



TC3 Workshop: Cognitive Elements of Effective Collaboration.



Theater Assessment Profiling System (TAPS) Contribution to Coalition Collaboration

**Briefing on an advanced visualization scheme powered
by a state space “engine” process in support of shared
situation awareness, collaboration, and decision making**

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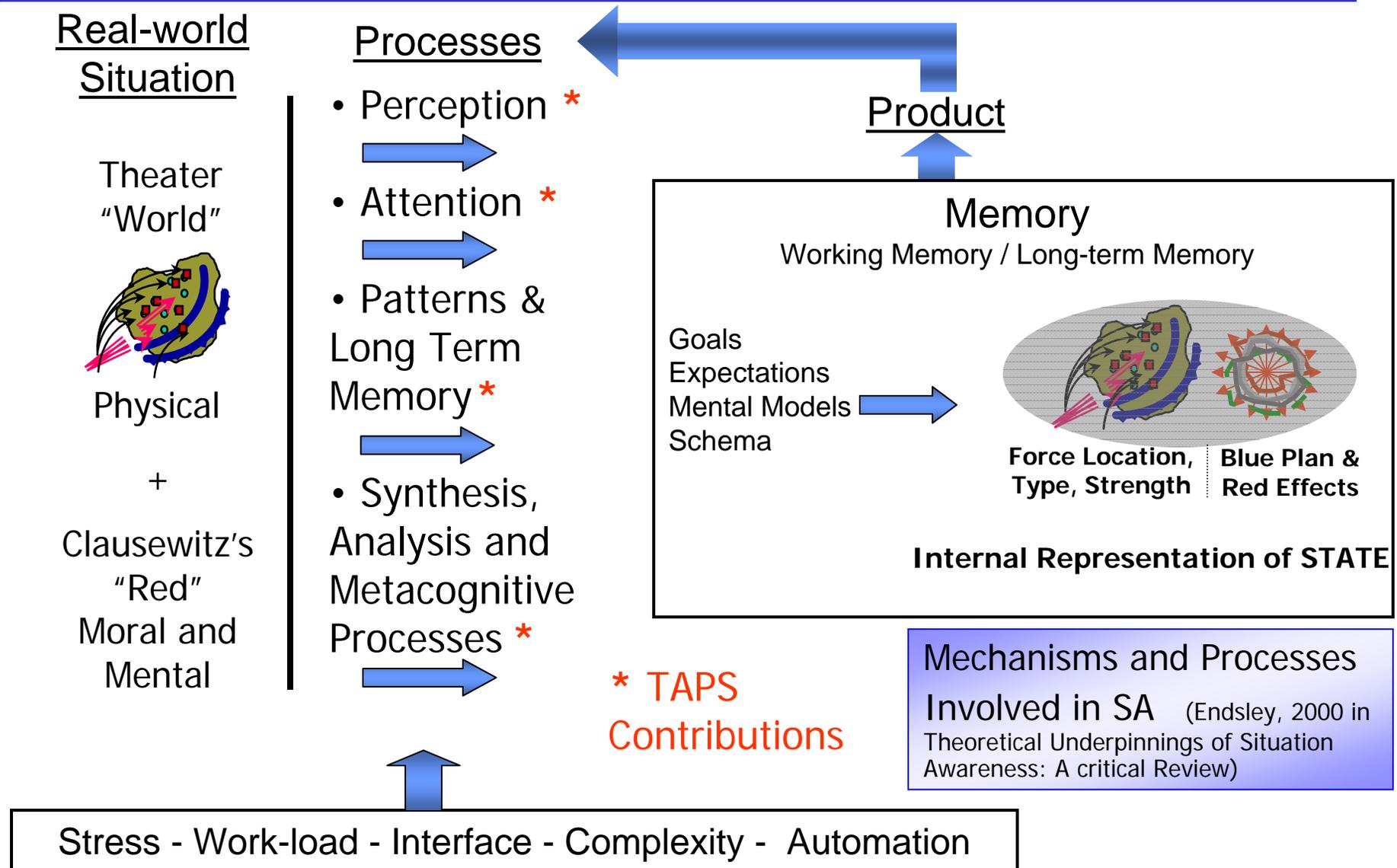


