

# Analyzing Decisions and Characterizing Information in C2 Systems

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ICCRTS 2005



<http://mentalmodels.mitre.org/>

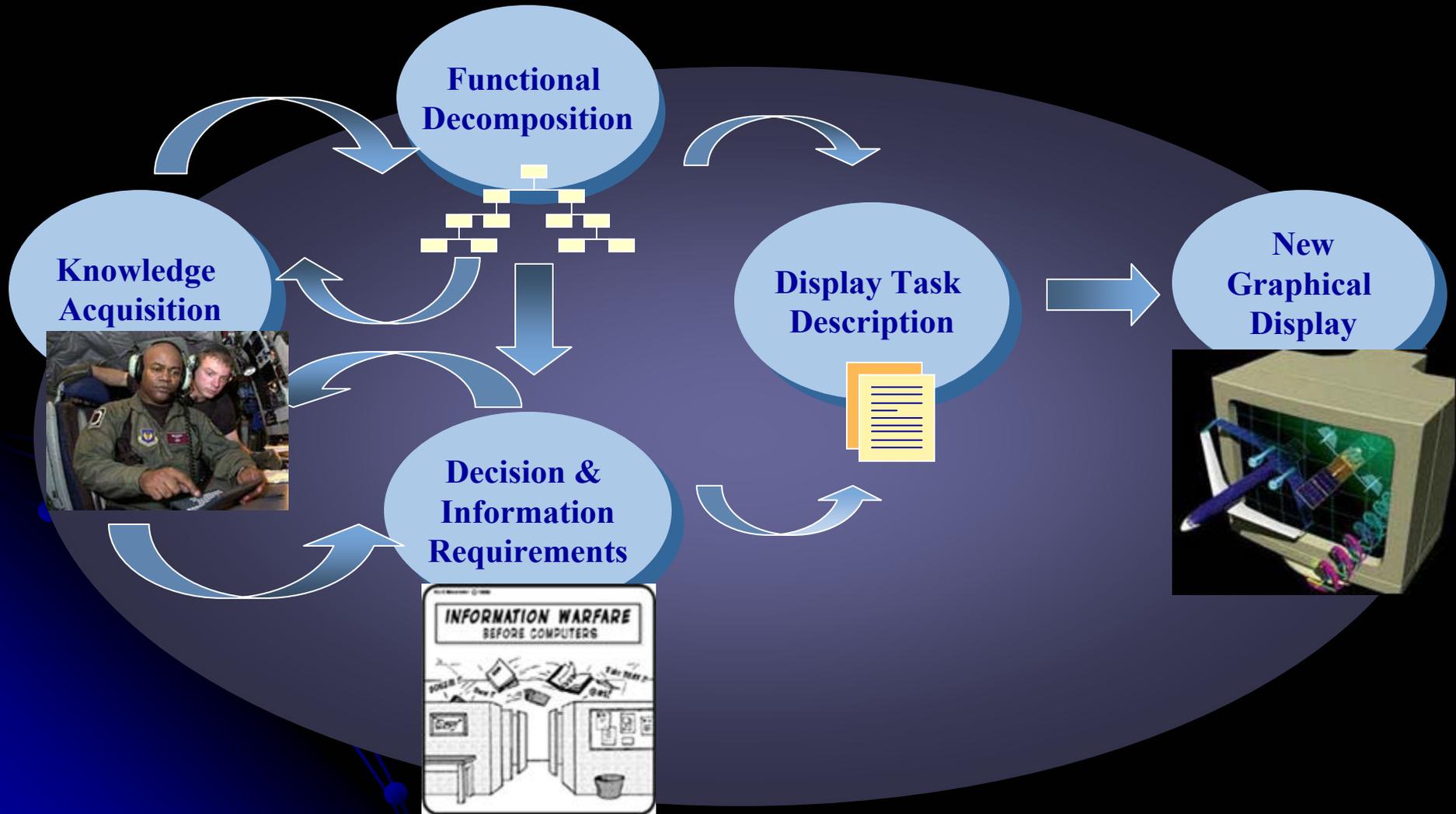
# Overview

- Background
- Applied Cognitive Work Analysis (ACWA) Methodology
- ACWA C2 Systems
- Information Space Characterization
- Recommendations

