

11TH ICCRTS  
COALITION COMMAND AND CONTROL IN THE NETWORKED ERA

**Parsimonious Analogical Reasoning For Smart Decision Support In Network-enabled  
Environments: Managing Situational Awareness**

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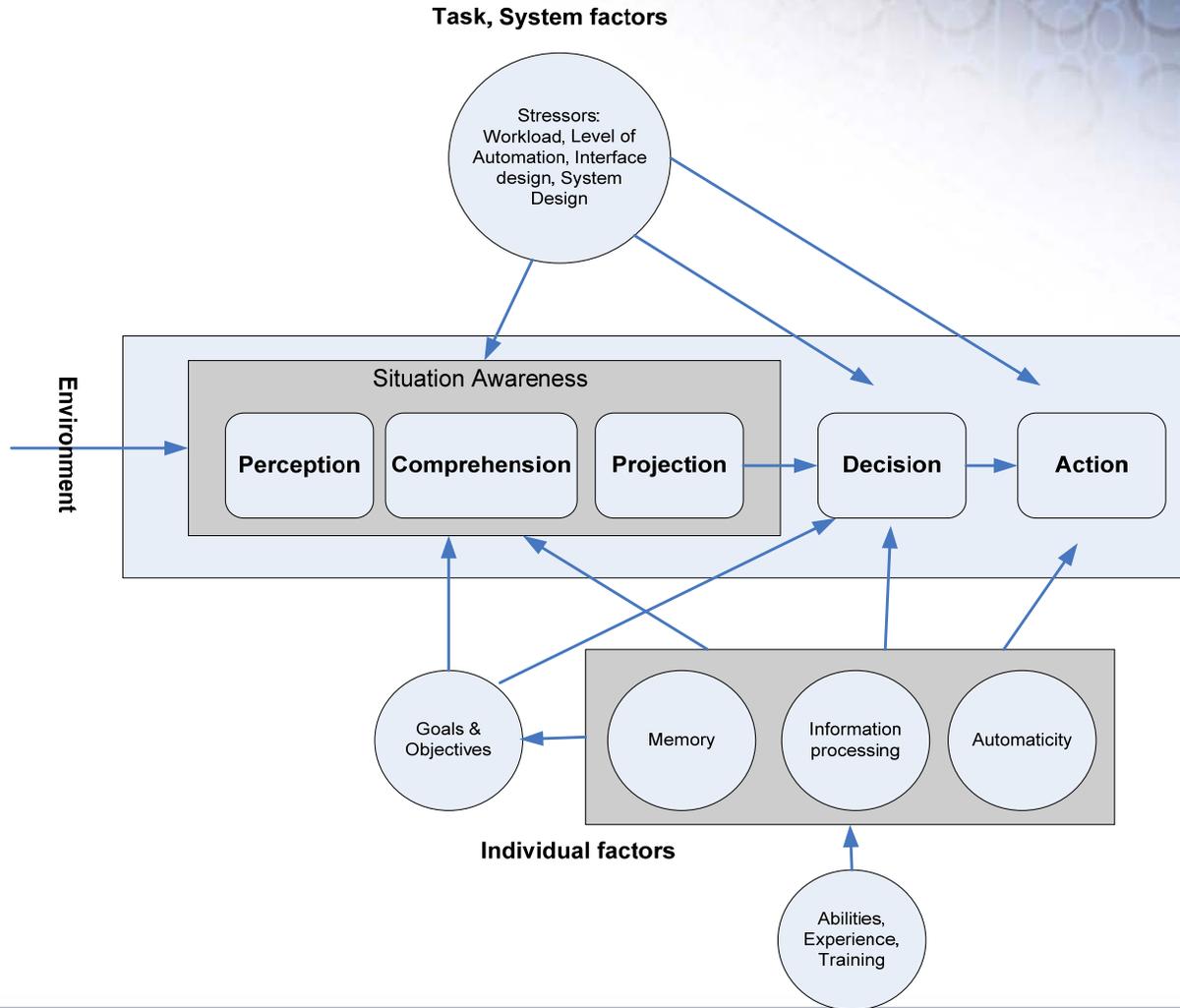
# Overview