Overview

- Effective SA in a JTF
- Definitions
- Goal of TAPS Contribution to Collaboration
- VSS "Under the Hood"
- Global War Game 2001 TAPS
- Situation Assessment
- Experimental Design
- Prototype and Top Sight™
- Summary



Requirements for Effective SA in a Joint Task Force (JTF) Setting





Descriptions of TAPS & VSS

- **TAPS – Theater Assessment Profiling System-** An Effects-Based Operations (EBO) visualization that provides:
 - Commander’s single view of his critical information environments as they progress, stagnate or fail (retrograde).
 - A high-level integrated view with “tailorable drilldown” enabled the commander to focus on normally disparate activities in the battlespace.
 - Explicit adversary and friendly (joint/coalition) EBO depictions
- **VSS – Valuated State Space™** - A model utilizing multi-attribute utility theory that:
 - Mathematically captures the commander’s intent, the desired effects on the enemy and unintended consequences for his planning-to-execution domain.
 - Incorporates the commander’s priorities
 - Fuses and normalizes objective metrics and expert subjective data
 - Defines objectives using measures of effects
 - Defines measures of performance with intervals of achievement

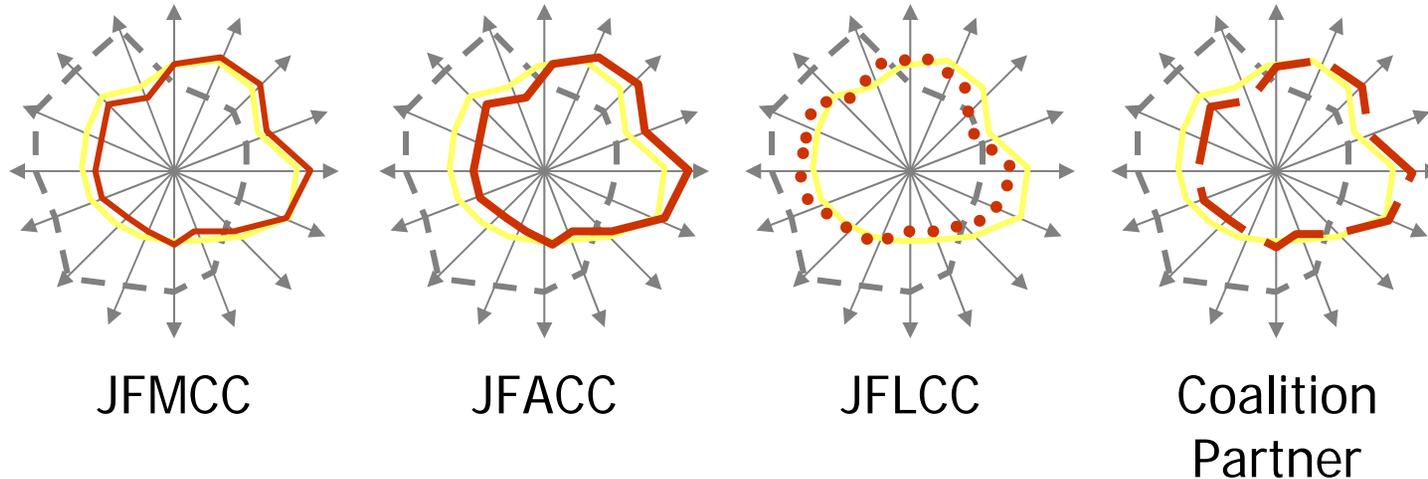


Goal of TAPS Contribution to Coalition Collaboration

TAPS Contribution to Coalition Collaboration

- Facilitates collaboration between elements by highlighting differences in team SA between the major elements, such as, JFMCC, JFACC, JFLCC and coalition partners
- Visualizes situation assessment of joint/coalition high-level purpose and achieved effects on the enemy
- Provides access to lower level details for further specification of differences

