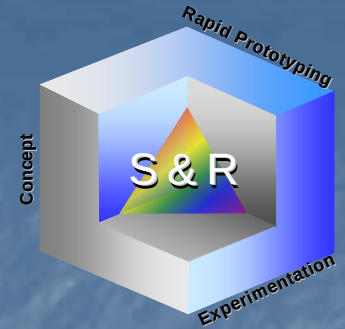




Multi-Dimensional Assessment of Technology Maturity Conference 9 -11 May



Sense and Respond Logistics: The Future of Warfighter Support

*Brett Andrews, CPL
Defense Acquisition University
Midwest Region*

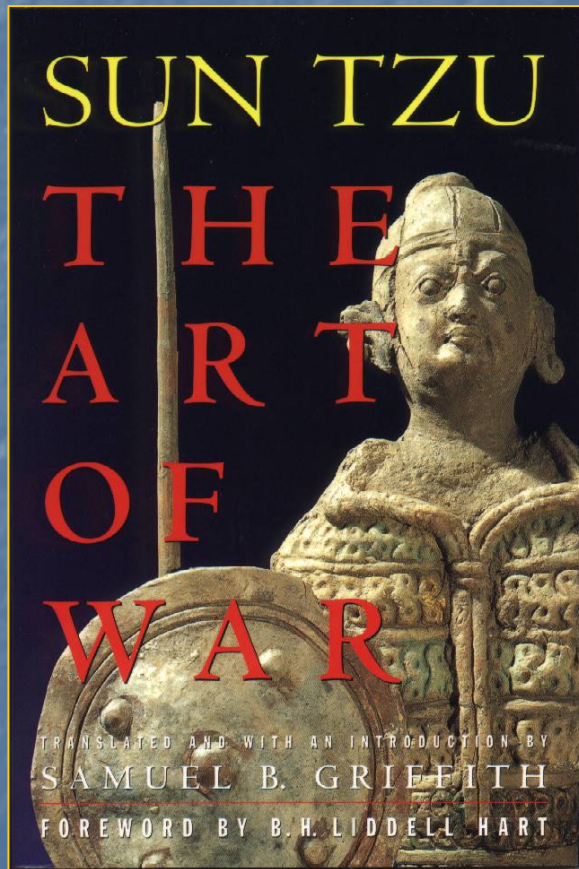


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Overview

- **Initiatives, Policies and Strategies**
- **A Conceptual Description of S&RL**
- **Needed Technologies and Capabilities**
- **Measuring S&RL success -- The Metrics**

Warfighter Information Needs: An Enduring Perspective



*“ Know the other **and** know yourself;
one hundred challenges without danger.*

*Know not the other **and yet** know yourself;
One triumph for one defeat.*

*Know not the other **and** know not yourself,
Every challenge is certain peril.”*

Sun Tzu

Initiatives, Policies and Strategies

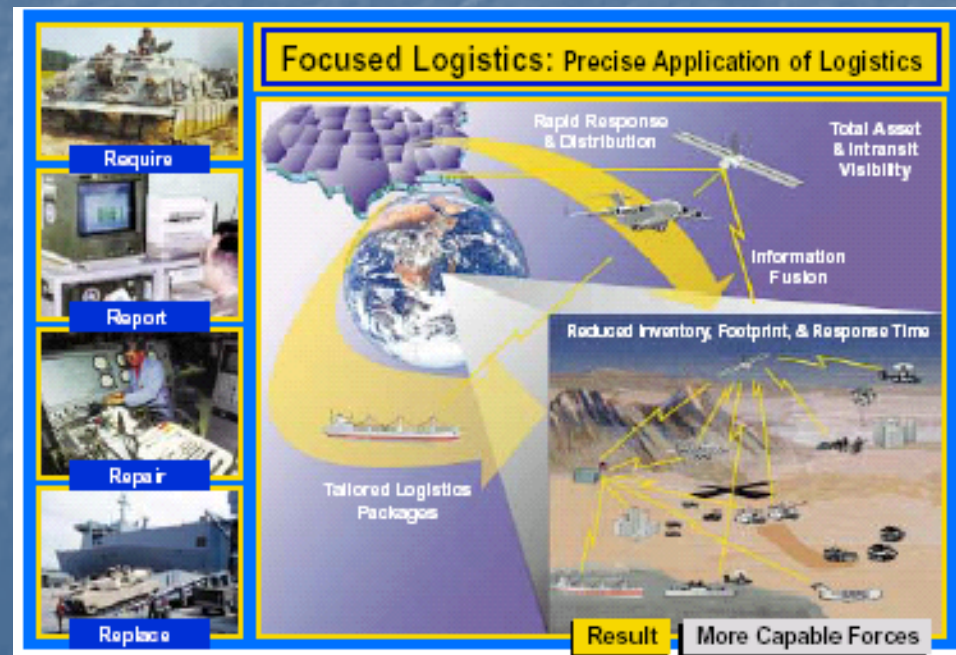
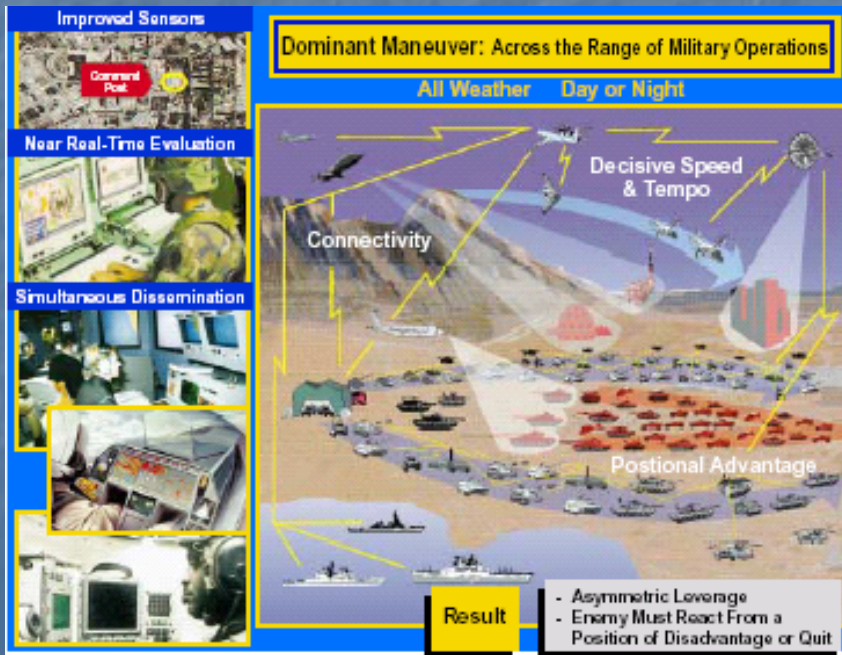
Joint Vision 2010/2020

Emerging Operational Concepts

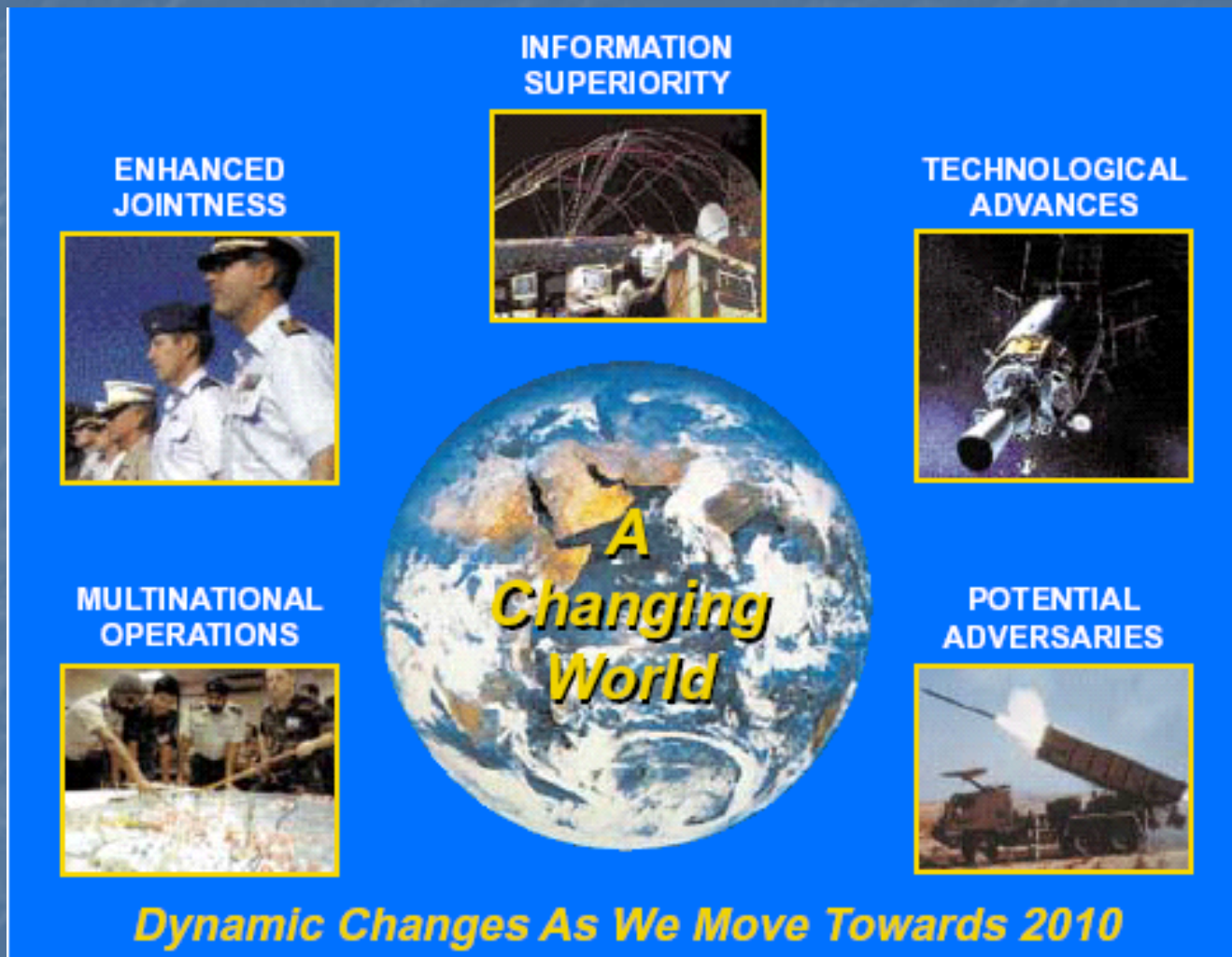


Joint Vision 2010 (Jul 97) was the conceptual template for how America's Armed Forces would channel the vitality and innovation of our people and leverage technological opportunities to achieve new levels of effectiveness in joint warfighting.

