Defense Information Systems Agency
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Adapting C2 to the 21st Century

Assessing the Operational Impact of New Network Centric Technology, Collaborative Replanning with User Defined Operational Picture: A Controlled Experiment with Warfighters (DRAFT Presentation I-131)

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Delta Experiment Purpose

- **To demonstrate and prove the differences in operational effectiveness, on NCW metrics, between current warfare practices using present Command and Control technologies, and new Network Centric Warfare practices using the combined DISA technologies of the User Defined Operational Picture (UDOP) with associated net enabled remote intelligence data bases of TMS/CWS red force tracker and SORTS blue force readiness data base and collaboration technologies instantiated by the Light Weight Collaborative White Board (LCW).**

Scenario Overview

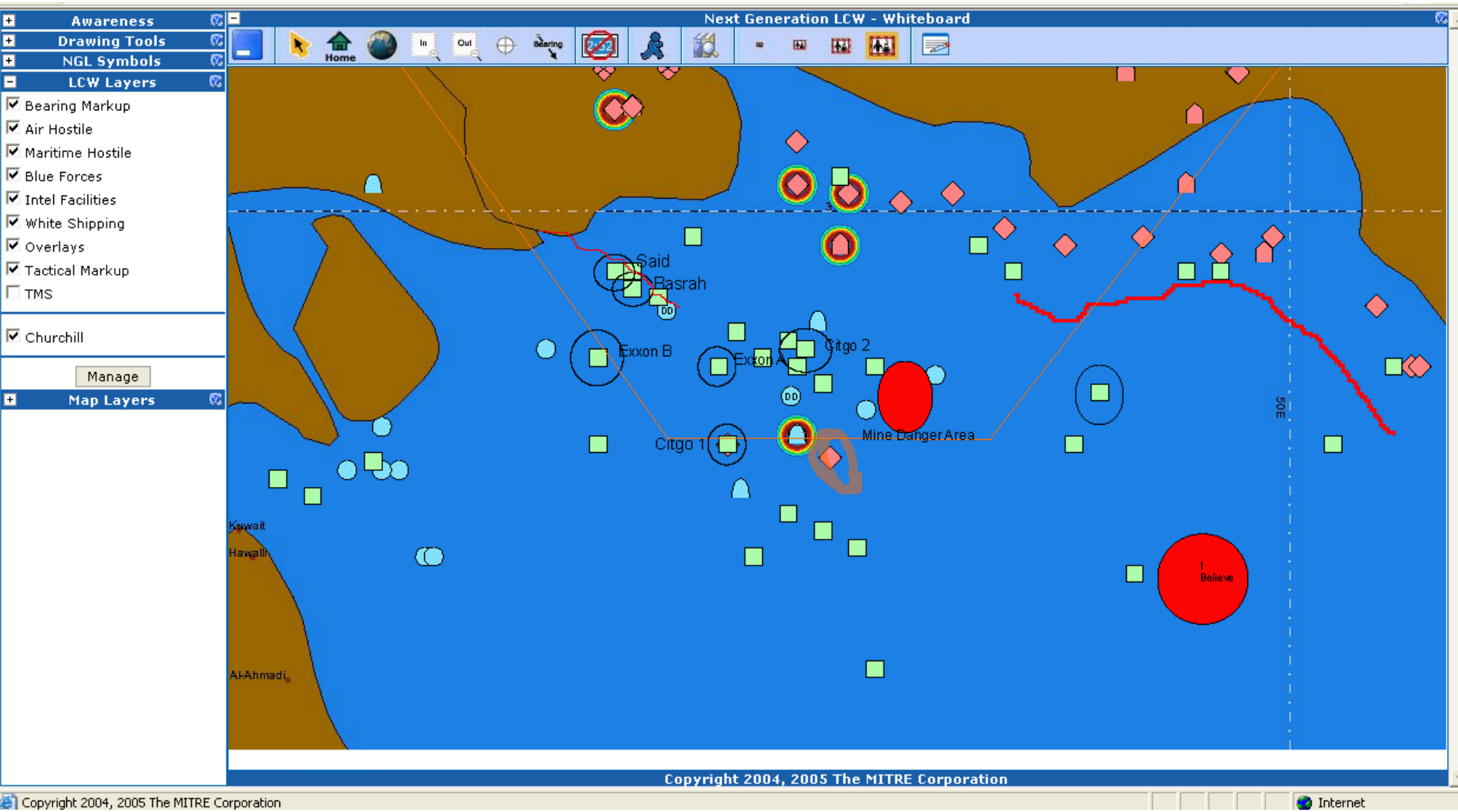
- **Persian Gulf setting where: Operation Storm Petrel involves**
  - **Two Blue Ships (DDGs) and JFACC air protecting several oil platforms under attack by:**
    - **Twelve Red fast attack crafts, Zhuks and Boghammers**
      - **Analogous to the Basrah terrorist incident of Spring 2004**
    - **Pirated Aircraft**