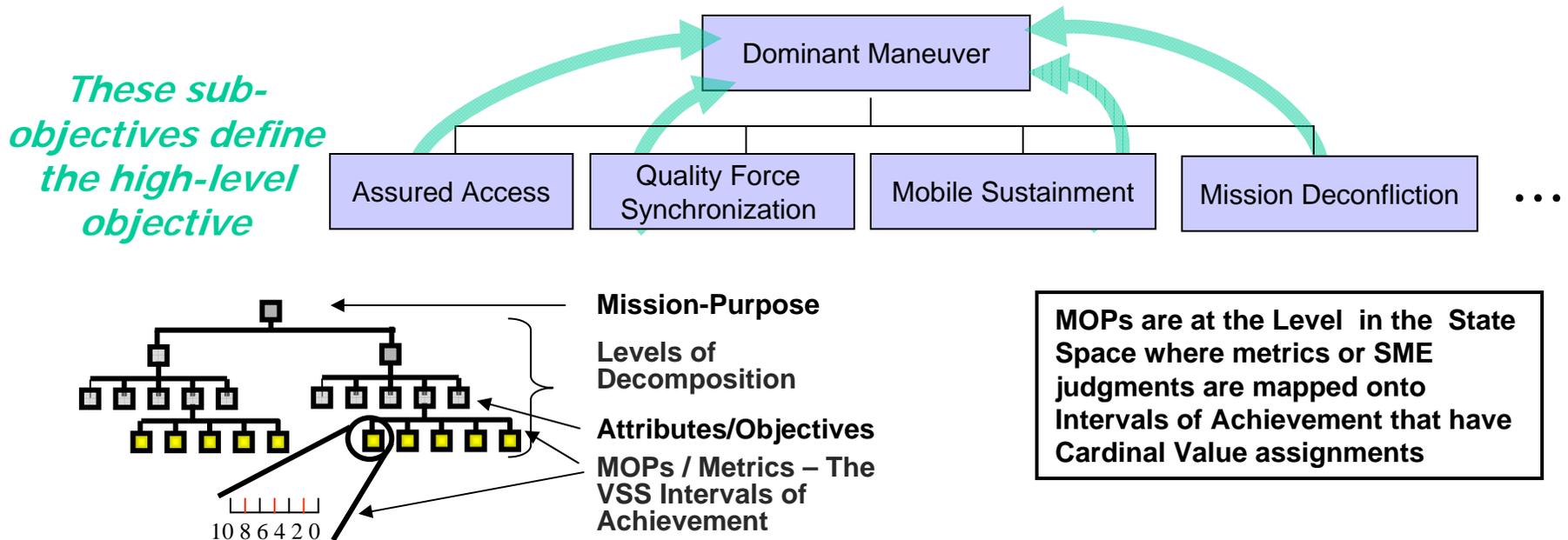
TAPS-VSS Environments Components and Coalition





VSS™ Functionality - “Under the Hood”

- **Decomposition** of an objective into lower-level, more detailed sub-objectives



- **Operational Environment:** Objectives must be useful to be meaningful to the decision-maker. Objectives should facilitate explanations to others.
- **Completeness:** A set of subobjectives, i.e. the state space, is complete if it is effective in indicating the degree to which the overall objective is met.
- **Non-redundancy:** Objectives in the Valuated State Space should be preferentially distinguishable

* Hierarchy of Objectives from *Decisions with Multiple Objectives: Preferences and Value Tradeoffs* by Keeney and Raiffa



VSS Under the Hood

Key Characteristics

Subject Matter Expert inputs for:

- Determining mission-purpose
- Constructing the state space
- Determining “importance weight” of each objective/attribute
- Establishing the achievement / assessment criteria and numeric cardinal value assignments, i.e., utilities.
- Defining intervals of achievement for Measures of Performance (MOPs) through which utility values are assigned