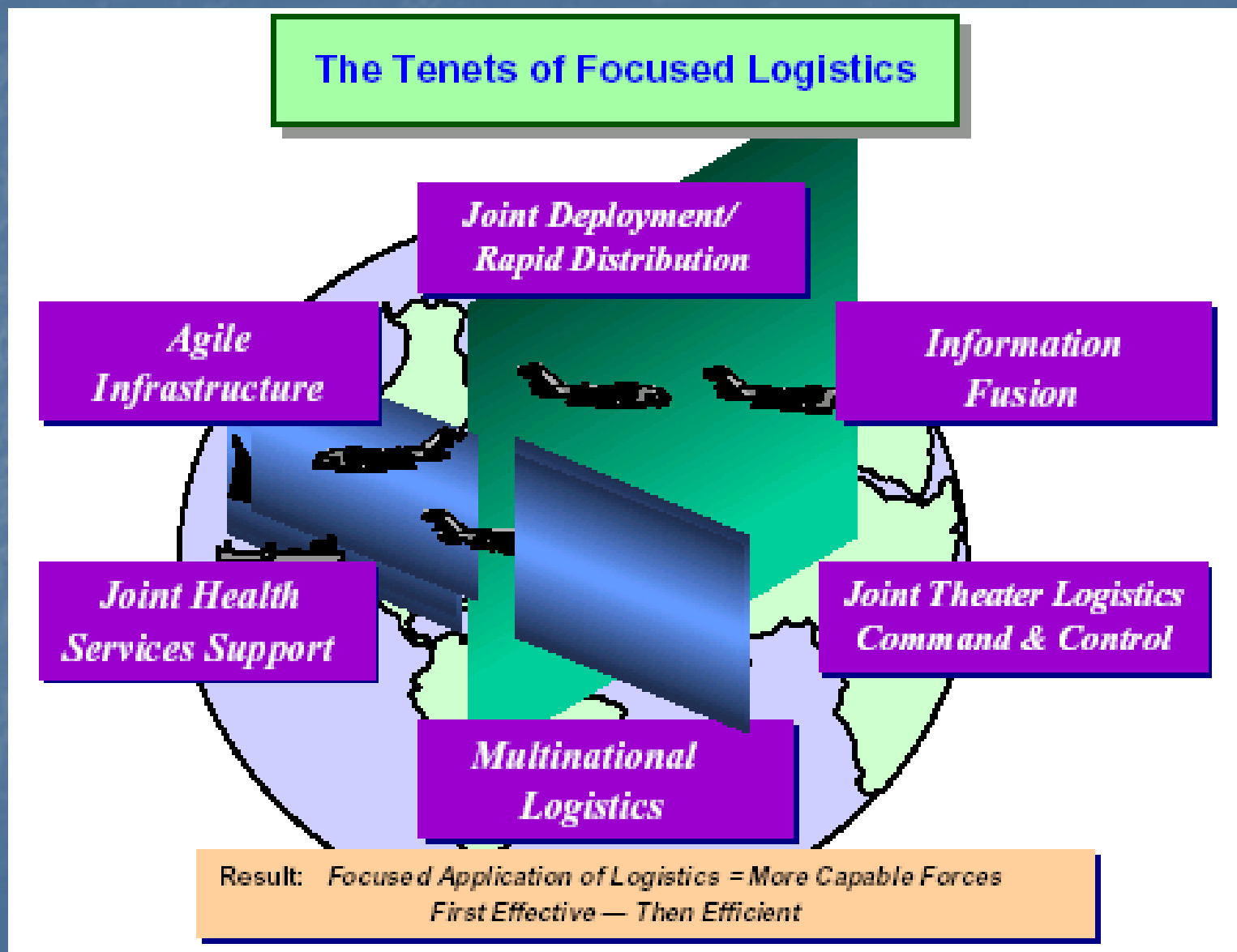
Joint Vision 2020 (May 00) built upon and extended the conceptual template established by Joint Vision 2010 to guide the continuing transformation of America's Armed Forces.



JV 2010 Dynamic Changes



Focused Logistics Roadmap (Aug 97)



JOINT DEPLOYMENT/RAPID DISTRIBUTION

... the process of moving multi-Service forces to an operational area coupled with the accelerated delivery of logistics resources through improved transportation and information networks providing the warfighter with vastly improved visibility and accessibility of assets from source of supply to point of need.

INFORMATION FUSION

... the timely and accurate access and integration of logistics data across units and combat support agencies throughout the world providing reliable asset visibility and access to logistics resources in support of the warfighter.

JOINT THEATER LOGISTICS COMMAND AND CONTROL (JT LOG C²)

... a concept to make clear lines of authority, through a single entity in a joint warfighting environment responsible for logistics support.

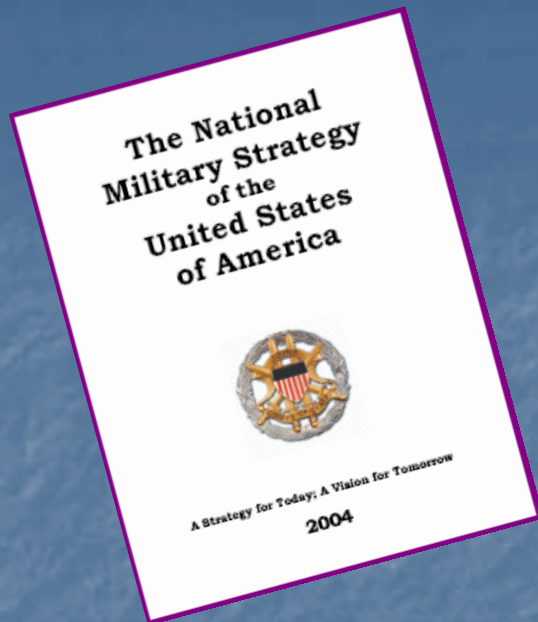
AGILE INFRASTRUCTURE

... will result in right-sizing of the logistics footprint through reductions in logistics forces, facilities, equipment and supplies. These reductions will be enabled through significant enhancements to joint logistics policies, structures and processes in inventory management, engineering, maintenance, and infrastructure improvements.

MULTINATIONAL LOGISTICS

... mutual logistics support relationships between the United States and allied/coalition partners.

JOINT HEALTH SERVICES SUPPORT (JHSS)



National Military Strategy (NMS)

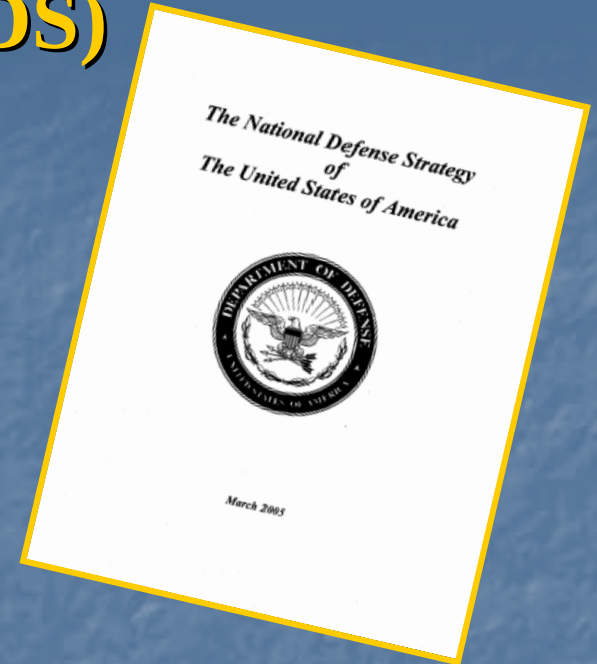
A Strategy for Today, A Vision for Tomorrow 2004

Describes the ways and means to protect the United States, prevent conflict and surprise attack and prevail against adversaries who threaten our homeland, deployed forces, allies and friends. Success rests on three priorities:

- Protecting the United States.
- Enhancing our ability to fight as a joint force.
- Transforming the Armed Forces “in stride” – fielding new capabilities and adopting new operational concepts

National Defense Strategy (NDS)

Mar 2005



■ Key Capabilities

- Strengthen Intelligence
- Protecting Critical Bases of Operations
- Operating from Global Commons
- Projecting & Sustaining Forces in Anti-access Environments
- Denying Enemy Sanctuary
- *Conducting Network Centric Operations*
- Improving Proficiency Against Irregular Challenges
- Increasing Capabilities of Partners: International & Domestic



**Secretary
of Defense**

Rumsfeld Doctrine

The core of the Rumsfeld doctrine is that the *speed/availability* of effects takes away options, thereby limiting/barring the enemy's ability to adapt. Speed is comprised of more than just physical speed, however. Cognitive speed is a vital component; it takes the initiative from the defender and severely limits their ability to react

The “New American Way of War”

Logistics, Operations, and Intelligence can no longer carry on as separate and distinct communities that share occasional interface points; their performance in the cognitive and information domains in particular must become more jointly coherent.



Gen Richard. B. Myers
Chairman, Joint Chiefs of Staff



Future Warfighter Information Needs: Desired Attributes of a Transformed Joint Force

- **Fully Integrated**: Capabilities must be born joint and able to integrate into a focused effort with a unified purpose
- **Networked**: Linked and synchronized in time and purpose— allowing dispersed forces to communicate, maneuver, and share a common operating picture
- **Adaptable**: Forces that are tailorable and scalable, prepared to quickly respond to any contingency
- **Decision Superior**: Gain/maintain information superiority to shape situation or react to changes
- **Decentralized**: Uses collaborative planning/shared knowledge to empower subordinate commanders to compress decision cycles
- **Expeditionary**: Rapidly deployable, employable, and sustainable
- **Lethal**: Capability to destroy an adversary and/or his systems in all conditions and environments

Source: United States Armed Forces - Joint Operations Concepts (JOpsC)



