



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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Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE JAN 2002		2. REPORT TYPE		3. DATES COVERED 00-00-2002 to 00-00-2002	
4. TITLE AND SUBTITLE 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				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) SYS ? San Diego Operations,C4I Division,9620 Chesapeake Drive, Suite 201,San Diego,CA,92123				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES ONR TC3 Workshop, Cognitive Elements of Effective Collaboration, 15-17 Jan 2002, San Diego, CA. U.S. Government or Federal Rights License					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 14	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

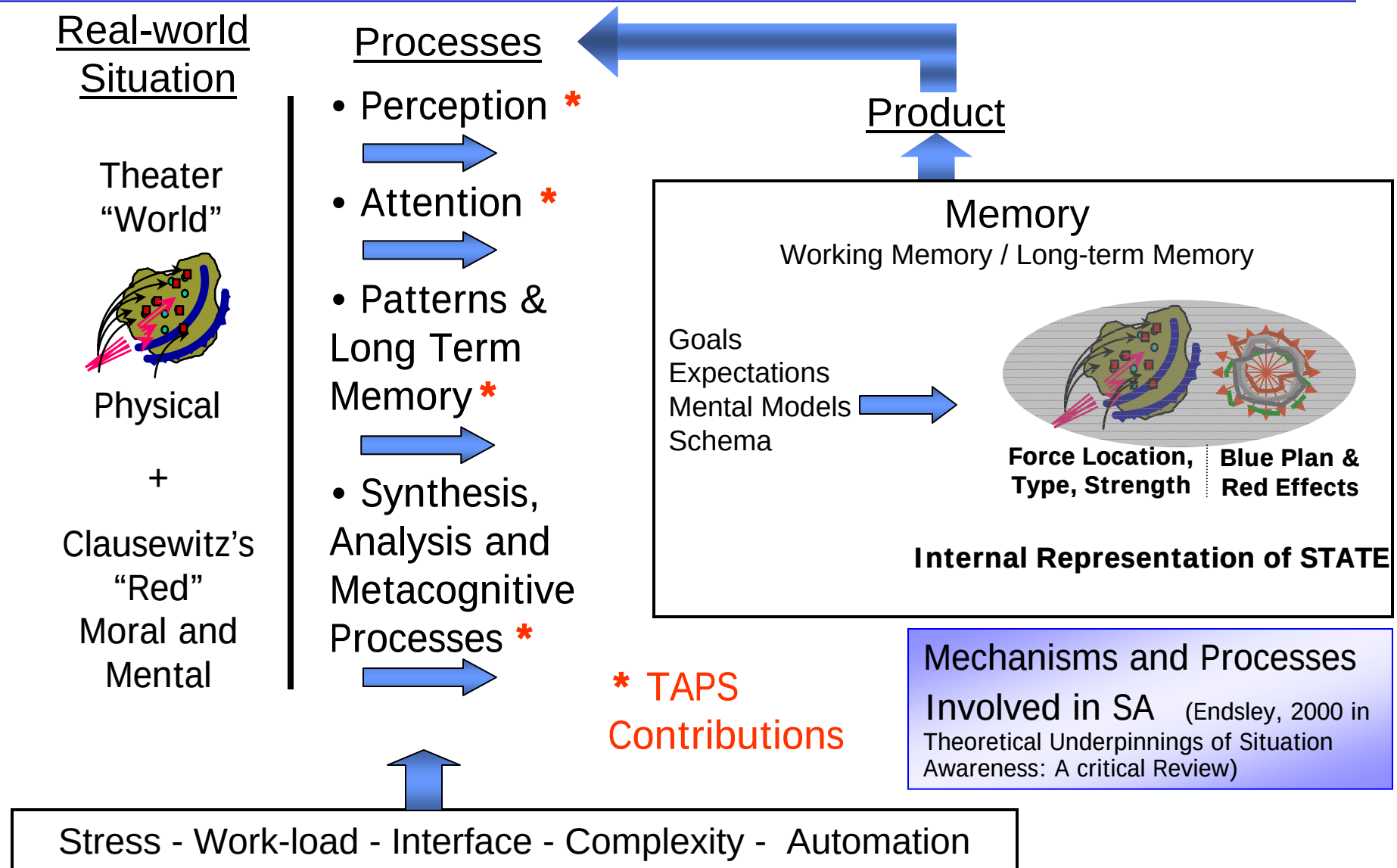


Overview

- 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

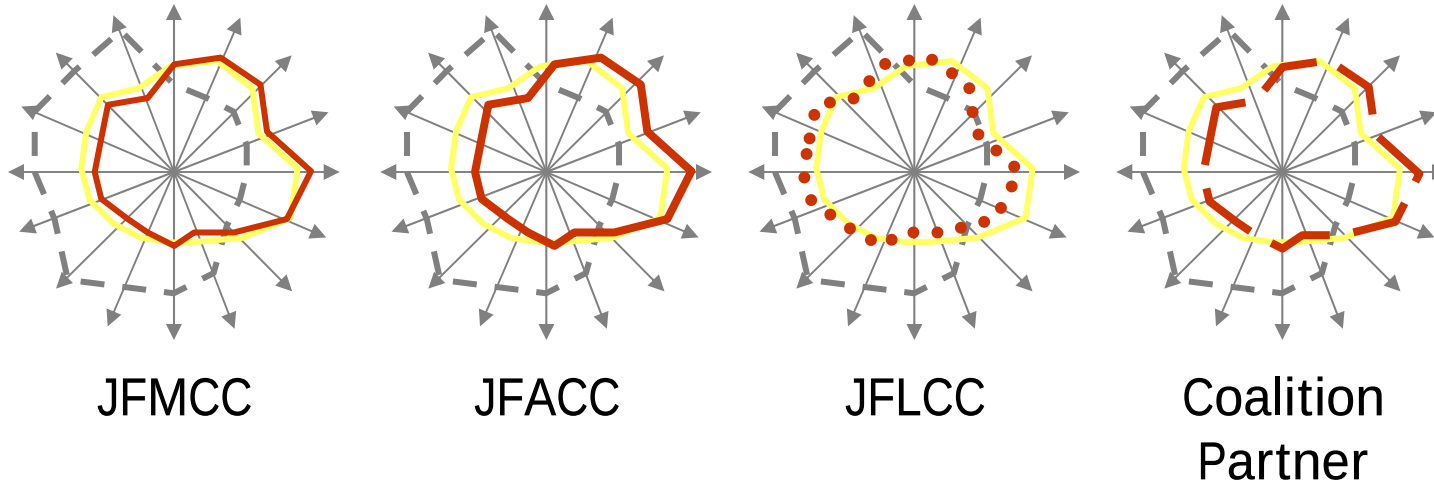


Goal of TAPS Contribution to Coalition Collaboration

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

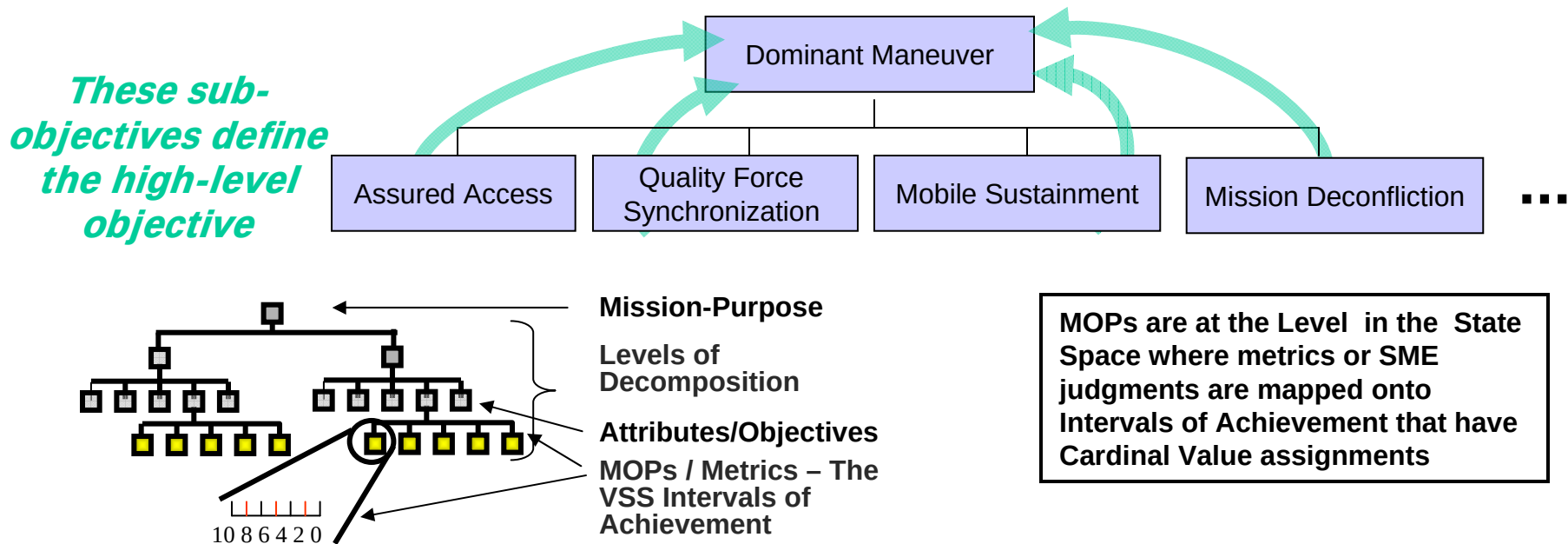
TAPS-VSS Environments Components and Coalition