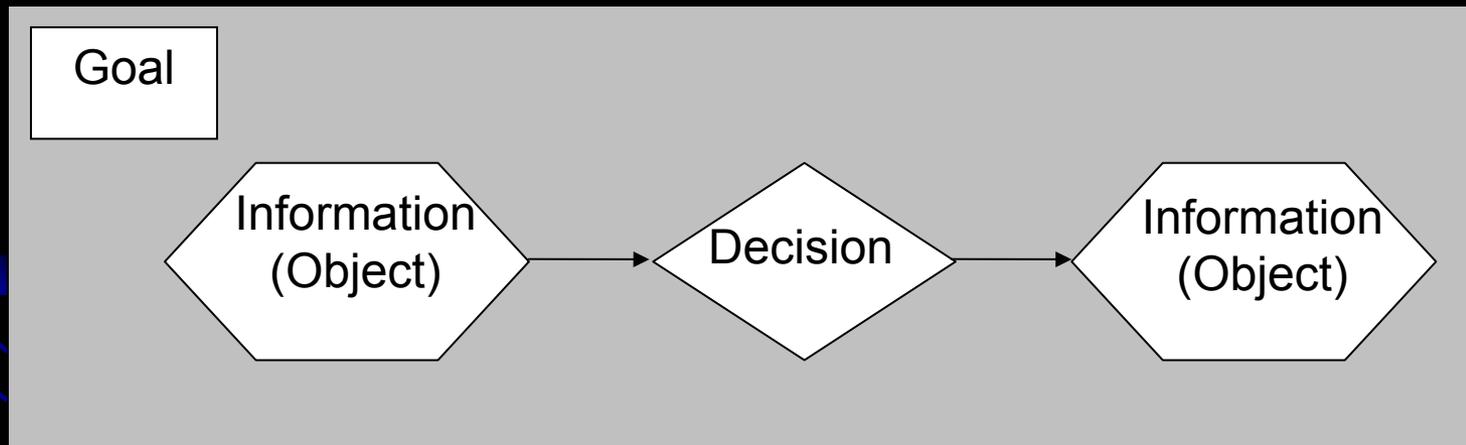
# Background

- C2 Operators encounter ever increasing amounts of information due to advances in sensors and multiplying effects of NCW
- Decision support systems must account for human decision making
- Analysis uses cognitive engineering techniques to analyze 3 AF systems, characterizes the information, and provide recommendations

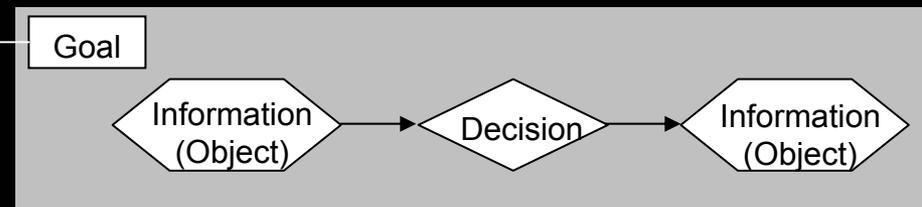
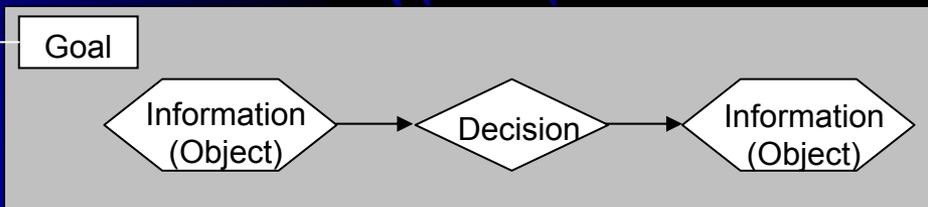
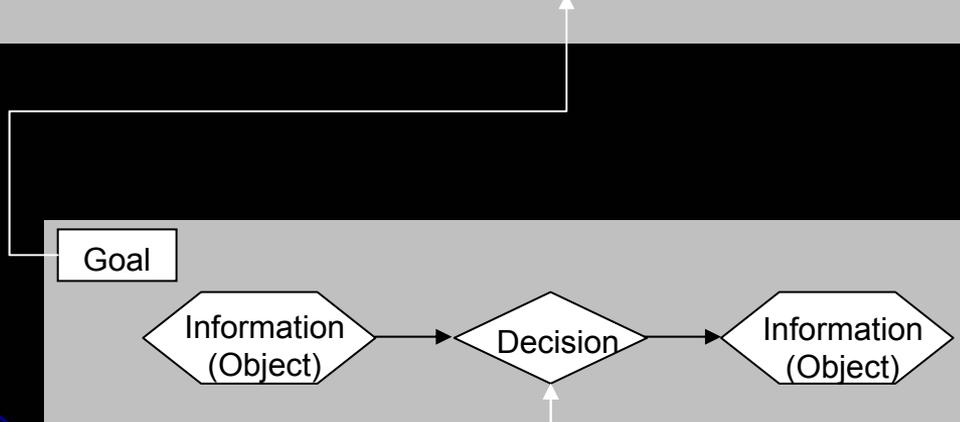
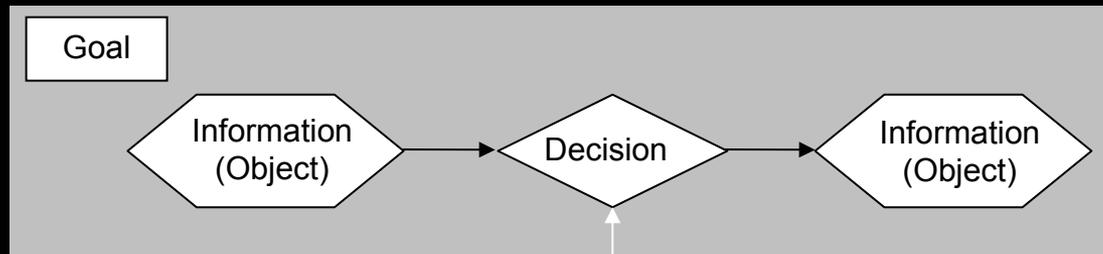
# What are the Steps in an ACWA?