Congressionally Direction

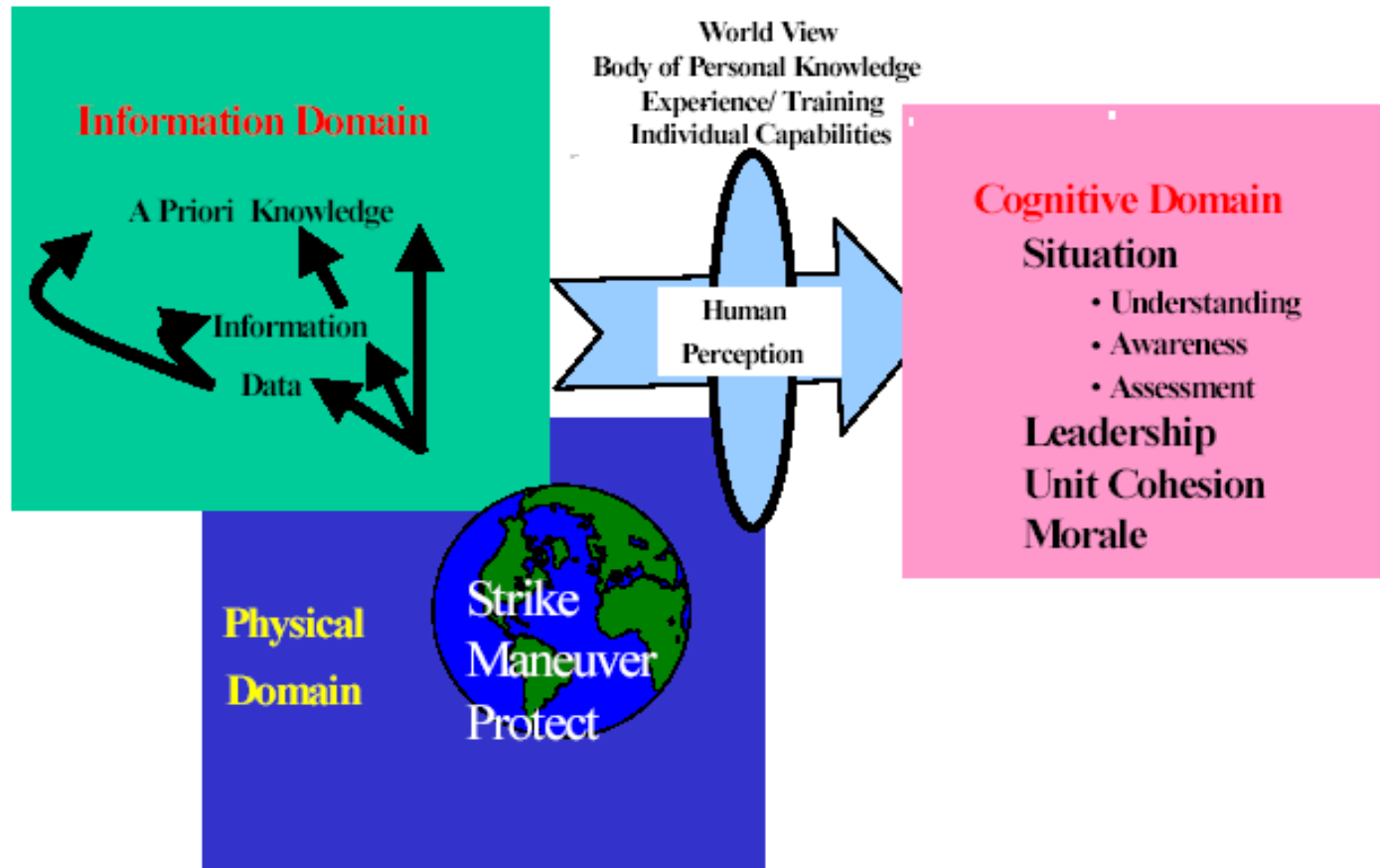
- Section 934 of Public Law 106-398 stipulates that areas listed below be addressed
 - SEC. 934. NETWORK CENTRIC WARFARE (NCW)
 - 1. Findings. Congress makes the following findings:
 - (a) *Joint Vision 2020* set the goal for the DoD to pursue information superiority in order that joint forces may possess superior knowledge and attain decision superiority during operations across the spectrum of conflict.
 - (b) One concept being pursued to attain information superiority is known as NCW. The concept of NCW links sensors, communications systems, and weapons systems in an interconnected grid that allows for a seamless information flow to warfighters, policy makers, and support personnel.

Network Centric Warfare/ Network Centric Operations

network-centric warfare — An information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self synchronization.

network-centric operations — Network Centric Operations (NCO) involves the development and employment of mission capability packages that are the embodiment of the tenets of Network Centric Warfare (NCW) in operations across the full mission spectrum.

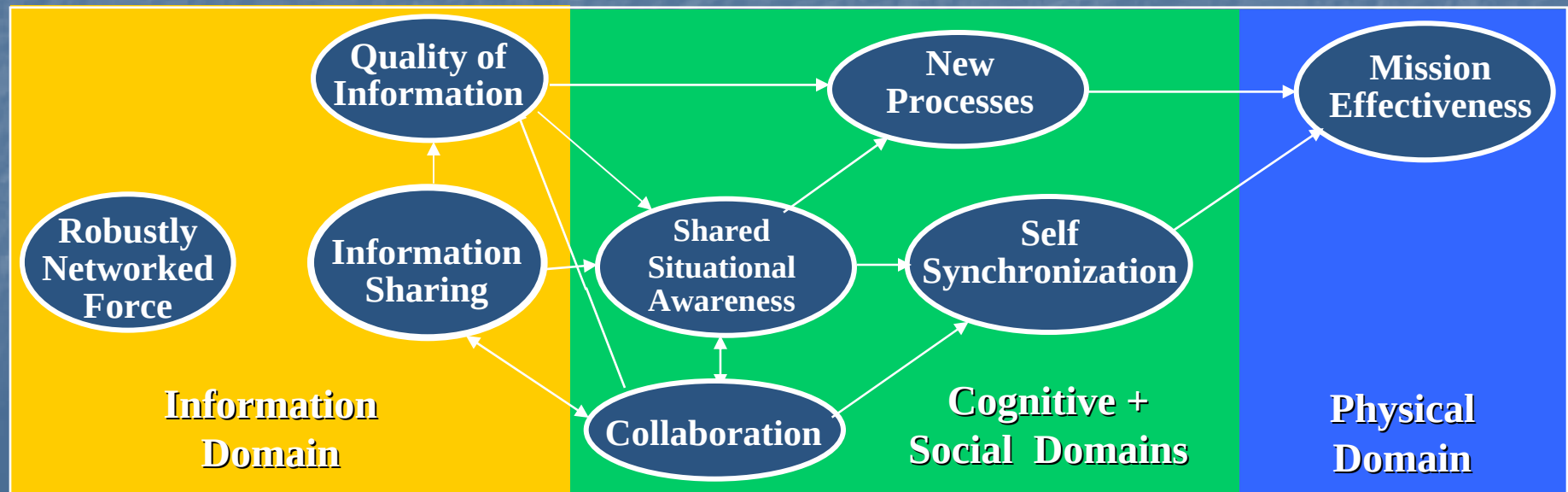
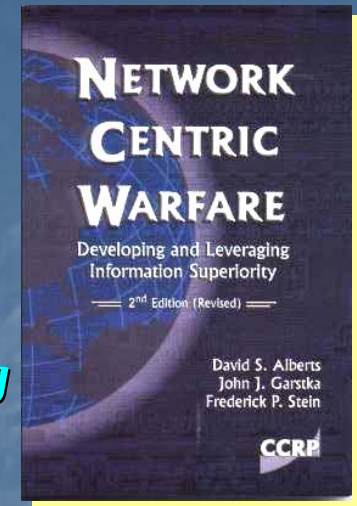
Domains of Warfare



Tenets of Network Centric Operations ...The New Value Chain

Tenets of NCW: A Hypothesis Regarding Sources of Power

- **A Robustly Networked Force Improves Information Sharing**
- **Information Sharing And Collaboration Enhances the Quality of Information and Shared Situational Awareness**
- **Shared Situational Awareness Enables Collaboration and Self Synchronization and Enhances Sustainability and Speed of Command**
- **These in Turn Dramatically Increase Mission Effectiveness**



Insight from an OIF Commander



*Lt. Gen. David D. McKiernan
Coalition Forces Land Component
Commander, OIF*

“Our joint campaign was so fast getting to Baghdad, that the regimes situation awareness was destroyed. They didn’t know where we were; didn’t know where their own forces were.”

Strategies for implementing NCW in DoD

- *Refine the new rules of information age warfare and the theory of NCW through simulation, testing, experimentation, and actual \combat experience.*
- *Apply the NCW theory enterprise-wide in DoD.*
- *Accelerate networking of the joint force at the tactical level, as well as at the strategic and operational levels.*
- *Accelerate deployment and employment of new network-centric concepts and capabilities.*
- *Experiment with network-centric concepts and capabilities to develop new and better ways to conduct network-centric operations (NCO).*
- *Address challenges of allied and coalition NCO.*
- *Develop doctrine and tactics, techniques, and procedures for NCO.*

Transforming Logistics



Logistics Problems Operation Iraqi Freedom



- Rate of Advance: **Out ran logistic communications**
- Reliable Communications: **Logistics units lacked best communication capability**
- Visibility of Supplies: **Lost visibility of incoming and intra-theatre supplies**
- In-theatre Transportation: **Less than optimal use of theater transportation assets**

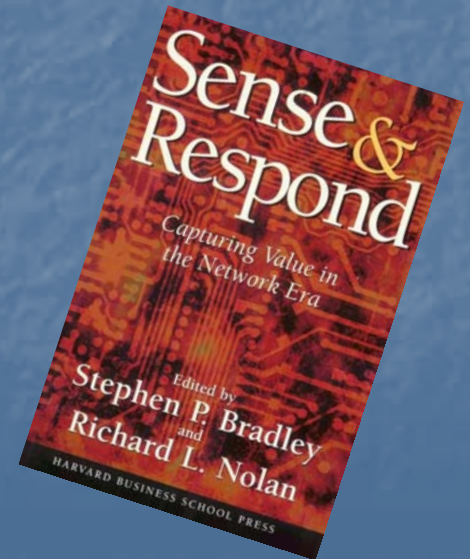
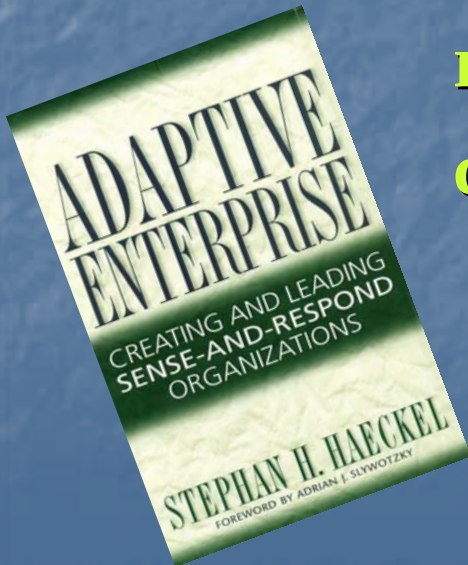
Logistics Support in a Transformed Military will require:

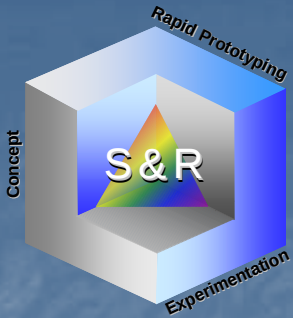
- Prioritization for support at the point-of-effect, with a streamlined end-to end process back to the source-of-supply, for the full range of military operations;
- Broadening of the source-of-supply across all potential sources;
- Logistics operations in a networked, distributed force that emphasizes speed of command, quality of effects, and adaptation;
- Commander's intent-focused capabilities-centric logistics for tasks, missions and effects, as opposed to the optimization of logistics supply;
- Development, maintenance, and real-time distribution of a logistics common relevant operational picture (LOG CROP); and
- Logistics support for rapid force projection and rapid, decisive operations of expeditionary forces.

