Decision Making under Conditions of Uncertainty:
The Impact of Uncertainty on Operator Performance

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MARITIME RAPID ENVIRONMENTAL ASSESSMENT CONFERENCE

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Presented by

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Outline

- Introduction
- Design Requirements
- Challenges and Constraints
- Conclusion

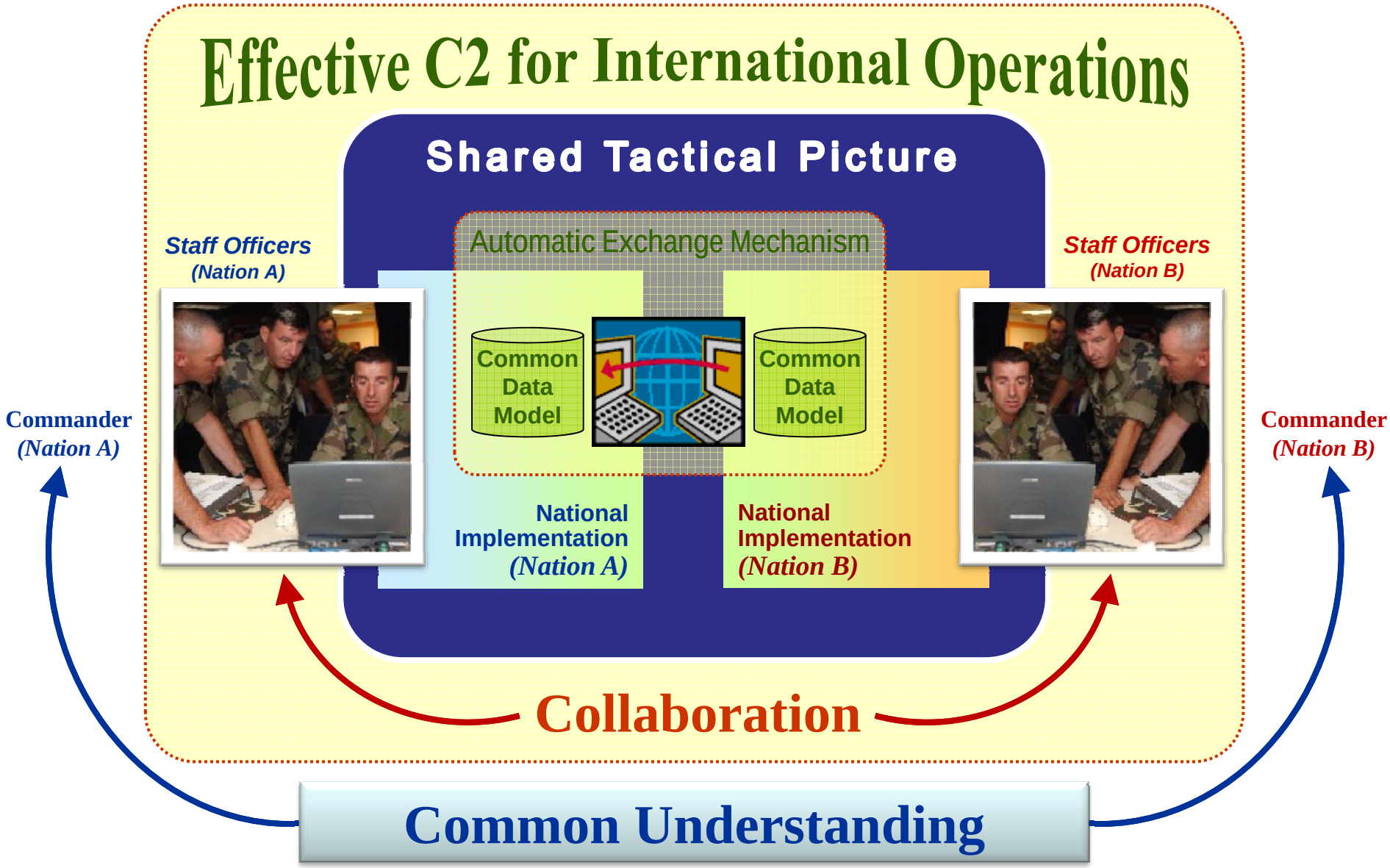
Introduction

Observables	Collect	Fuse	Analyze	Disseminate	*Decide/Act
• Vessels • People • Facilities • Cargo • Infrastructure • Sea Lanes • Threats • Friendly Forces • Weather	• Sensors • Operators & Field Personnel • Intel Agencies • Open Source • Private Sector Data	• Tracks