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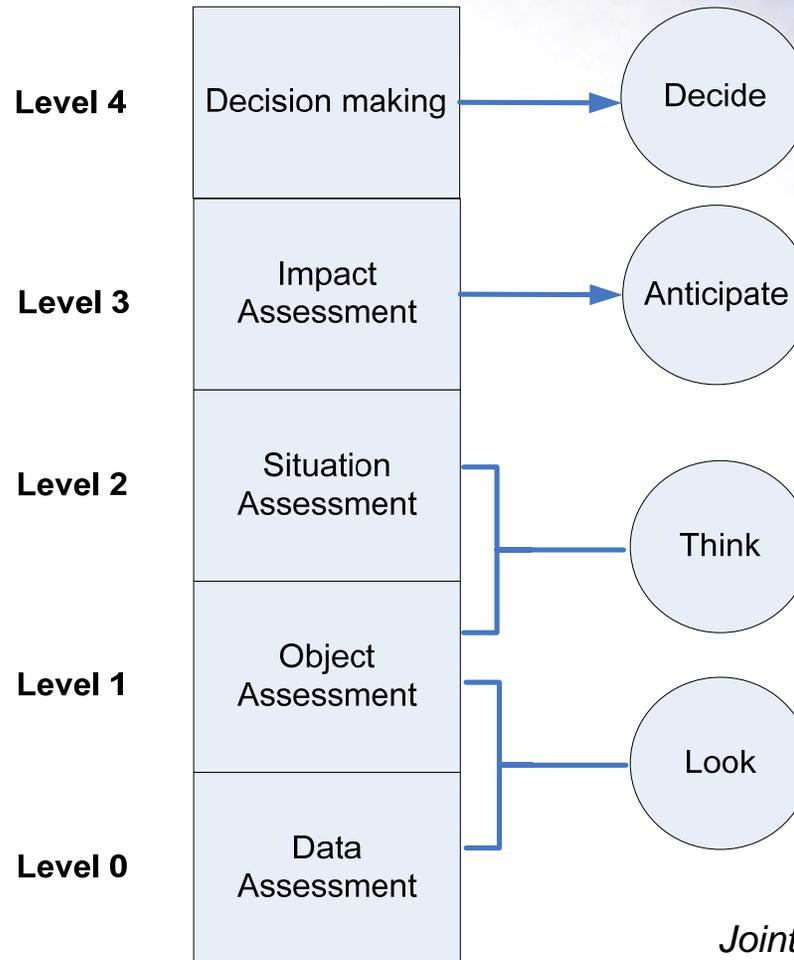
# Introduction

- Effective decision making constitutes the most important factor of modern warfare
- Human Decision makers have limited cognitive capacity that when reached it impairs their decision making capability
- Human information processing increases the mental workload of the decision maker which in effect reduces situation awareness
- Hence, need for automated data/information fusion to support commanders SA.

# Situation Awareness



# Data Fusion model



*Joint Development Laboratory (JDL)*

# Military Decision Making

- The cognitive process of selecting a course of action among multiple alternatives.
- Characterised by time pressure and dynamically evolving scenarios
- The limit to our cognitive capabilities is evident from the volume of human errors that are committed in such
- Naturalistic decision making
  - How it can be supported?