Logic engine that produces values for the TAPS display

Mathematical/Computational Normalization Process

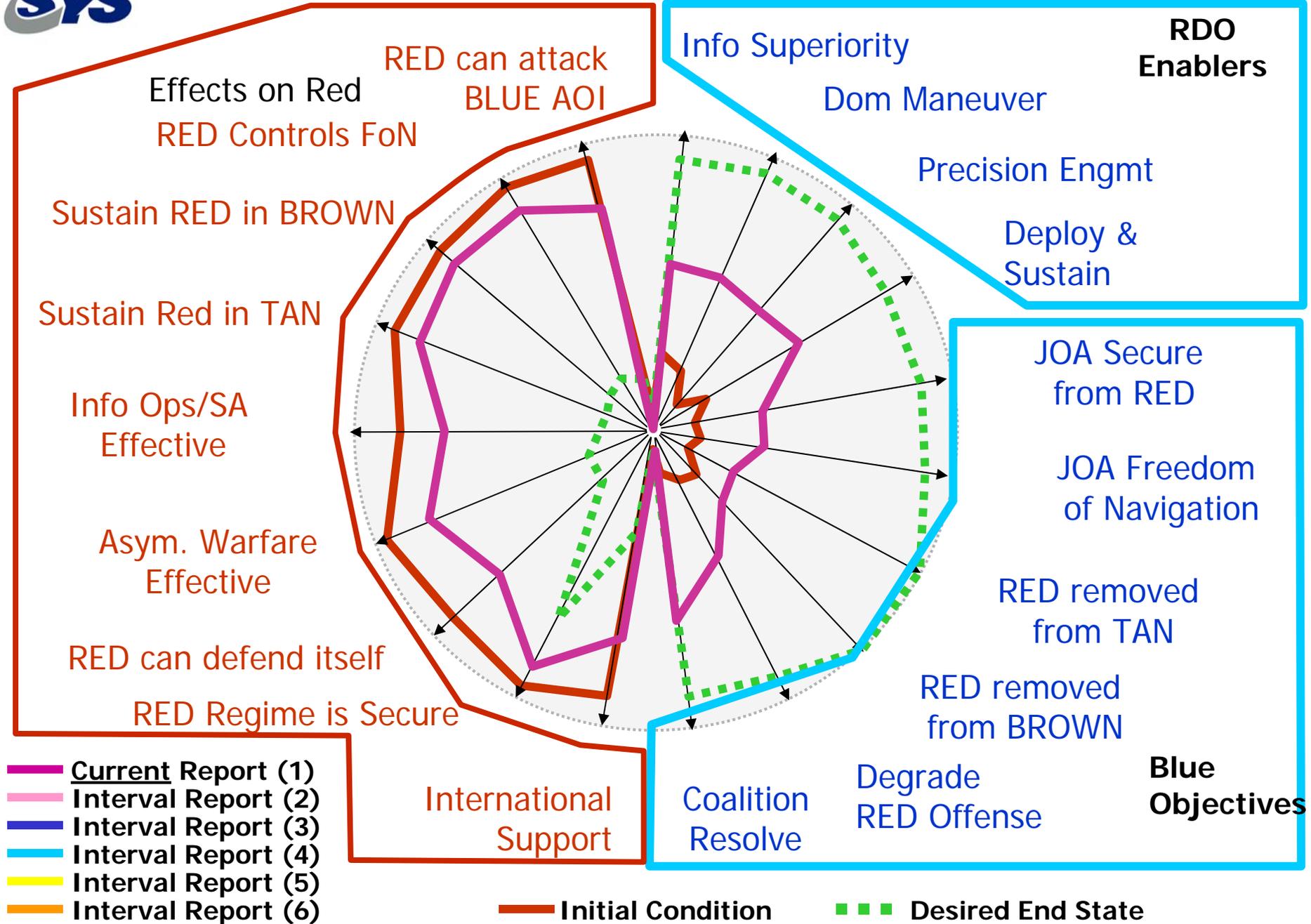
- Arithmetic & geometric means and default thresholds
- Future Research: Incorporation of other data sources, NSS
- Future Research: Evolutionary computation, fuzzy logic, etc.