Sense and Respond Logistics

Sense & Respond Concept Origin

- S&R business analog is an adaptive managerial framework originally developed by IBM
- Business literature and practice reflect application of network centric theory and principles





Sense and Respond Logistics (S&RL)

Sense and Respond Logistics is a transformational, network-centric, knowledge-driven concept that enables Joint effects-based operations and provides precise, agile support. Sense and Respond Logistics relies upon highly adaptive, self-synchronizing, and dynamic physical and functional processes. It predicts, anticipates, and coordinates actions that provide competitive advantage across the full range of military operations.

Operational Sense And Respond Logistics: Co-evolution Of An Adaptive Enterprise Capability, Concept Document, May 2004, Office of Force Transformation

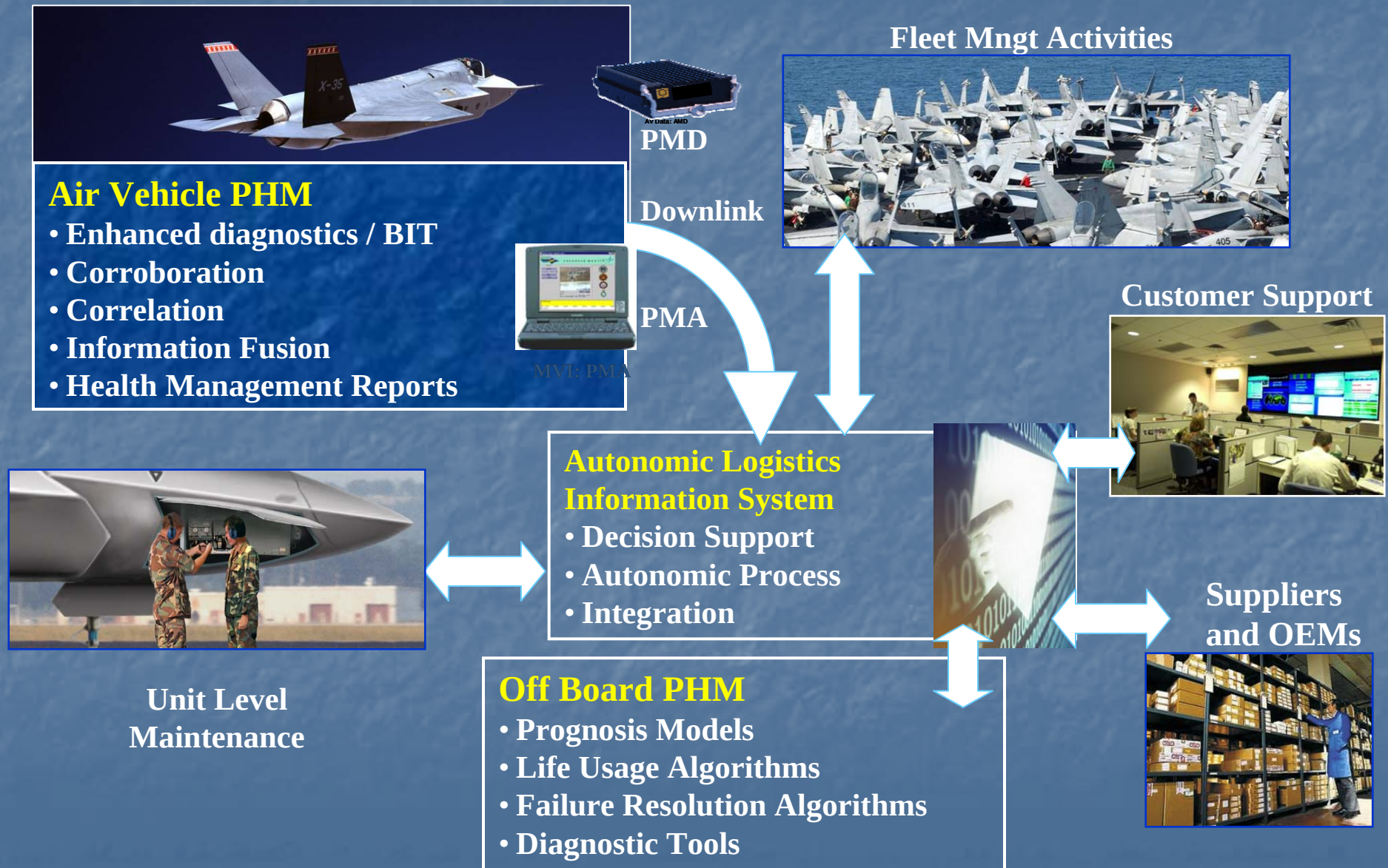
My View of S&RL

- Three aspects of S&RL
 - System Design/Situational Inputs (Sense)
 - Networked logistics Infrastructure (Respond)
 - Predictive (Respond)

Technologies and Capabilities Needed

- Improved Diagnostics and Prognostics (i.e., sensors,)
- Sophisticated networks
- Intelligent software (predictive, self-learning)

Example: JSF Prognostics Health Management

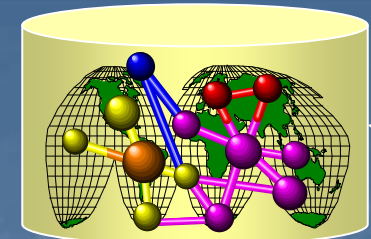


JOpsC



7 Attributes
Of The
Future Joint Force

Knowledge-enabled, demand driven



GIG

S&R knowledge-
based
environment

Interoperable
joint
communications
to the tactical
level

Critical asset
visibility

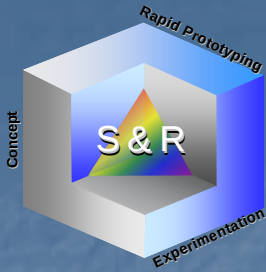
Rapid configuration, re-
configuration, and
delivery of
mission-ready capabilities

Dynamically managed
inventory of capabilities

Cross-service,
cross-
organizational

Uses transparency,
transportation flexibility
and robust IT to leverage
uncertainty and manage
risk

Prime metric: Speed/quality of effects



Sense and Respond Logistics (S&RL)

- **S&RL provides an end-to-end, point-of-effect to source-of-support network of logistics resources and capabilities.**
- **Within S&RL, every entity, whether military, government, or commercial, is both a potential consumer and a potential provider of logistics.**
- **It delivers flexibility, robustness, and scalability for Joint expeditionary warfare through adaptive, responsive, real-time, demand and support networks within U.S., allied, and coalition operations.**

Operational Sense And Respond Logistics: *Co-evolution Of An Adaptive Enterprise Capability*, Concept Document, May 2004, Office of Force Transformation

The Concept for Transformational Operational S&RL includes:

- Networked adaptive logistics supported by a community of software agents that represent logistics suppliers, consumers, and resources
- Real-time logistics management and control
- Seamless logistics through Total Asset Visibility
- Integration of the global sustaining base with logistics in the battlespace
- Logistics-related cognitive decision aids (automated computer processes) that support logistics operations and decision-making
- Integration of logistics with operations and intelligence providing proactive support to command decision-making

What Comprises Sense and Respond Logistics

LOGISTICS KNOWLEDGE BASE



Logistics Knowledge Base:

- correlates logistics resources (supplies, services, equipment, transportation, facilities) to logistics operations for full spectrum assets visibility
- captures feedback, lessons learned, experience
- use to store knowledge created by cognitive decision aids, including proposed COAs

ADAPTABLE BUSINESS AND DECISION RULES



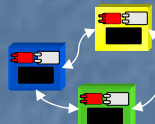
Business and Decision Rules

- precisely tailor logistics execution (*local optimization*)
- are dynamically adapted to meet evolving commander's intent, strategic, operational, and tactical situation, battlespace environment (*global awareness*)

S&RL monitors the Total Situation, and dynamically adapts logistics execution and planning via business and decision rules

network-centric warfare national information infrastructure

INTELLIGENT SOFTWARE AGENTS



Intelligent Software Agents represent:

- logistics consumers
- logistics suppliers
- logistics resources

Agents also monitor:

- evolving commander's intent
- the strategic, operational, and tactical situation
- the battlespace environment
- status of friendly forces and equipment

Other Agents:

- represent the priorities for commander's intent at all levels, including effects, missions, and tasks
- control the distribution of scarce resources

LOGISTICS APPLICATIONS, PORTALS, AND INTERFACES



Logistics Applications:

- S&RL developed, and obtained from other logistics systems developments
- provide functionality to support S&RL processes

Logistics Portals:

- provide operator interface to S&RL functions
- Web-based, and graphics user interfaces
- adjusted to role, scope of operator/user

Logistics Interfaces:

- interface S&RL functions, information, agents with other DoD, sustaining base logistics systems and data
- two-way interface
- includes interfaces to NCW infrastructure