w/Tracks • Data w/Data • Tracks w/Data	• Anomaly Detection • Pattern Recognition & Analysis • Compare with Rules • Research Tools	Net-centric warfare components: – Displays – Networks – Indications & Warnings – Assessments Estimates	Strategic Operational Tactical **Decision Making**

Persistent Surveillance, Data/Intel Gathering

Human Decision Making!

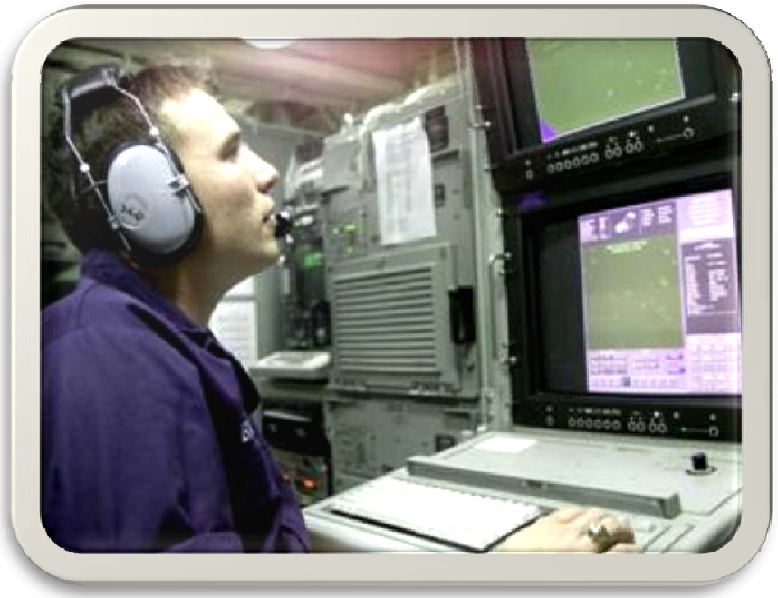
Decision Making

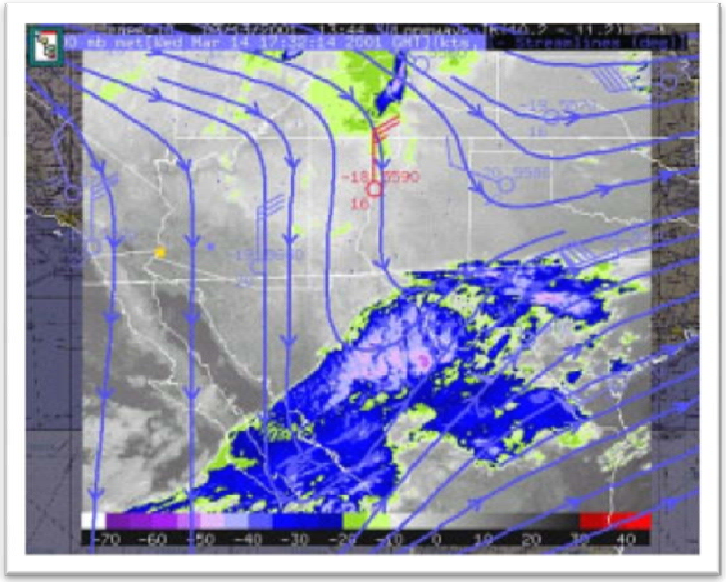


System Design Requirements

Objective(s):

- *Develop models to reduce uncertainty*
- *Design systems to enable operators to simultaneously display several unique models*
- *Develop tools to support collaborative METOC MSA*
- *Enhance operator performance and effectiveness*