What is needed to operate the TAPS-VSS model?

- Context
- Mission-Objectives (CCIRs,)
- SMEs
- Calibration of SMEs at MOP level
- Maintain Calibration of SME Population

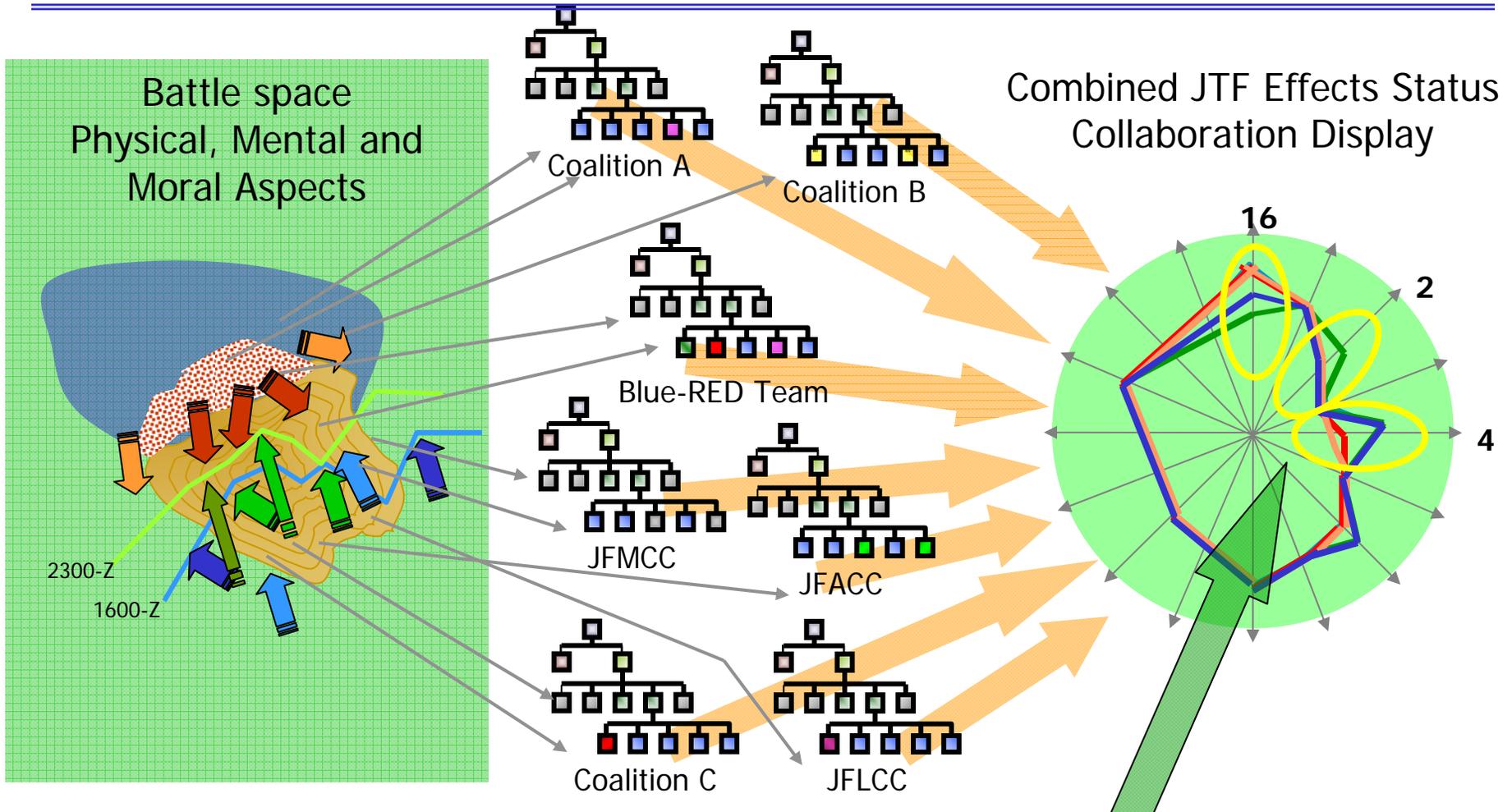


GLOBAL 2001 – TAPS – Effects on RED & BLUE Strategy