C2 Baseline vs. NCW Technology

- **In C2 baseline condition, all four military players share a COP view of the Gulf and communicate via internet relay chat. Intelligence products are obtained under current time lines (e.g. via hard-copy message, I&W briefings).**

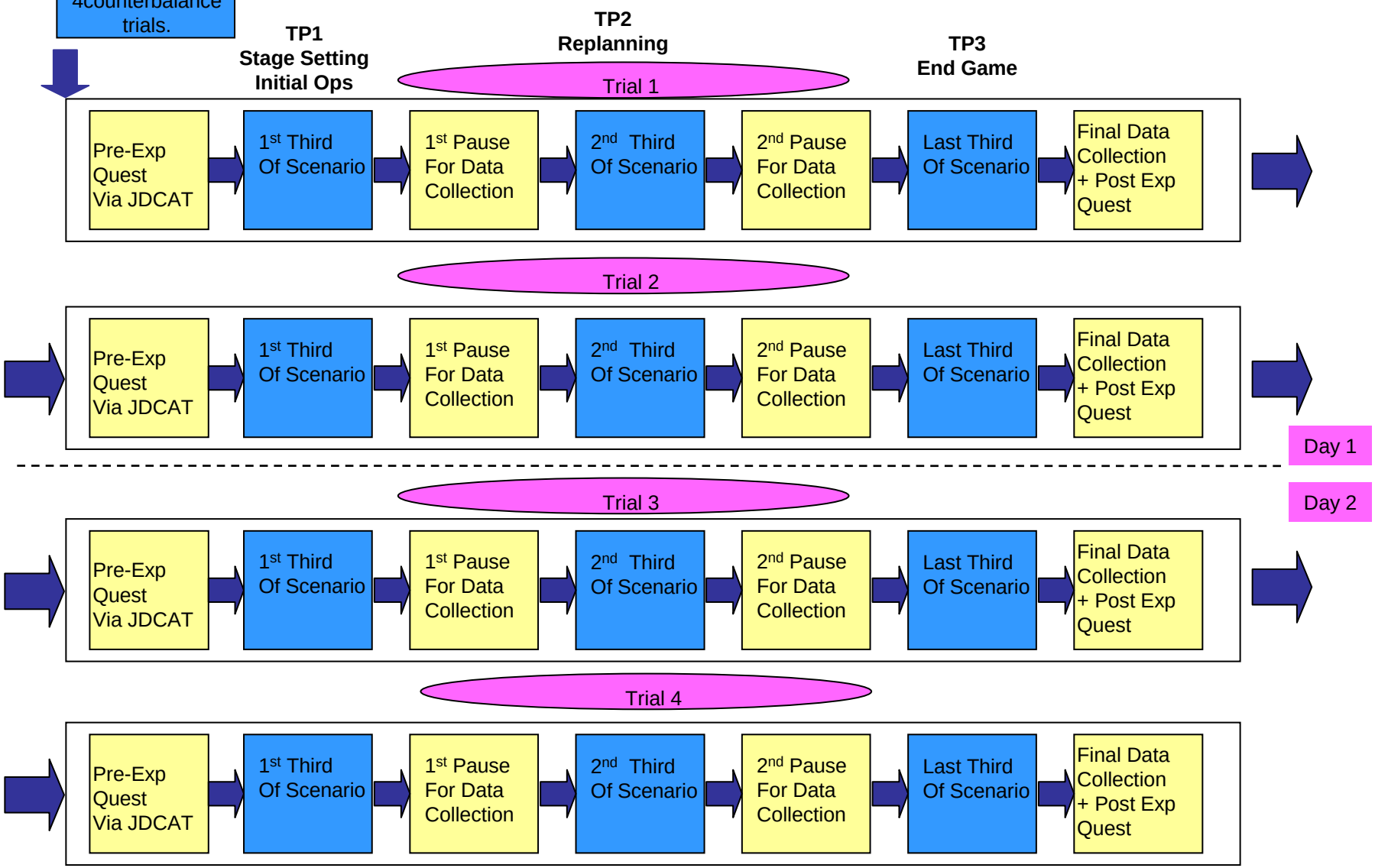
- **In NCW condition, JFACC/AOC subscribe to air track and intel OpContext for air Community of Practice, and two Navy destroyers subscribe to maritime track and intel OpContext for maritime Community of Practice, the ashore CJTF operational planner subscribes to all these and SORTS blue force readiness data and all jointly collaborate over wide area network using common LCW with stated Commander's Intent forming a common Community of Action.**