# Decision Diagram



# Functional Decomposition Diagrams

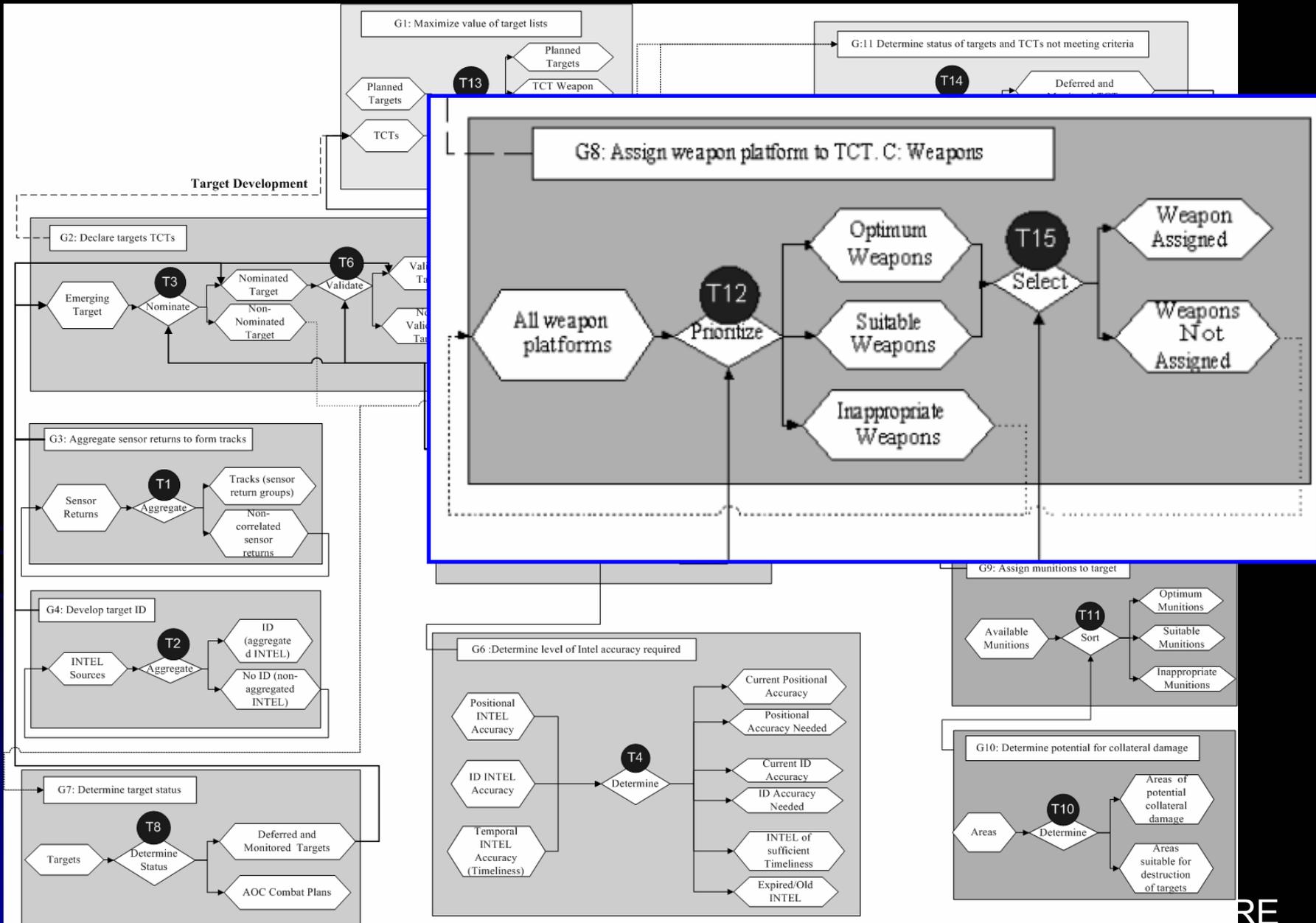


# Time Critical Targeting Functionality (TCTF)



[www.hanscom.af.mil/Hansconian/](http://www.hanscom.af.mil/Hansconian/)