Situation Assessment Deltas Identified and Highlighted by Major JTF Element



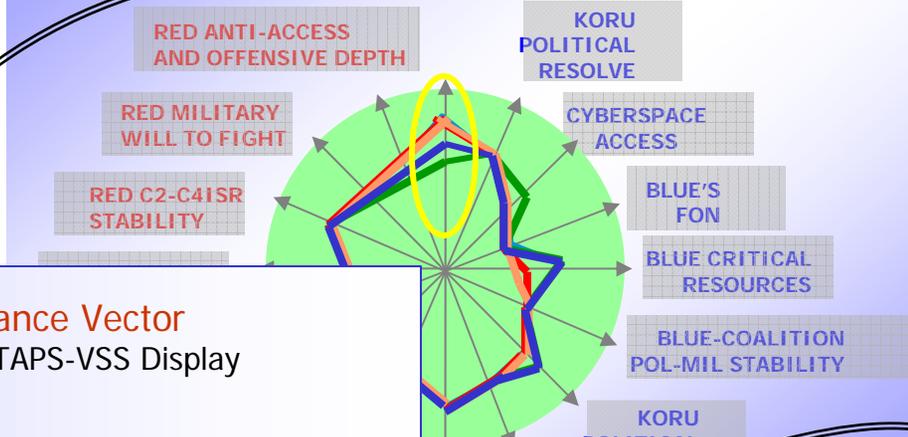
- Data collected for major elements shown in Combined Display
- Yellow  Show Deltas in Situation Assessment by High-level purpose
- Drill down into Vectors 16, 2 and 4 will disclose details