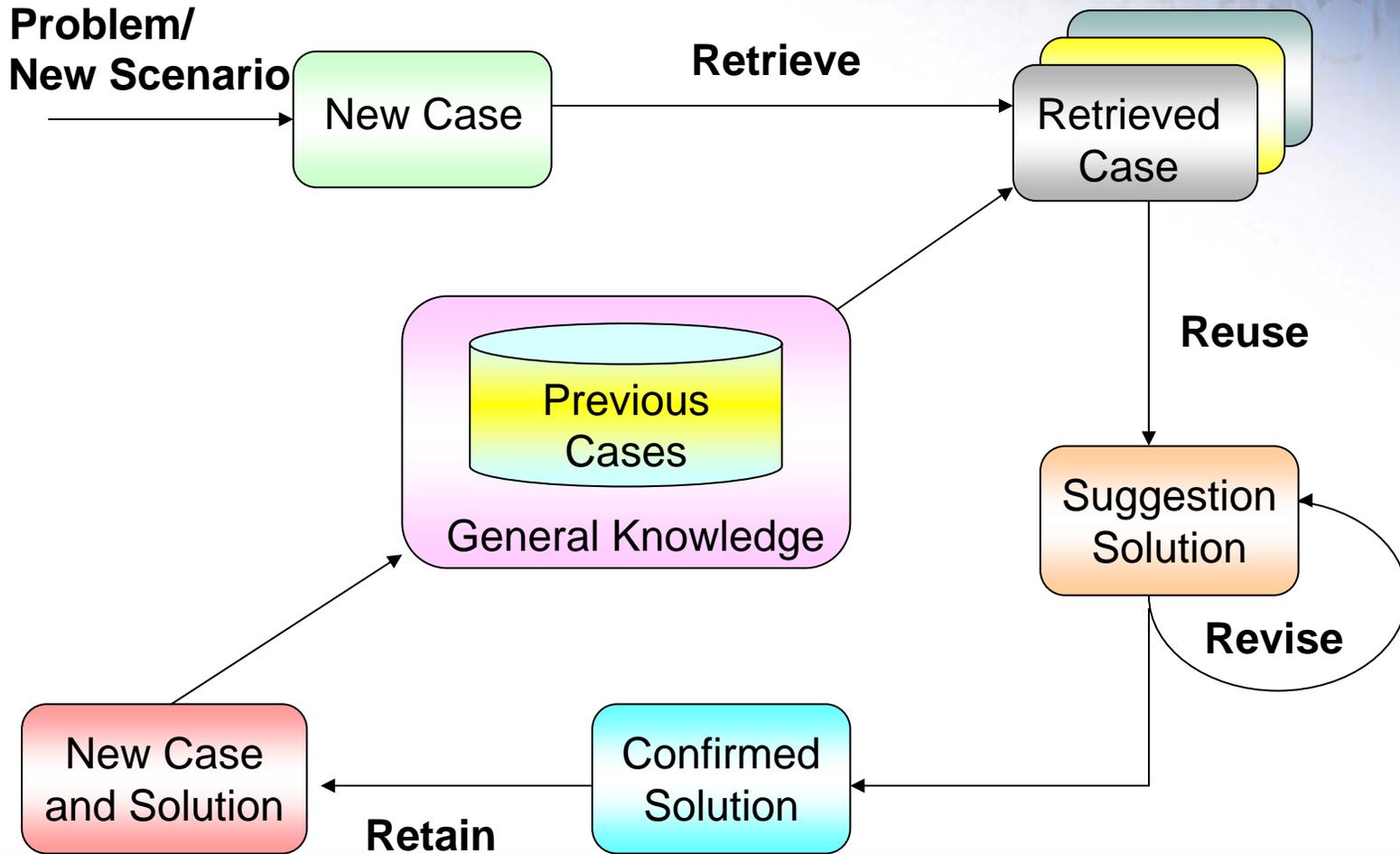
# Critical Success Factors

- Military Critical Success Factors (CSFs) are the key areas on which commanders should concentrate and that should be monitored for the successful realisation of intent (Louvieris, 2005)
- Initially defined by Rockart (Rockart 1979) as the limited number of areas in which results, if satisfactory, will ensure successful performance for the organization

# Maintaining Situation Awareness: The approach

- Based on the principles of analogical reasoning.
  - Reuse the knowledge form the most similar past experience
  - The methodology is described in the following distinct stages:
    - Data acquisition
    - Information interpretation
    - Scenario characterisation
    - Scenario retrieval
    - CSF quantification