UDOP Screen Shot of Operation Storm Petrel Scenario



UDOP Collaborative Replanning Experimental Design

Joint Training
All Four Teams-
Each team plays
4counterbalance
trials.



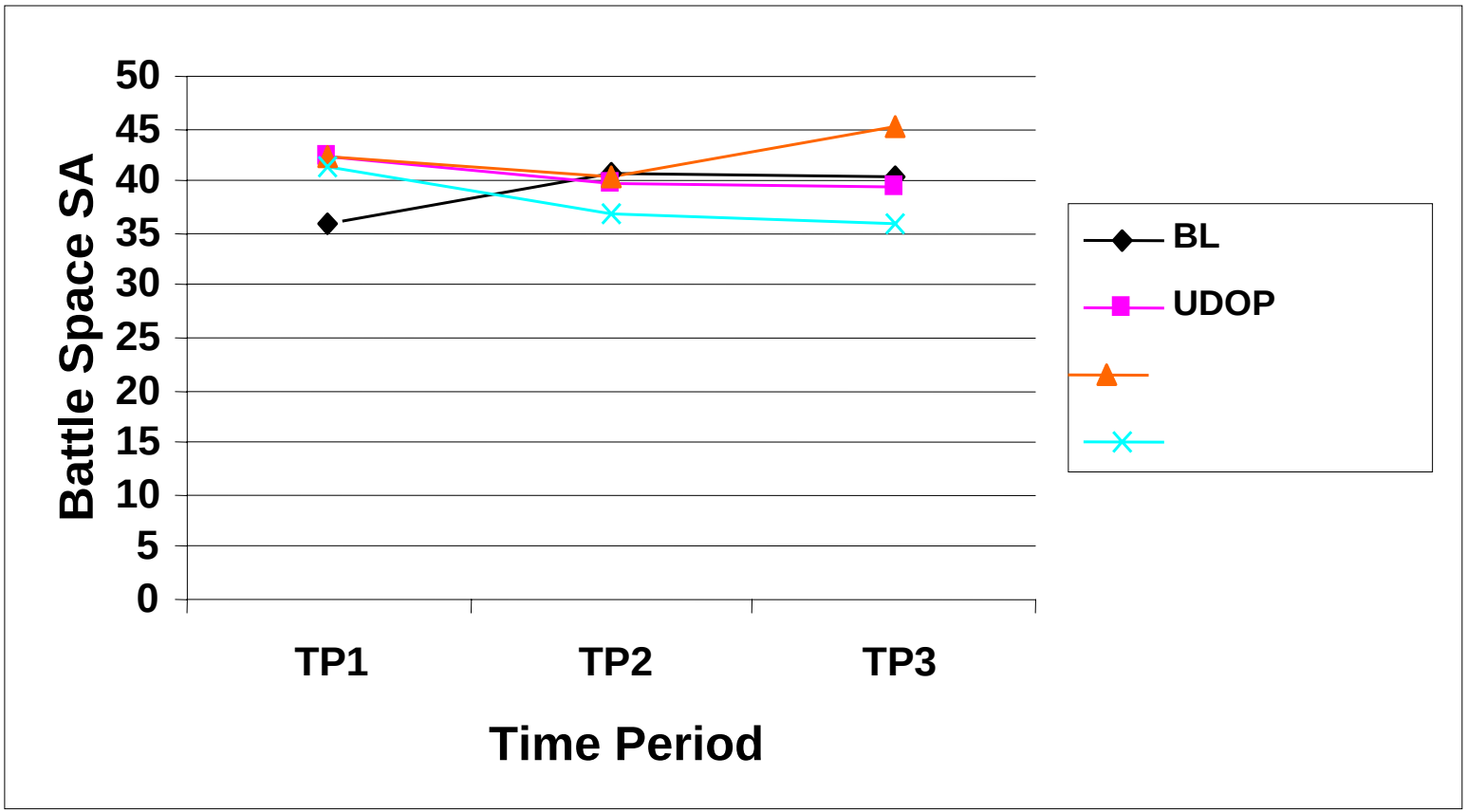
Hypotheses