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

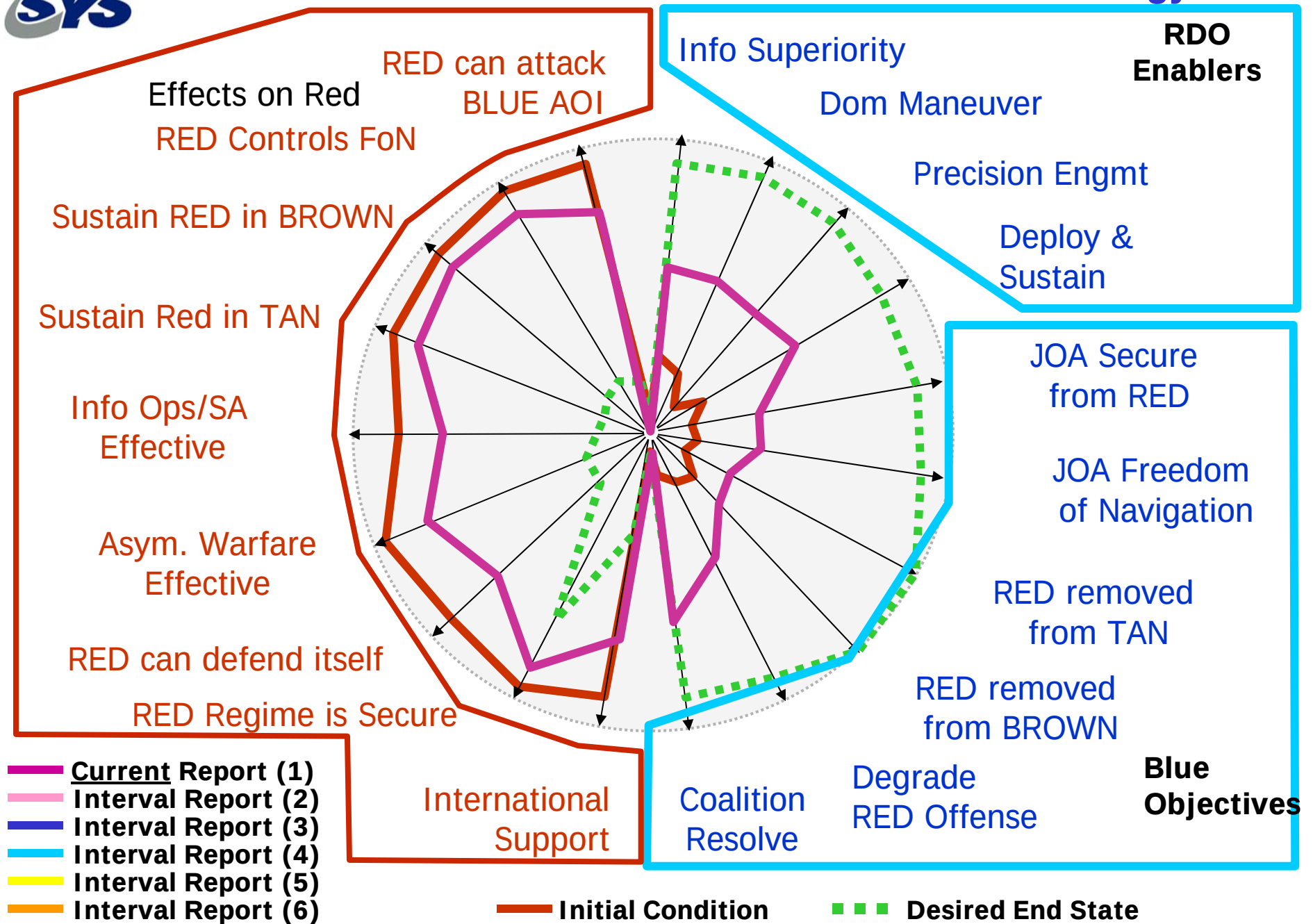
- Arithmetic & geometric means and default thresholds
- Future Research: Incorporation of other data sources, NSS
- Future Research: Evolutionary computation, fuzzy logic, etc.