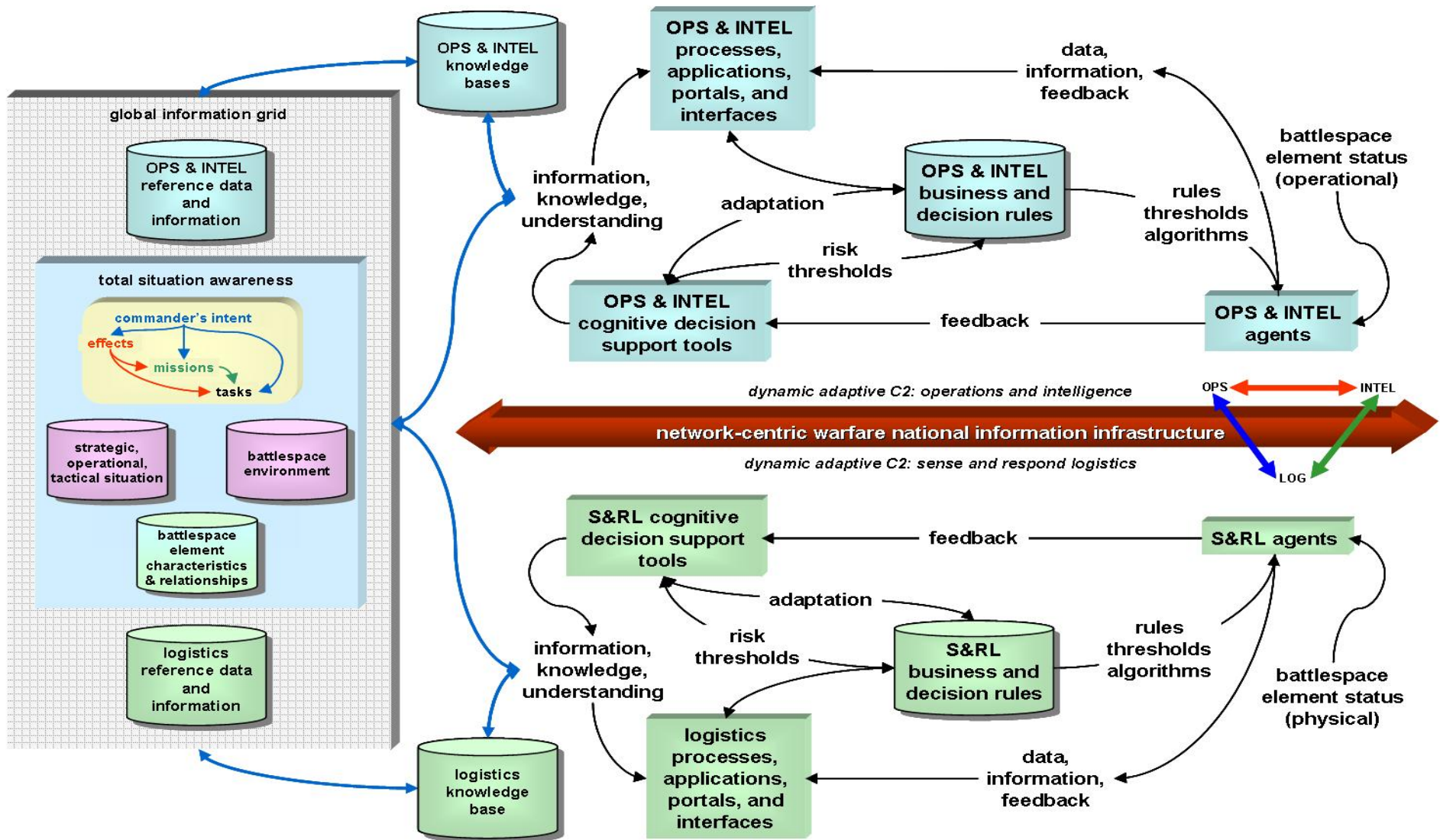
COGNITIVE DECISION SUPPORT AIDS



Cognitive Decision Support Aids:

- analyze feedback, experience, lessons learned from the Intelligent Software agents, and adapt logistics execution and planning
- adapt S&RL execution to evolving commander's intent, situation, and environment
- support course of action analysis for logistics planning
- provide recommendations for operations and intelligence missions and tasks relative to reducing risk to achieve commander's intent due to logistics
- identify patterns of activity that require adjustment of logistics execution or planning (anticipation and prediction)
- identify and process supply network events

The Marriage of Operations, Intelligence and Logistics



Full Spectrum Asset Visibility: Increasing Logistics Support Opportunities

Logistics Resources Represented by S&RL Agents:
Visibility of All Potential Assets from All Potential Sources

- Logistics resources directly associated with/allocated to battlespace elements (includes resources either associated with logistics activities and functions, or associated with operations and intelligence activities and functions)
 - Consumables (e.g. POL, ammunition, MREs, medical supplies)
 - Parts: replaceables/reparables allocated to non-logistics elements
 - Transportation assets, onloading/offloading equipment (includes vehicles not in logistics employ)
 - Maintenance/repair personnel, tools allocated to non-logistics elements
- Logistics resources at other organizations in or near the battlespace
 - Other services, governmental agencies
 - Allied, coalition, treaty organization forces
 - Host/Allied/Coalition nation governmental, commercial, private agencies, organizations
- The sustaining base: CONUS, OCONUS, operations area
 - Suppliers, manufacturers
 - Logistics facilities (depots, other storage areas)
 - Representing capacities, surge capabilities, transportation and distribution access
- Indigenous and other opportunistic logistics resources
 - Opportunistic local resources (e.g. privately owned POL in the battlespace)
 - Captured enemy resources, caches
- Logistics service capabilities and capacities (e.g. maintenance, health, legal, contracting, protection)
- Battlespace elements, engaged, unengaged, or in reserve, or in transit to and from the battlespace
- Battlespace elements not in theater, not associated with the operation, or not part of the combatant command, or with allied/coalition/treaty organization forces not committed to the operation
- Planned and predicted arrival of logistics from the sustaining base

S&RL Extensions to Total
Asset Visibility, In-Transit
Visibility, and Logistics Best
Practices

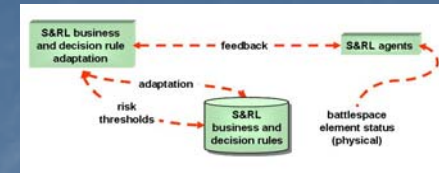
Tailored Precise Logistics: The S&RL Agent Mosaic



Total Situation Awareness

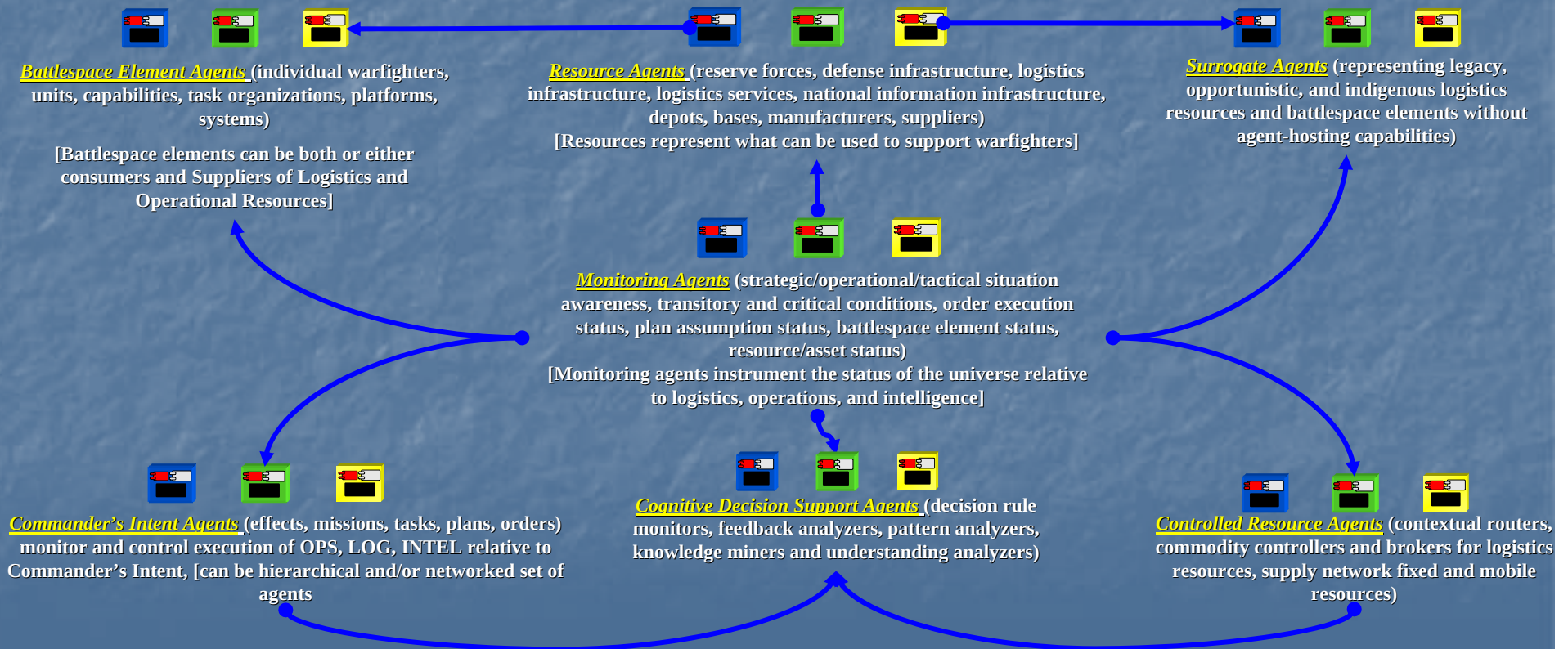


... permits a global perspective of the battlespace relative to Commander's Intent



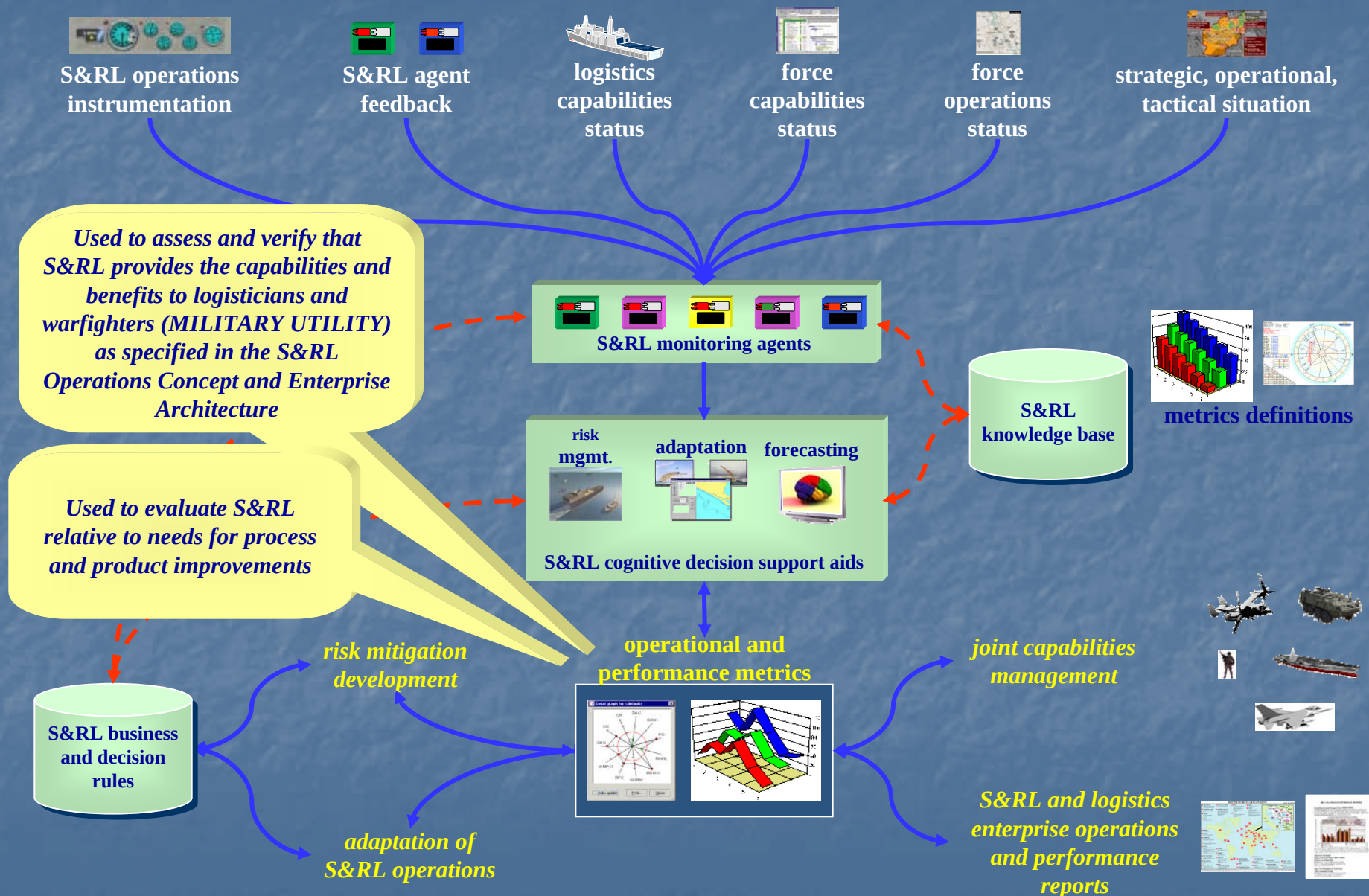
... which leads to local optimization of logistics support via dynamically adapted business rules