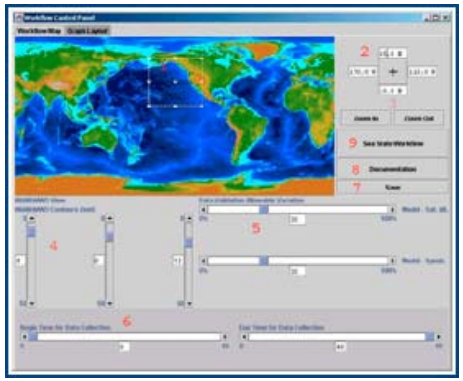




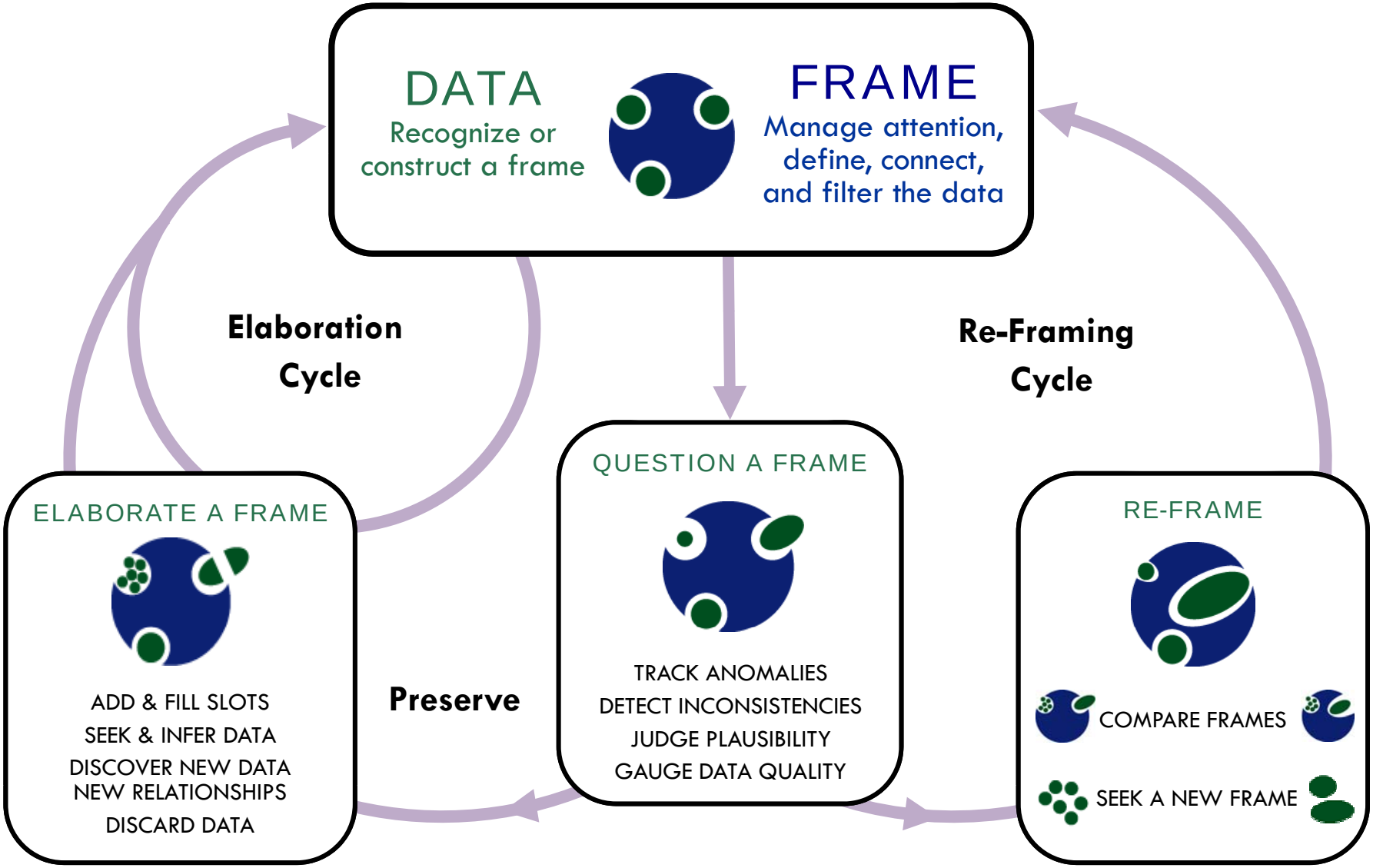
Uncertainty is the primary cause of error and inaccurate decision making!