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

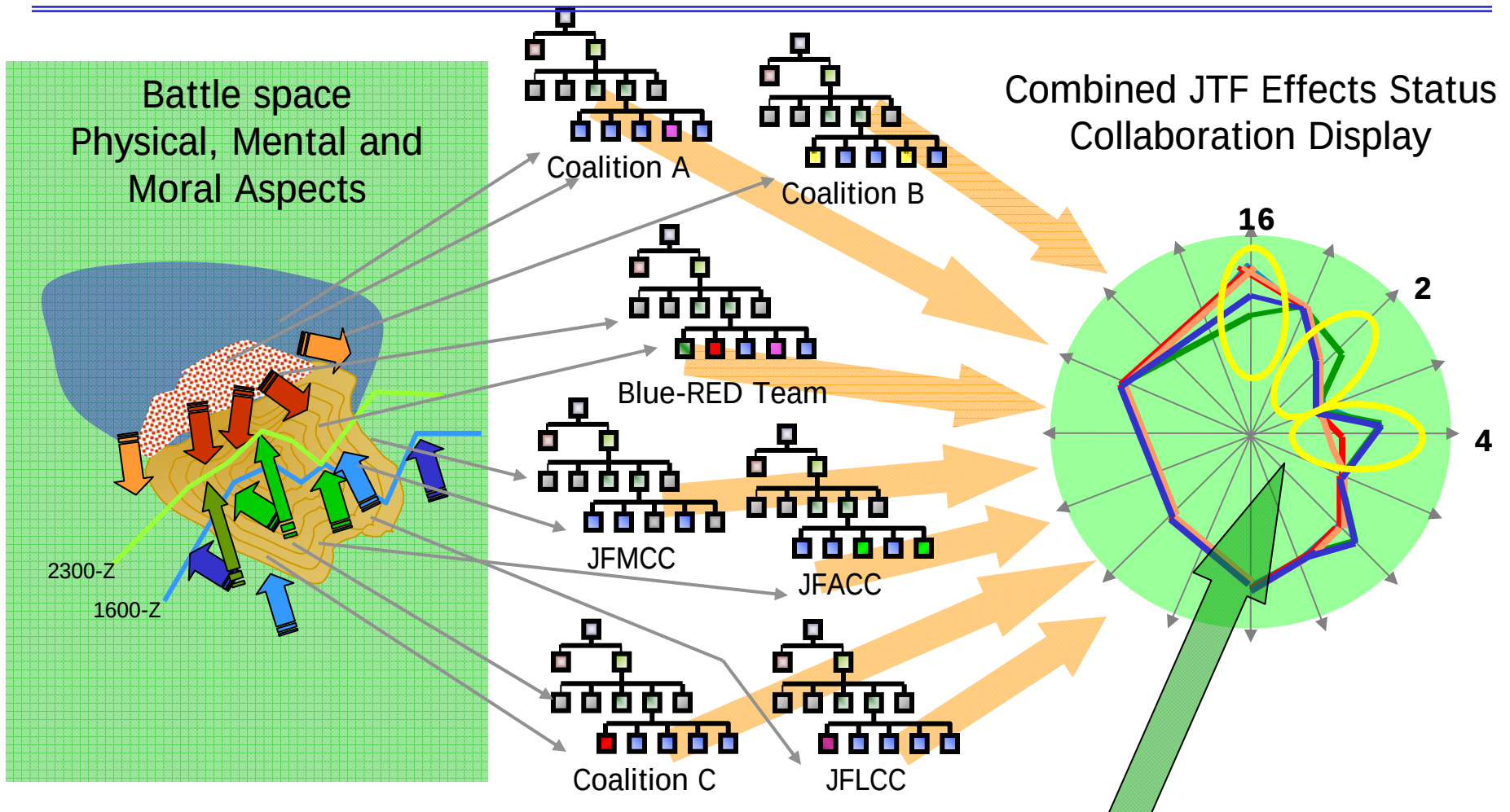


GLOBAL 2001 – TAPS – Effects on RED & BLUE Strategy





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

RED ANTI-ACCESS
AND OFFENSIVE DEPTH

RED MILITARY
WILL TO FIGHT

RED C2-C4ISR
STABILITY

KORU
POLITICAL
RESOLVE

CYBERSPACE
ACCESS

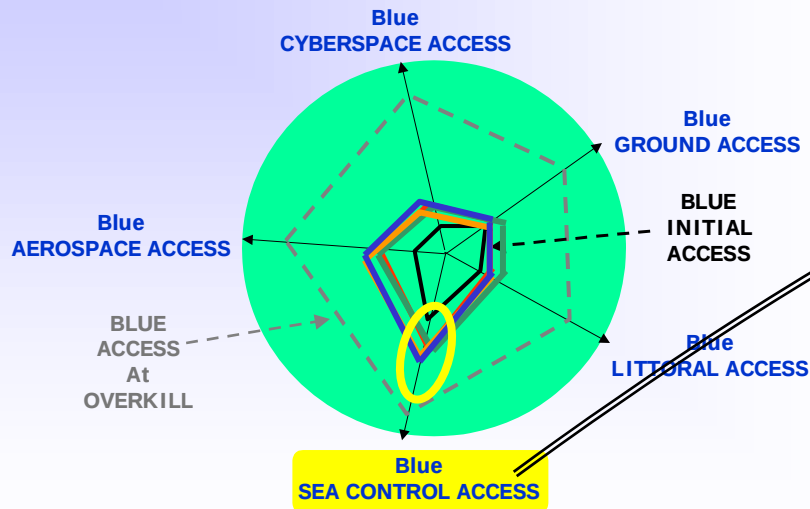