... which is implemented by the S&RL "Community of Agents" as tailored precise logistics



S&RL and Metrics

S&RL Metrics: How They Are Generated and Used



Sense and Respond Logistics Metrics

- Operational Metrics: Specific military enterprise-relevant logistics metrics.
- Performance Metrics: Focus on supporting the adaptation of S&RL business rules, and cognitive decision processes that predict the situation and logistics needs, and are used to anticipate those needs through preemptive, proactive logistics support.
- Infrastructure Metrics: These are used to monitor, review, and act upon/recommend improvements or corrections to the military enterprise and logistics domain infrastructure (for example, the NCW backbone),
- Supported Metrics: This is data, information, and knowledge collected in support of metrics generated by other elements of the military enterprise, other commercial and governmental entities, and allied, coalition, and treaty organization members that are not used directly in S&RL.

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (1 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Network-centric	The functional and physical elements of S&RL must be linked and synchronized in time and purpose, able to share a common view of the situation, and able to view the total force capability as a resource. Networking includes cross-organization, cross-service, cross-ally, and physical and functional interfaces to host nations, allies, coalition partners, treaty organization members, and the sustaining base, CONUS and OCONUS	Operational Responsiveness: time between logistics event and S&RL response to the event Supply Source Connectivity: Average number of responses for logistics resource requests/demands, categorized by types (peer-to-peer, autonomic, brokered, cross-organization, cross-service, cross-ally, to commercial sustaining base) Third Party Transportation Connectivity: Number of satisfied logistics resource demands using third party transportation vs. total number of satisfied logistics resource requests/demands Synchronization Lag: the average time between when a significant change in situation, environment, force status, logistics resource status, or commander's intent is posted in networked information and when S&RL responds with posting an adaptation or some other response to networked information
Adaptable	S&RL components must provide force sustainment that dynamically adapts logistics execution and planning in response to total situation awareness and full spectrum asset visibility	Rule Adaptation to Change Events: the number of business and decision rules updated, added to, or deferred in response to situational, environmental, force status, logistics resource status, and commander's intent changes vs. the total number of business and decision rules employed for S&RL activities, over some given period of time Adaptation to Observed Trends and Patterns: the number of trends or patterns observed resulting in S&RL adaptations vs. the total number of trends or patterns observed
Fully Integrated	Service, combatant command, combat support agencies, and other elements supporting operations, logistics, and intelligence activities must be fully integrated, with all functions and capabilities focused toward a unified purpose	Supply Source Integration: Number of responses for logistics resource requests/demands fulfilled by non-logistics sources vs. total number of responses for logistics resource requests, categorized by types (peer-to-peer, autonomic, brokered, cross-organization, cross-service, cross-ally, to commercial sustaining base) Integration Support Index: the number of times over a given timeframe that S&RL provides operations or intelligence recommendations that are accepted and enacted by other non-logistics activities based on evaluation of the total situation, predictions, or anticipation vs. the total number of times such recommendations are provided

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (2 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Commander's Intent Focus	S&RL must be able to correlate all S&RL operations to achievement of commander's intent, as prioritized by the commander, and as the intent and the situation evolve	Logistics-based Options: for each Operations Plan or Operations Order, the number of options provided by Logistics to support commander's intent Logistics Satisfaction of Commander's Intent: number of logistics request/demand events satisfied for each level of priority of commander's intent vs. total number of logistics request/demand events for each level of priority of commander's intent
Speed vs. Mass	S&RL must provide the right-sized logistics support that emphasizes speed of delivery and continuity of military operations vs. assemblage of massive quantities of logistics resources	Operational Continuity: percentage of logistics activities that were accomplished within the tactical envelope of the demanding force element Operational Speed: percentage of time within tactical envelope of the requesting/demanding force element required by S&RL to meet demand
Effective vs. Efficient	S&RL must focus on effectively achieving commander's intent vs. achieving logistics operations efficiency. To that extent, S&RL must provide sustainment support that is focused on risk-mitigated solutions that eschew optimization of service and that promote the achievement of operational results	Operational Risk Mitigation: average calculated risk for logistics operations vs. ratio of successful logistics request/demand satisfaction events to total logistics request/demand events Supply Effectiveness: average number of support options provided for each logistics resource request/demand
Force Capabilities Management	S&RL must support the development and recommendation of operational and intelligence courses of action that reduce the risk associated with logistics operations in achievement of commander's intent. S&RL must support the use of joint capabilities, such as network-centric warfare infrastructure, operations, and intelligence assets as logistics resources	Course of Action Options: Number of logistics course of action options presented for each Operations Plan, Operations Order, or change in commander's intent Force Capabilities Options: Number of force employment options presented for each Operations Plan, Operations Order, or change in commander's intent Operational Risk Due to Logistics: Average Operational Risk due to logistics estimated for each Operations Plan, Operations Order, or change in commander's intent vs. ratio of successful logistics support events to total logistics support events required

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (3 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Kinetic and Potential	Military operations in execution must be logistically supported (kinetic), and support must be developed for military operations planned, in reserve, for contingencies yet encountered, and for force capabilities (potential). Preparation for military operations logistics support must include provisions for foreseeable and planned operations (kinetic support) as well as to support force capabilities that might be employed to meet unforeseen contingencies (potential support).	Kinetic Logistics Support Activities Ratio: the total number of logistics activities identified by S&RL as pertaining to kinetic logistics support, vs. the total number of logistic activities performed by S&RL, over some period of time. Note that the sum of this ratio plus the Potential Logistics Support Activities Ratio may be greater than 1. Potential Logistics Support Activities Ratio: the total number of logistics activities identified by S&RL as pertaining to potential logistics support, vs. the total number of logistic activities performed by S&RL, over some period of time. Note that the sum of this ratio plus the Kinetic Logistics Support Activities Ratio may be greater than 1. Identification Factor for Potential Logistics Support Activities: the number, over time, of identified requirements for S&RL activities for potential logistics support
Full Range of Military Operations	S&RL must provide measurable improved logistics support for commander's intent across the entire range of military operations.	Static Support for ROMO: the number of S&RL activities that may be used for each of the military operations specified in the ROMO vs. the total number of S&RL activities. Note that the total of these ratios may exceed 1. Dynamic Support for ROMO: the ratio, for each of the military operations specified in the ROMO over a given period of time, of S&RL activities that were successful, vs. the total number of activities supported by S&RL in that timeframe
Predictive and Anticipatory	S&RL must provide proactive support for military operations and towards achievement of commander's intent through predictive and anticipatory support that reduces the risks associated with future operations and that anticipates support needs that have not heretofore been foreseen.	Predictive and Anticipatory Logistics Support Recommendations Presented: the number of recommendations provided by S&RL activities for logistics support to change, add to, or defer executing or planned logistics support as a result of cognitive decision support aids predicting and anticipating logistic resource needs Predictive and Anticipatory Logistics Support Recommendations Accepted: the number of recommendations provided by S&RL activities for logistics support that changed, added to, or deferred executing or planned logistics support as a result of cognitive decision support aids predicting and anticipating logistic resource needs, vs. the Predictive and Anticipatory Logistics Support Recommendations Presented

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (4 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Tailored and Precise	While maintaining an overall global perspective of logistics support relative to total situation awareness and commander's intent, S&RL will tailor logistics support for individual battlespace elements, providing focused and precise support, including provision of all attendant components of the support (such as distribution, transportation, tools, trained personnel)	Logistics Resource Demand Satisfaction: by priority of assigned effect, task, or mission, the ratio of logistics resource demands satisfied within the force element's tactical envelope vs. total logistics resource demand Logistics Resource Supply Satisfaction: by priority of assigned effect, task, or mission, the ratio of logistics resource demands completely fulfilled within the force element's tactical envelope to total logistics supply events (that is, with all appropriate logistics elements available including distribution and transportation, onloading/offloading equipment and personnel, requisite replenishment/replacement/repair resources such as skilled personnel, tools, facilities)
Peer-to-Peer and Brokered	S&RL will permit situationally adapted, simultaneous, distributed demand and supply of logistics resources (supplies, services, etc.) that may be requested and supplied autonomously among battlespace elements (peer-to-peer) or supplied under the control and auspices of some command, logistics, or resource control authority (brokered)	Peer-to-Peer Support Ratio: the number of S&RL satisfied logistics resource requests/demands that were implemented via peer-to-peer transactions, vs. the total number of S&RL-satisfied logistics resource requests/demands Brokered Support Ratio: the number of S&RL satisfied logistics resource requests/demands that were implemented via brokered transactions, vs. the total number of S&RL-satisfied logistics resource requests/demands
Autonomic	S&RL logistics and command and control operations must support logistics operations that directly connect needs and demands at the point-of-effect with suppliers and supplies at the source-of-supply, independent of procedural or structural lines.	Autonomic Support Ratio: the number of S&RL satisfied logistics resource requests/demands that were implemented via autonomic transactions between the point-of-effect requestor/demander and the source of support, vs. the total number of S&RL-satisfied logistics resource requests/demands