By facillitating the development of more accurate shared mental models among members of the warfighting CAS, use of collaborative UDOP with associated intel and blue force readiness schema causes:

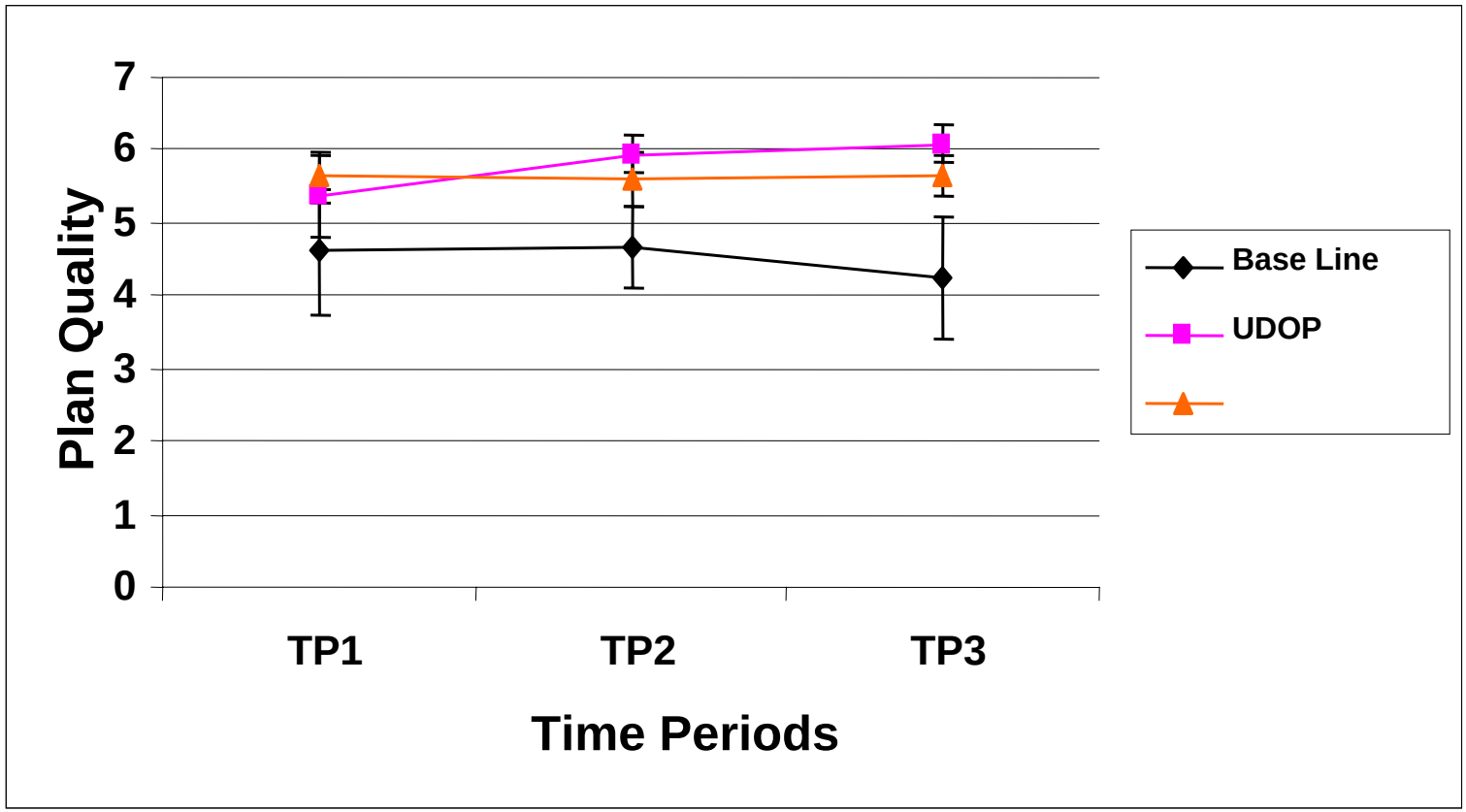
(H1) increased Situational Awareness(SA);