BLUE'S
FON

BLUE CRITICAL
RESOURCES

BLUE-COALITION
POL-MIL STABILITY

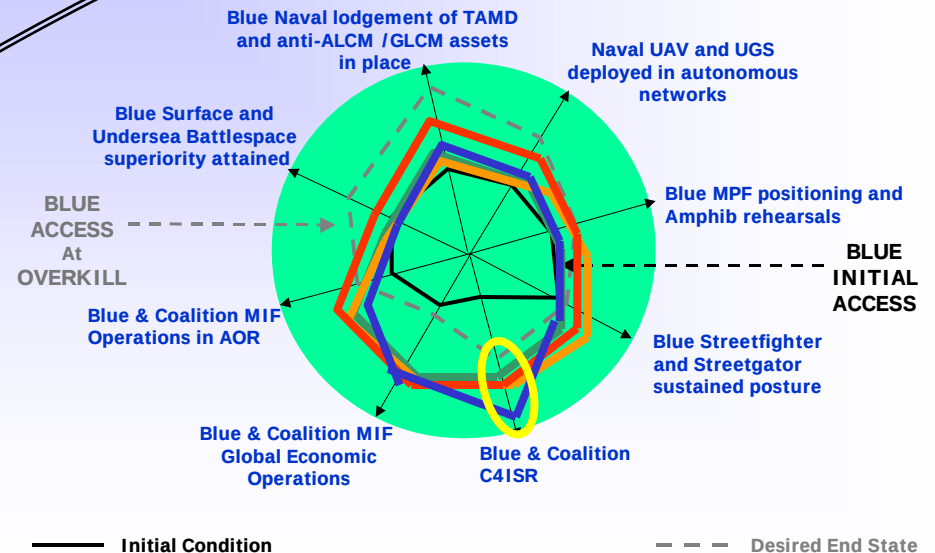
KORU
RESOLVE

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



Drill Down to
Third level
MOEs/MOPs

(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	Debrief	Situation Briefs CG Scenario	Debrief
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