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (5 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Cognitive Decision Support	S&RL operations must apply advanced cognitive technologies to automate support for decision-making in logistics, operations, intelligence, and command and control functions.	Successful Opportunistic Application of Cognitive Decision Support: the number of times that S&RL cognitive decision support aids autonomously provided recommendations that were eventually enacted to logistics, operations, and intelligence activities, vs. the total number of autonomous recommendations presented by S&RL cognitive decision support aids, over some given period of time Successful Specified Application of Cognitive Decision Support: the number of times that S&RL cognitive decision support aids were specified to provide recommendations that were eventually enacted to logistics, operations, and intelligence activities, vs. the total number of specified recommendations presented by S&RL cognitive decision support aids, over some given period of time
Total Situation Awareness	All logistics operations performed by S&RL must operate with awareness of the strategic, operational, and tactical situation, the environment being supported, and the total force capability status, with respect to achieving commander's intent.	Adaptation to Change Events: the number of situational, environmental, force status, logistics resource status, and commander's intent changes acted upon through S&RL adaptation vs. the total number of occurrences of such total situation awareness change events Total Situation Awareness Impact on Satisfaction of Commander's Intent: the number of situational, environmental, force capability status, and logistics resource status change events that were evaluated by S&RL as impacting commander's intent, vs. the total number of changes to the situation, environment, force capability status, and logistics resource status presented

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (6 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Full Spectrum Asset Visibility	S&RL must extend total asset visibility/in-transit asset visibility (TAV/ITV) to include interrelationships among assets (kits, assemblies, necessary serviceability elements such as gaskets, nuts and bolts), transportation and handling restrictions, requisite personnel skills, tools, and facilities for servicing and repair of a given item, estimates for replenishment, repair or replacement time for given supplies, cross-correlation of logistics resource identifiers among services, allies, and suppliers, and identification of allowable substitutes and alternative logistics approaches and remedies for a given logistics asset, including opportunistic resources such as indigenous and captured resources.	Asset Visibility within Kits/Assemblies: the number of times a logistics resource was supplied in response to a request/demand that was identified by its inclusion in a kit or assembly vs. the total number of logistics resource requests/demands satisfied Asset Visibility Completeness: the number of times a logistics request/demand required S&RL identified separately acquired associated assets (e.g. necessary serviceability elements such as gaskets, nuts and bolts) or separately acquired requisite personnel skills, tools, and facilities for servicing and repair of a given item to satisfy the demand vs. the total number of logistics resource requests/demands processed by S&RL Asset Special Processing Identification: the number of times a logistics request/demand required S&RL identified special transportation, handling, distribution, offloading, or onloading equipment or support to satisfy the demand vs. the total number of logistics resource requests/demands processed by S&RL Risk Mitigation Due to Full Spectrum Asset Visibility: the number of times that S&RL-developed responses that satisfied logistics resource requests/demands were mitigated, and risk subsequently reduced, by aspects of full spectrum asset visibility, vs. the total number of S&RL-developed responses that satisfied logistics resource requests/demands

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (7 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Non-linear	Given the complexity and chaos of situations and environments in which military forces must operate, S&RL must support concurrent operations that are not ordered and sequential, but that respond effectively to the complexity and chaos in a non-linear manner	Concurrency Index: the average number of different S&RL activities, in different transactions, over some given period of time, that S&RL is concurrently performing vs. the total number of S&RL activities being performed, in total transactions Chaos Index: the average number of S&RL activities responding to changes in the total situation resulting in adaptation of S&RL operations, vs. the total number of S&RL activities resulting from planned S&RL operations, over some given period of time Non-linearity Index: the number of transactions being processed by S&RL activities at any time that are correlated sets of transactions, vs. the total number of transactions being processed. This is the ratio of transaction spawning, that is, the degree of disjointedness among transactions being processed by S&RL activities over some given timeframe
Robust	S&RL mechanisms and infrastructure, and the associated tactics, techniques, and procedures, must be flexible and adaptable so as to reduce the risk associated with logistics support and to increase its effectiveness while requiring the minimum set of logistics resources. Redundancies and other robustness factors must be provided to assure meeting commander's intent. This includes the ability to successfully sustain the forces when faced with shortfalls in access, information, processing power, or communications.	Demand Risk Assessments: the total number of S&RL responses to logistics resource requests/demands that were impacted by risk assessments made during S&RL operations vs. the total number of S&RL-evaluated logistics resource requests/demands Demand Risk Mitigations: the total number of satisfied responses to logistics resource requests/demands that were influenced by risk mitigations made during S&RL operations vs. the total number of S&RL-satisfied logistics resource requests/demands Supply Source Robustness: Average number of responses for logistics resource requests/demands evaluated as within the requestor's tactical envelope, categorized by types (peer-to-peer, autonomic, brokered, cross-organization, cross-service, cross-ally, to commercial sustaining base, or opportunistic resources, including indigenous and captured resources) Asset Substitution/Alternatives Index: the number of times S&RL satisfied a logistics resource request/demand using identified allowable substitutes and alternative logistics approaches and remedies

Initial Recommendations for S&RL Measures vs. Enabling Concept Attributes (8 of 8)

S&RL Attribute	Attribute Definition	Metrics Recommendations
Transformational	The impact of S&RL must be transformational such that it steps ahead of normal evolution of logistics operations and force sustainment efficiency to full integration of logistics with operations and intelligence activities. S&RL must shift logistics focus to the fast and effective achievement of commander's intent and to the provision of support from the source of support directly to the point of effect. S&RL must also be supportive of the transformational concepts being developed and implemented for the full range of military operations.	Static Correlation of S&RL to Transformational Concepts: the number of S&RL functions that can be directly or indirectly correlated to support for DoD transformational concepts Dynamic Correlation of S&RL Activities to Transformational Concepts: the ratio of S&RL activities correlated to each given DoD transformational concept that are performed by S&RL, over some given timeframe, vs. the total number of S&RL activities performed in that given timeframe

Source/Web Sites

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2. *Network Centric Warfare, DoD Report to Congress.*
<http://www.defenselink.mil/nii/NCW/>
3. *Network-Centric Warfare: Its Origin and Future.* Adm Cebrowski, Director, DoD Office of Transformation.
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4. *Network Centric Warfare: An Overview of Emerging Theory*, John J. Garstka, Joint Staff. <http://www.mors.org/publications/phalanx/dec00/feature.htm>
5. *Network-centric warfare: Not there yet*, Dan Caterinicchia, Federal Computer Work.
<http://www.fcw.com/fcw/articles/2003/0609/cov-netcentric-06-09-03.asp>
6. DAU Acquisition Community Connection. <https://acc.dau.mil>
7. DoD OFT Brief, *"Sense and Respond Logistics: Co-Evolution of an Adaptive Enterprise Capability"*.
8. National Defense Strategy (2005)
9. National Military Strategy (2004)
10. Joint Vision 2010 (1997)
11. Focused Logistics Roadmap (1997)
12. OFT, Sense and Respond Logistics Metrics Overview (2005)
13. OFT, Sense & Respond Logistics, Concept Document (Long Version) (2004)
14. OFT Brief, *"S&RL Integrated Enterprise Domain Architecture, OV-1: High Level Operational Concept"*

Conclusion

“On many issues there still exist differences of opinion of a quite fundamental nature. Only time will tell who is right. But it is incontrovertible that as a general rule new weapons call for new ways of fighting, and for appropriate tactical and organizational forms. You should not pour new wine into old vessels”.

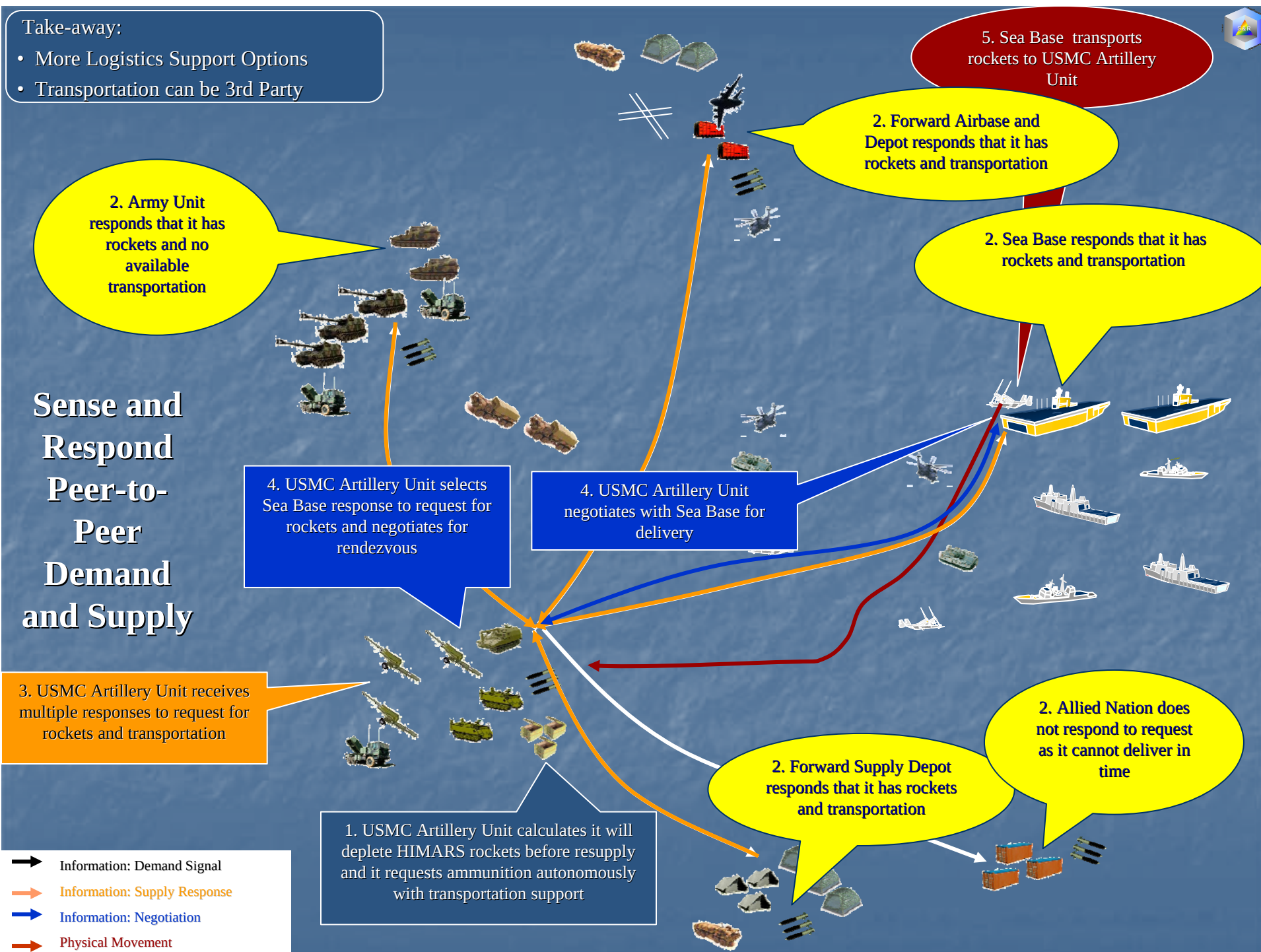
Heinz Guderian
Achtung-Panzer! (1937)