# Case-based Reasoning Life Cycle

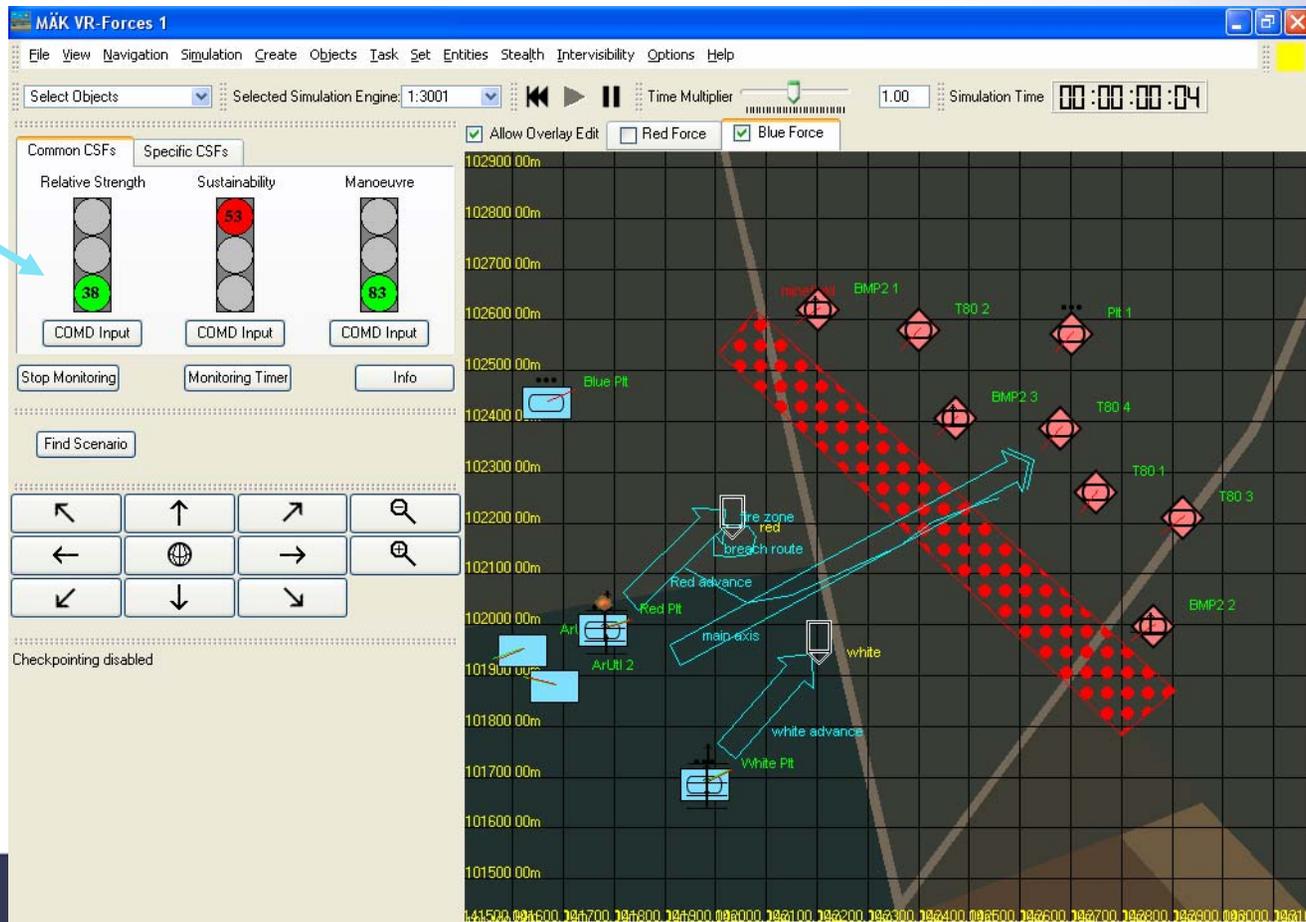


# CSF quantification using BBN

- The military domain is characterise by uncertainty due to incomplete or inaccurate information.
- Hence, employ Bayesian Belief Networks (BBN) technology to model and assess CSFs.
- Prior knowledge parameterised using the principles of Noisy-Max

## Case study: Application of an analogical reasoning technique to maintain commanders situation awareness

CSFs act as directives based on which commander's attention is drawn.



# Conclusions

- Situation awareness is a research area with limited tool support
- The approach proposed enables the improvement of commander's situation awareness and decision effectiveness
- Use principles of analogical reasoning and information fusion
- Fuse information from the environment to characterise the situation and subsequently identify and assess CSFs

## Next Stage Evaluation & Validation

- Validation studies
  - Use scenario walkthrough approach to compare and assess SA of prospective commanders.
  - Evaluators will be assigned the task of recognising the situation, plus identifying and assessing the state of CSFs during a scenario simulation.
  - The experiment will be conducted with and without tool support
    - Similar to SAGAT method (Endsley)
  - Compare results of the two to assess the goodness of the proposed SA & decision support method.

# Questions