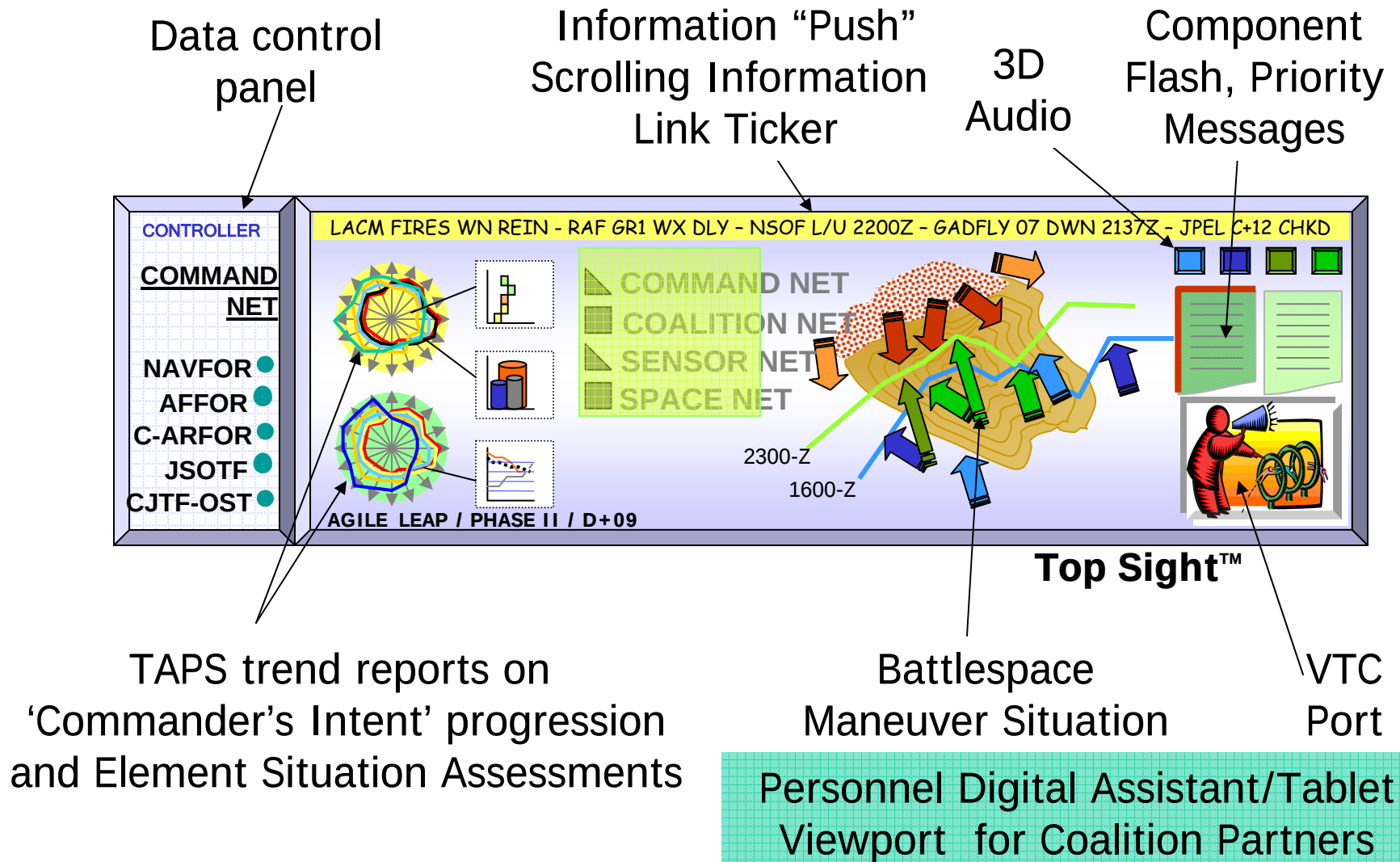
- Scheduled Events

- 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™

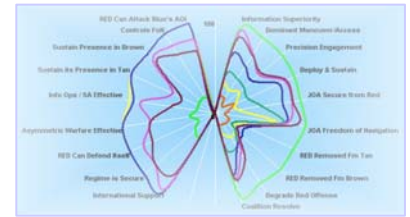
Command Information Viewport



SYS PROPRIETARY



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