Constraints/Issues

- **METOC Forecasters**
- **Time Constraints:** make predictions for extended periods of time; thus, increasing the levels of uncertainty as time progresses.
  - Fatigue effects
  - Training issues; various models, impact on performance
  - Experience: *required to forecast in areas in which they lack operational experience*



Klein Sensemaking Analysis Process



Expertise and Sensemaking

- **Sensemaking facilitates decision making and planning**

- **Sensemaking Processes:**
  - Assessment
  - Questioning
  - Elaborating
  - Re-framing

- **Requirements analysis methods for the design of systems functionality**
- **Interface challenges**

Sensemaking & Decision Making

- **HOW IS SENSEMAKING DIFFERENT FROM DECISION MAKING?**

- **Sensemaking: process by which individuals seek to to understand what is going on in a situation, i.e. explain events and anticipate future events.**
- **Breakdowns in Sensemaking: When we can't make sense of a situation – potential for error**
- **Decision Making:**

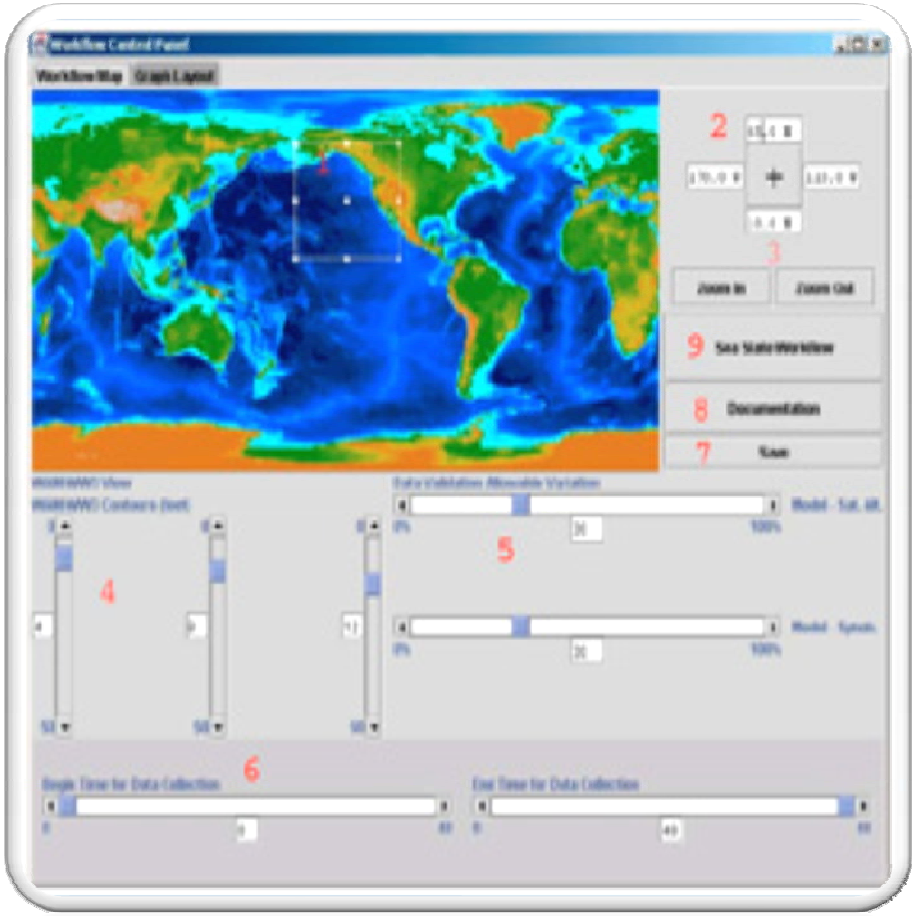
Challenges

- Humans are pivotal parts of the information network!
- Cognitive challenges to reducing uncertainty, e.g. memory and attention. Information overload, multi-tasking, etc.
- Perceptual challenges to reducing uncertainty, e.g. pattern recognition and expectations, errors of omission (missed information) and/or errors of commission (miscategorization).
- Performance challenges due to fatigue, illness, and/or stress.