Drill Down to Second level MOEs

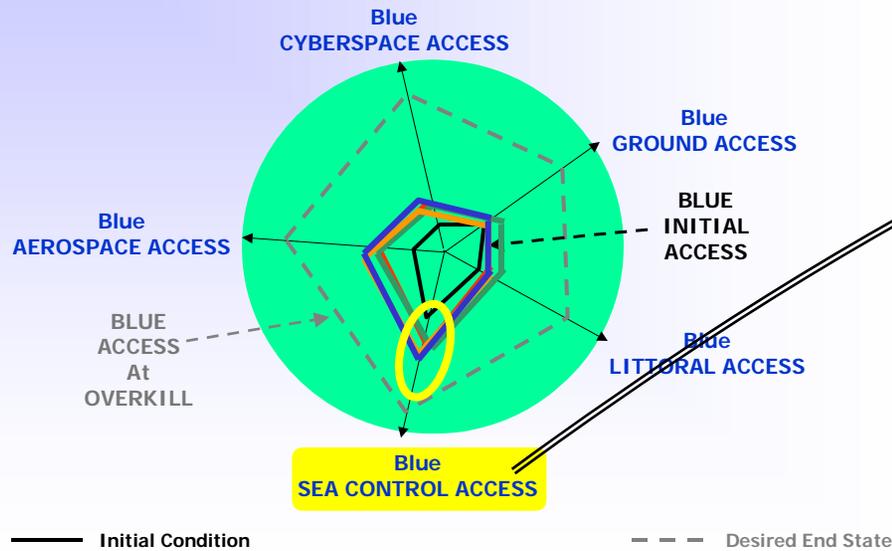
High-Level Display

BLUE ACCESS ASSURANCE

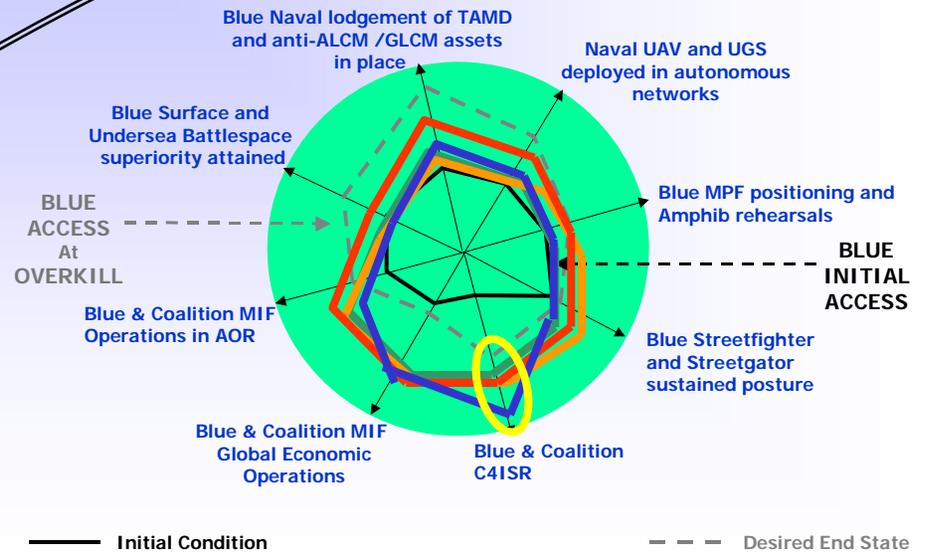


Drill Down to Third level MOEs/MOPs

Blue Access Assurance Vector Second Level Nesting of TAPS-VSS Display



(Blue Access Assurance) -> Sea Control Access Third Level Nesting of TAPS-VSS Display



Level 2 SA – Comprehension Enabled by Detailed Views of MOE's



2x2 Experimental Design

Innovative Concept to Enhance JTF & CTF Collaboration

	Training	Trial I	Trial II
Treatment A TAPS-VSS	1. Experiment set-up, org., process, scenario, etc. 2. Treatment technologies 3. Schedules 4. Debrief Questionnaires	Situation Briefs CG Scenario	Situation Briefs CG Scenario
Treatment B TBD		Situation Briefs CG Scenario	Situation Briefs CG Scenario

- Teams of Component/Coalition Commanders

1. JFMCC
2. JFACC
3. JFLCC
4. Coalition Country A
5. Coalition Country B

- Data Collection

1. Questionnaires
 2. Debriefings
 3. Observations
 4. Situation Awareness probes
- ✓ Cobra Gold 02
 - ✓ FBE-J

- Success Criteria

1. Improved Situation Assessments for Components/Coalition
2. Identification of specific "CCIR Deltas" in Situation Assessment between JTF Elements
3. Improved collaboration