(H2) increased Shared Situational Awareness(SSA);

H1: UDOP Causes Increased SA --Example Data Presentation



H3: UDOP Causes Increased Planning Quality—Example Data Presentation



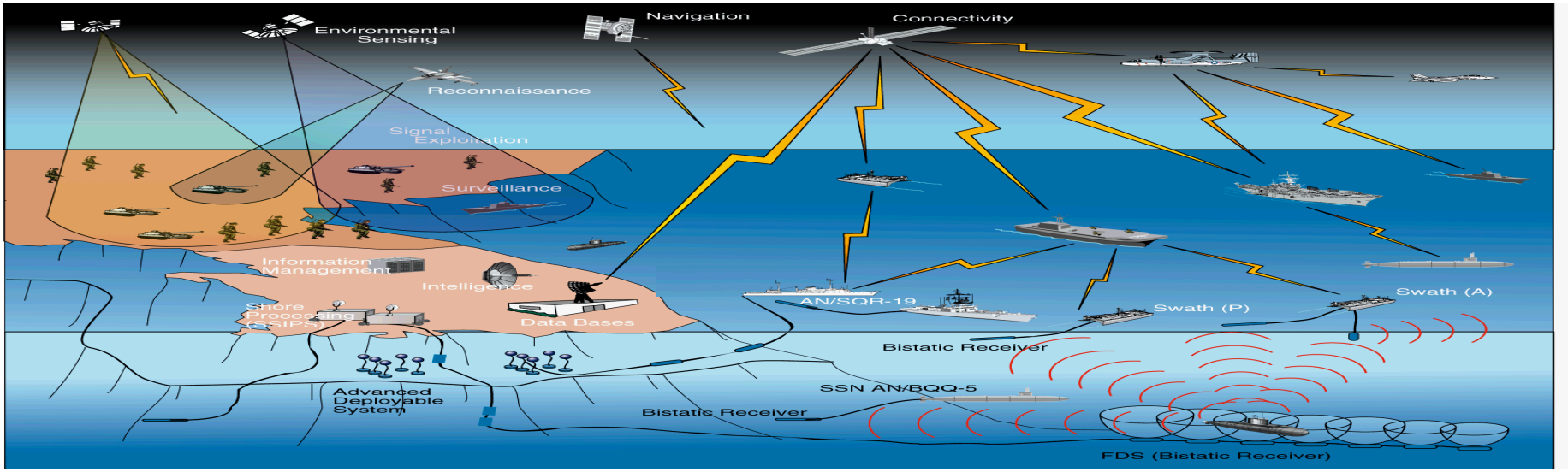
Summary of Significant Findings

Warfighters' Hotwash Inputs

Conclusions

Backups

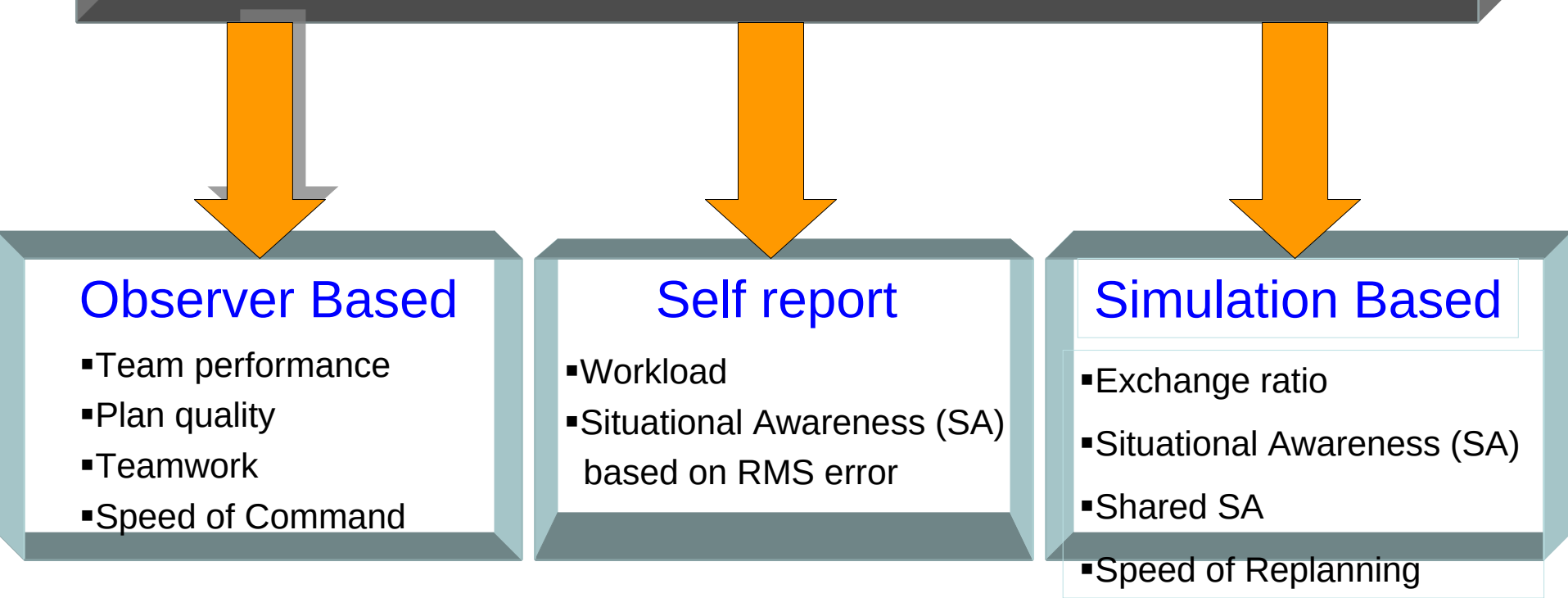
Network Centric Warfare



- **A promise of Network Centricity: Unprecedented operational tempo and situational awareness through networked connectivity**
  - **Ability to support collaborative environments**

Dependent Measures

Three classes of dependent measures: observer based, self report, simulation based