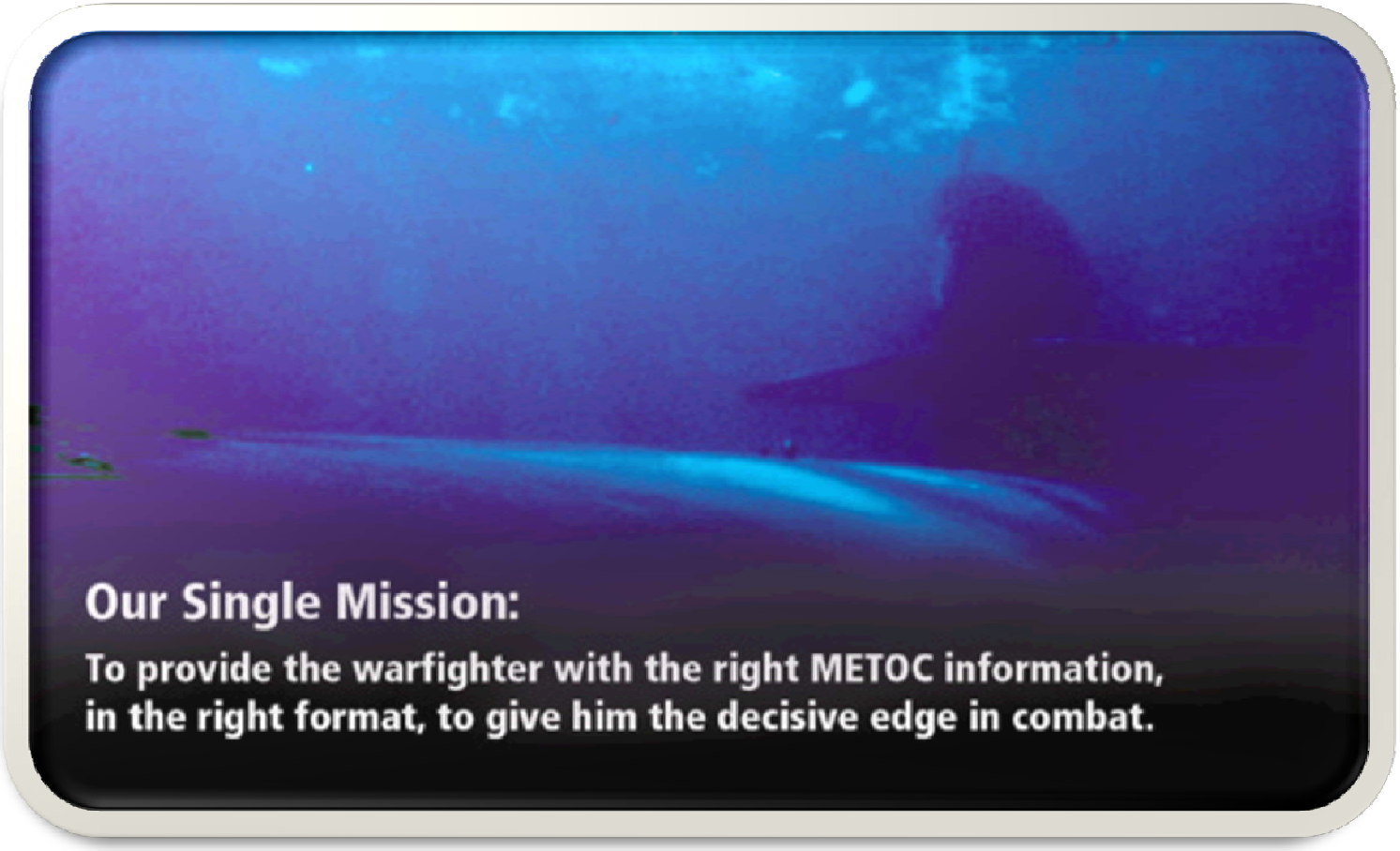
Recommendations

Enhance METOC MSA

- Reduce uncertainty and complexity
- Develop intuitive, collaborative decision support tools
- Provide the warfighter with the Decision Advantage



Conclusions



Give the Commander the Decision Advantage!