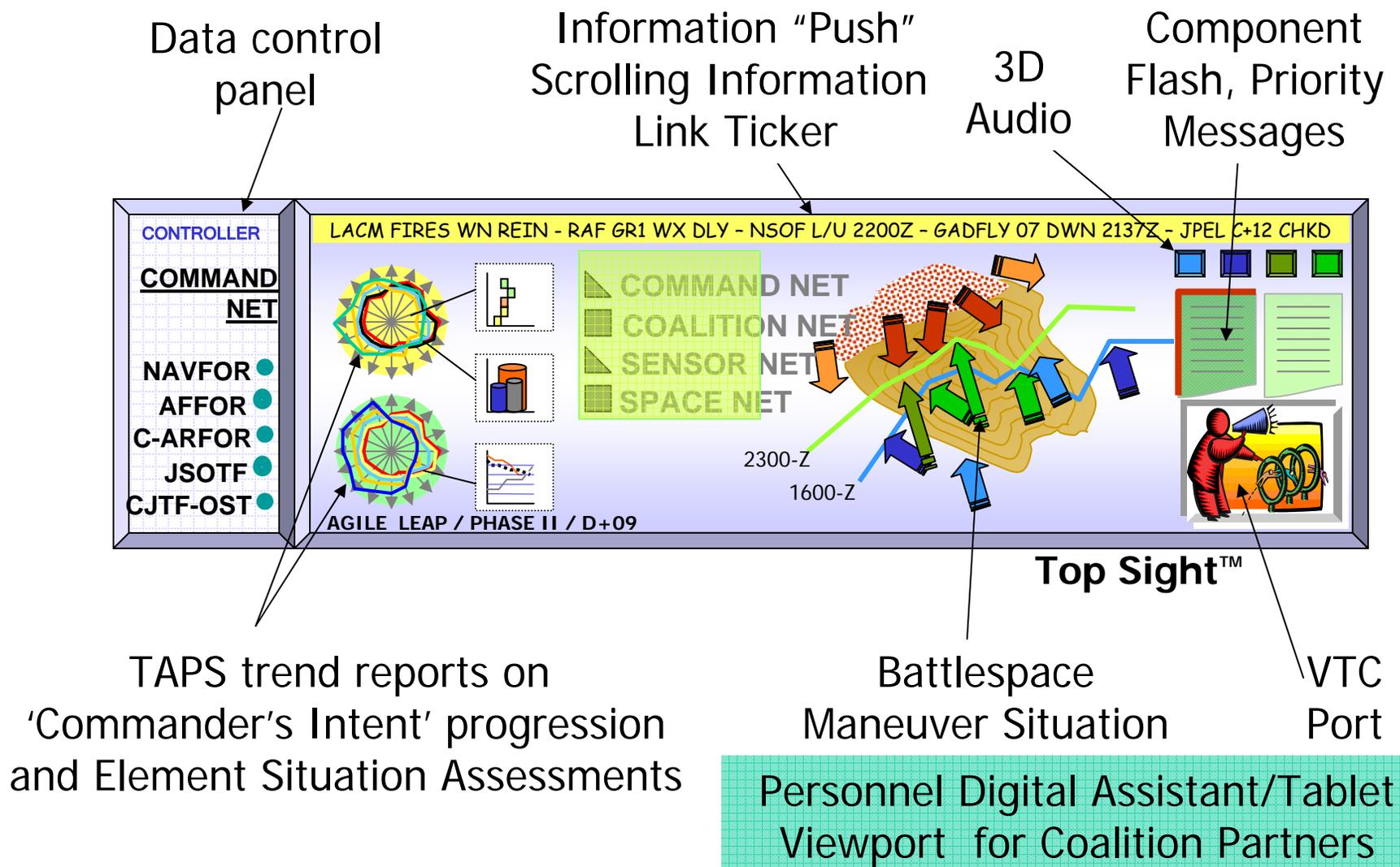


TAPS-VSS Prototype

- TAPS Prototype Events
 - Global Wargame 2000 (August) & 2001 (July)
 - The VSS metrics construct was validated as an appropriate way to track disparate topics relevant to the commander
 - TAPS as a prototype visualization provided both a high level roll-up assessment of input data and illustrated trend progression, stagnation or retrograde
 - US Joint Forces Command Presentation LOE – July '01
 - Formal Report due Dec 01
- Scheduled Events
 - Cobra Gold 02 – Attended USPACOM Joint Mission Force PC and CG02 IPC and MPC. Attending FPC in mid Jan 2002.
 - Fleet Battle Experiment Juliet – Attended IPC/MPC

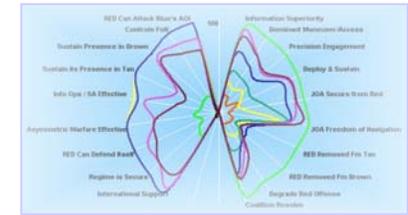


Top Sight™ Command Information Viewport





Summary



- TAPS-VSS was successfully used in Global Wargame 2000 & 2001, and JFCOM UV01 Presentation LOE
- Senior Military Leadership has encouraged continued development
- Navy operational and technical communities are supportive and participating
- Improved prototype targeted for FBE – Juliet and Cobra Gold 02
- SYS working to develop Component/Coalition Shared SA and Situation Assessment Collaboration Scheme
- Experimentation, research and studies continue