Back up Slides

Take-away:

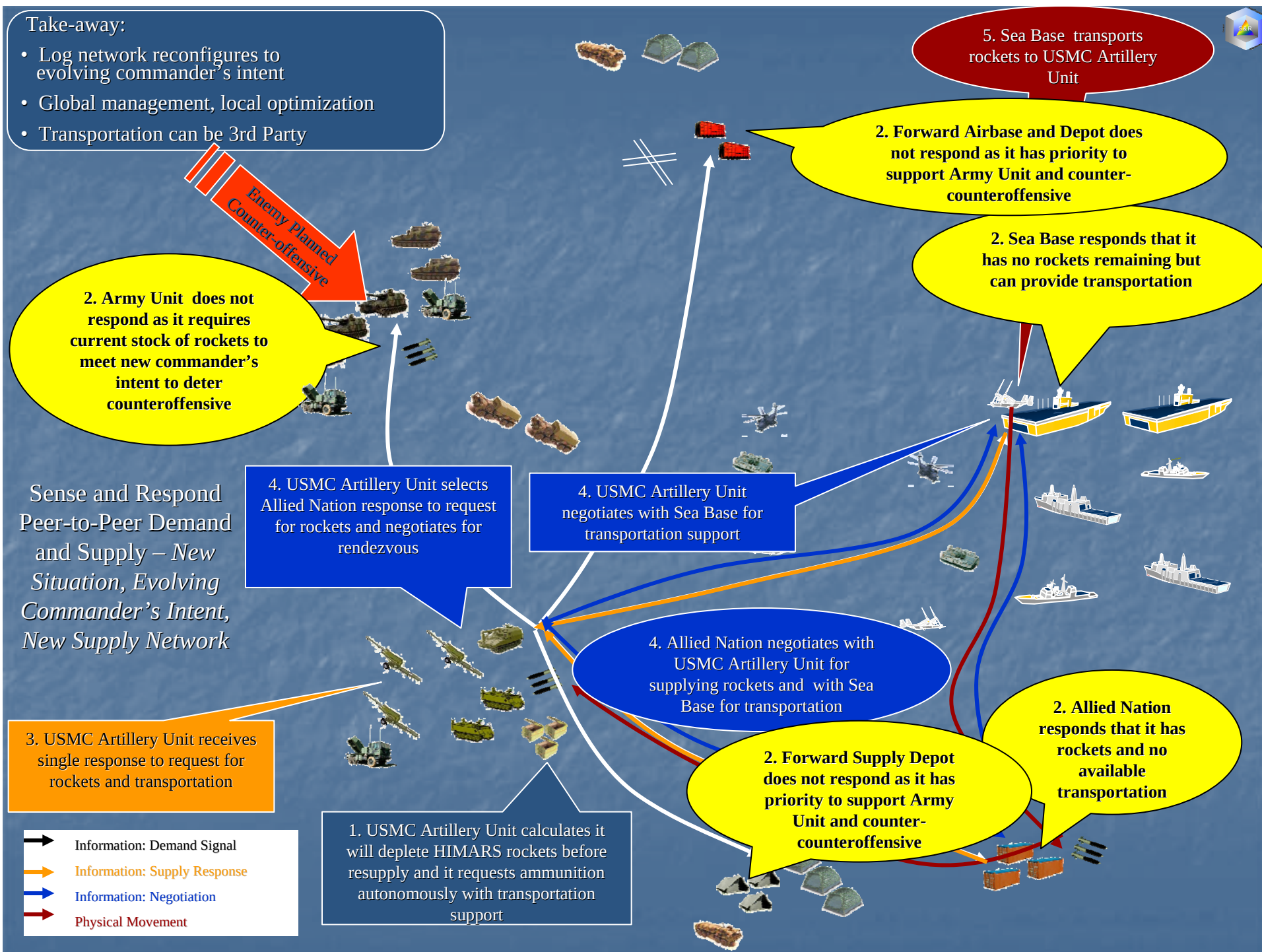
- More Logistics Support Options
- Transportation can be 3rd Party

Sense and
Respond
Peer-to-
Peer
Demand
and Supply



Take-away:

- Log network reconfigures to evolving commander's intent
- Global management, local optimization
- Transportation can be 3rd Party



S&RL Demand and Supply with Brokers: A Simple Example

- Logistics cognitive support agents predict a shortfall in delivery of HIMARS rockets, given the current count of available rockets, scheduled delivery of the rockets to the theater of operations, and projection of needs to meet commander's intent and the evolving situation; the agent recommends the use of a HIMARS rocket commodity controller
- After review and approval by a logistics commander, a commodities control agent is instantiated to manage the temporary short supply of HIMARS rockets, with delegated authority to allocate the scarce resource and to arbitrate among competing demands
- Business rules for HIMARS units are adapted and distributed to require the use of the HIMARS Rocket Commodity Controller in all demands for the rocket
- The HIMARS Rocket Commodity Controller resolves all needs for rockets against the situation, the environment, and commander's intent, as defined by it's (the commodities controller's) business rules

Take-away:

- **Commodity Brokers** for scarce resources
- **Situation awareness** factors into support

Sense and Respond
Brokered
Demand and Supply

2. The HIMARS Rocket Commodity Control Agent requests HIMARS rockets from battlespace elements (operational units, logistics support)

1. USMC Artillery Unit calculates it will deplete HIMARS rockets before resupply and it requests rockets from the HIMARS Rocket Commodity Controller

1. The HIMARS Rocket Commodity Control Agent (running on a computer at the Forward Supply Depot) determines if the USMC request for HIMARS rockets falls within current guidelines for commander's intent, prioritization of tasks, and availability of resources

3. Sea Base responds that it has rockets and transportation

3. Army Unit responds that it has rockets and no available transportation

5. Sea Base transports rockets to USMC Artillery Unit

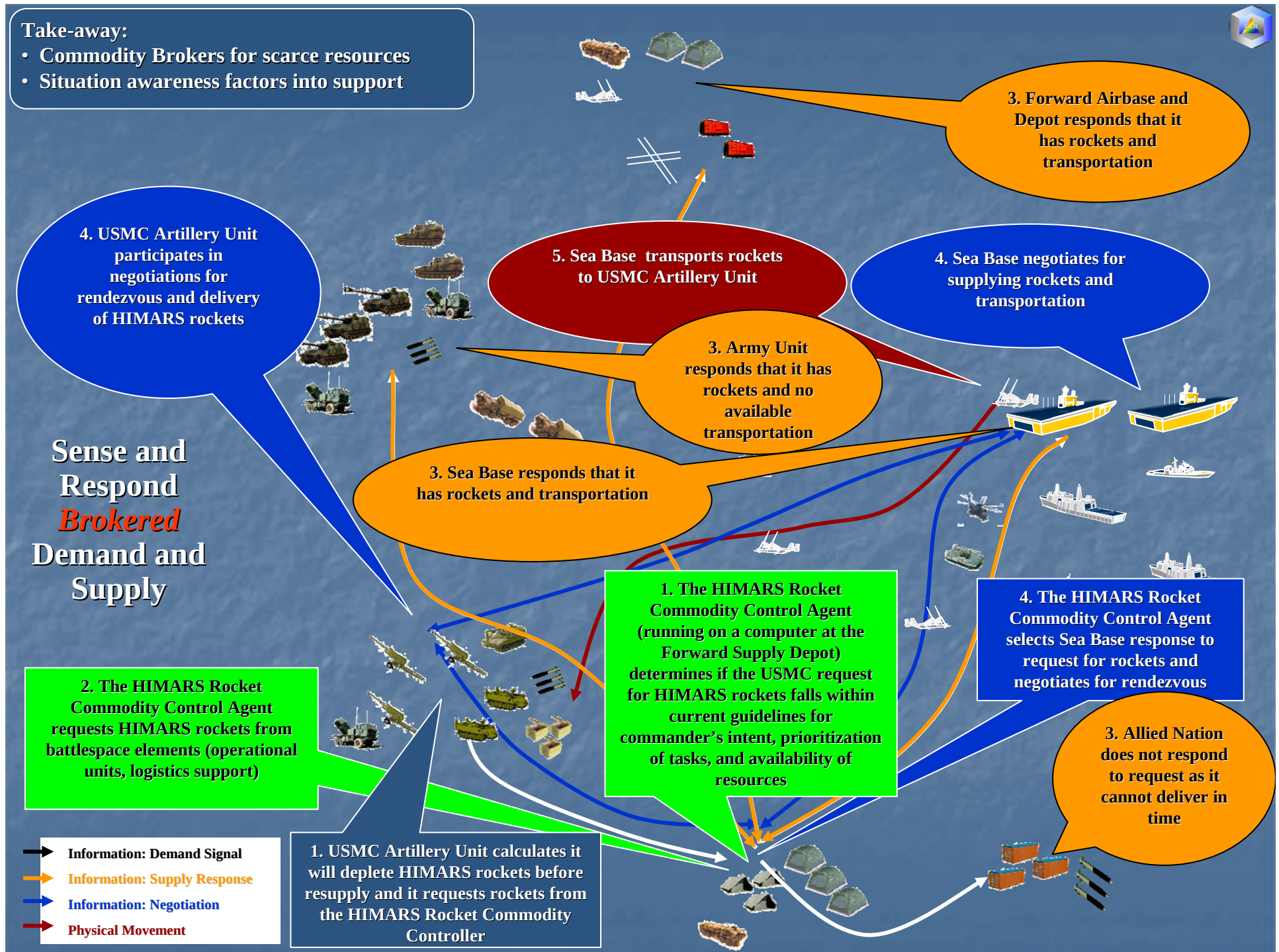
3. Forward Airbase and Depot responds that it has rockets and transportation

4. Sea Base negotiates for supplying rockets and transportation

4. The HIMARS Rocket Commodity Control Agent selects Sea Base response to request for rockets and negotiates for rendezvous

3. Allied Nation does not respond to request as it cannot deliver in time

- Information: Demand Signal
- Information: Supply Response
- Information: Negotiation
- Physical Movement



Take-away:

- Advanced log concepts supported (autonomic logistics, agile manufacturing)
- Point-of-effect to source-of-supply

Sense and Respond Demand and Supply Autonomic Logistics Agile Manufacturing