Observer Based

- Team performance
- Plan quality
- Teamwork
- Speed of Command

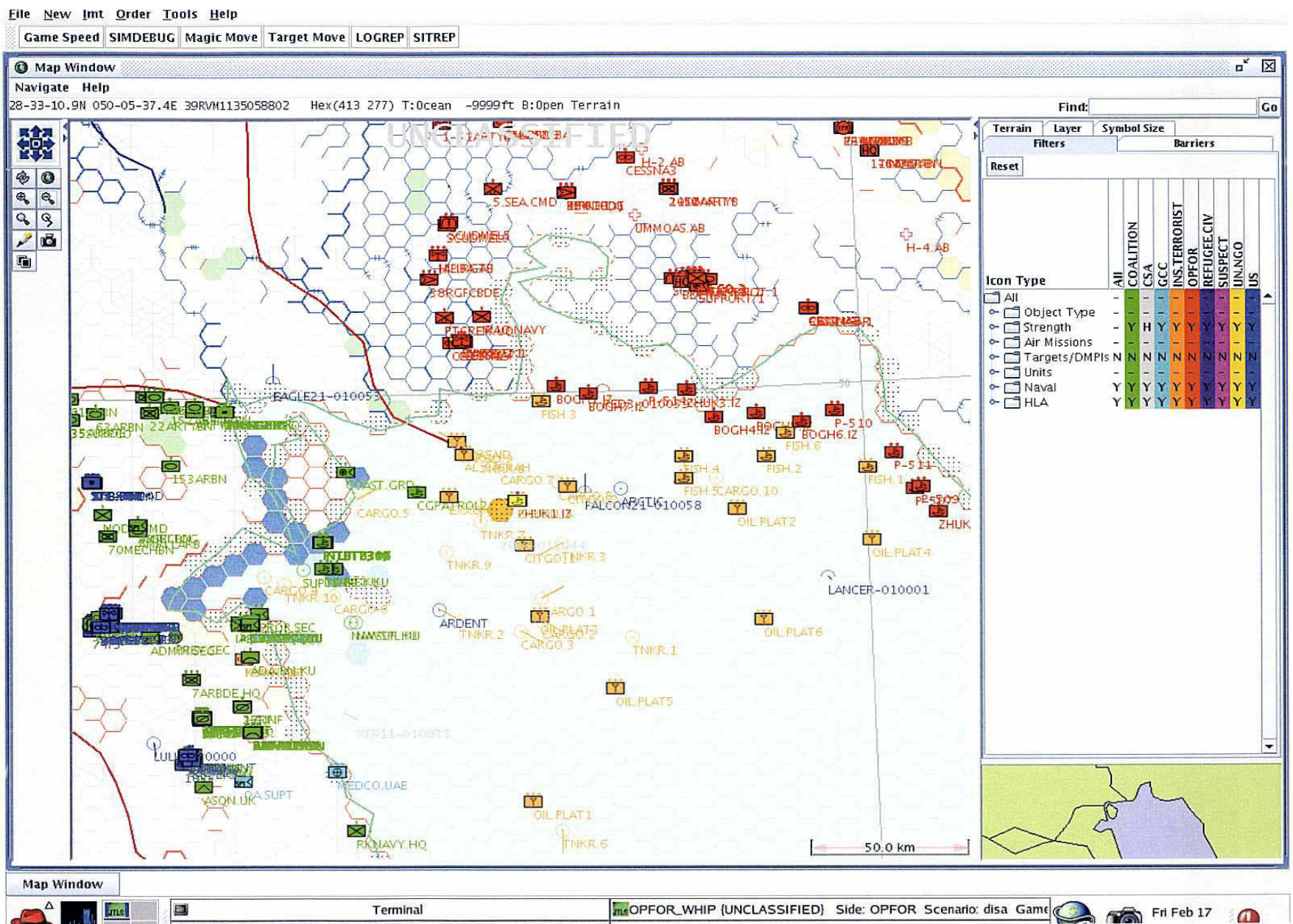
Self report

- Workload
- Situational Awareness (SA) based on RMS error

Simulation Based

- Exchange ratio
- Situational Awareness (SA)
- Shared SA
- Speed of Replanning

JTLS Screenshot of Scenario



Measurement Definitions for Operational Assessment of UDOP/Collab Tech

Confidence Intervals for ΔSA (Δx) from exp, for t-distribution

$\Delta x - t_{\alpha} (s/\sqrt{n}) < \mu < \Delta x + t_{\alpha} (s/\sqrt{n})$, where $s = \sqrt{(\Sigma x_i / n-1)}$

Confidence intervals for ΔSA (Δx) from exp, for F-distribution

$(x_{.1} - x_{.2}) - \sqrt{F_{\alpha}}\, s_w \sqrt{(2(k-1)/n)} < \mu < (x_{.1} - x_{.2}) + \sqrt{F_{\alpha}}\, s_w \sqrt{(2(k-1)/n)}$,
where $s_w = \sqrt{(wss/k(n-1))}$ and wss = within groups sum of squares

Situational Awareness (SA) = Proportion of mission critical set of warfighting platforms correctly identified by a warfighter (Ground Truth cf. COG @ t_i)

Shared Situational Awareness = Proportion of overlap between pairs of COGs for complete warfighting team.

Speed of Command ($t_{d} = t_c + t_r + t_a + t_b$), where total speed of command is the sum of time to size up situation + time to plan + time to act + time to complete decision cycle with battle damage assessment

Combat Effectiveness = Loss/Exchange Ratio= red platform losses / (red + blue + neutral losses)

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