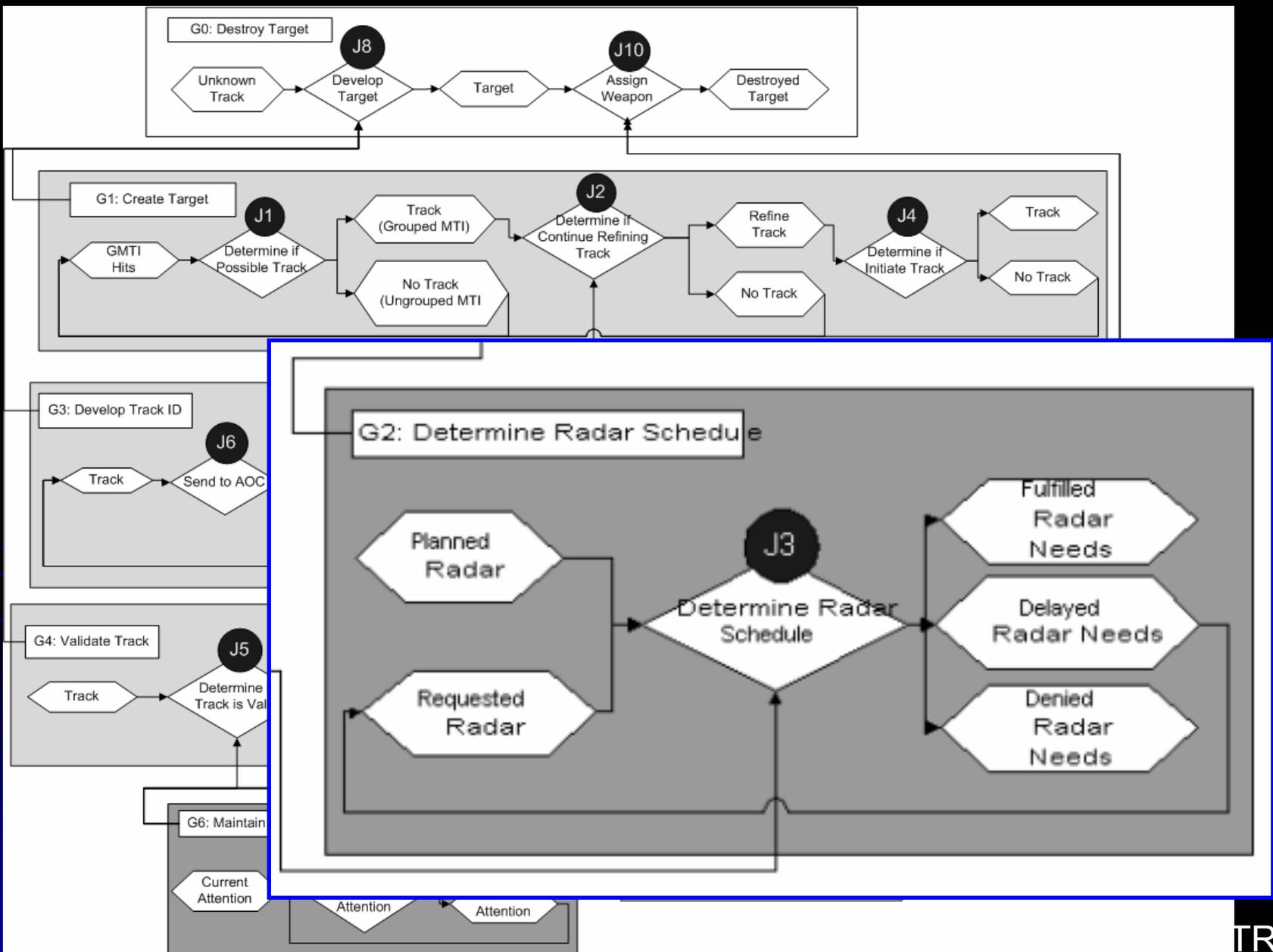
# TCTF



# Joint Surveillance Targeting and Attack Radar System (JSTARS)



# JSTARS



# Airborne Warning and Control System (AWACS)



[www.af.mil/](http://www.af.mil/)



[www.tinkertakeoff.com/](http://www.tinkertakeoff.com/)

# AWACS

G0: Move Assets to Targets

G1: Move Assets to Proper Location

A3

Assets Under Control

Determine Where to Direct Assets

Location:

- AOR
- CAP
- Launch Basket
- Enemy Air
- ISR Asset Station

Tanker

Friendly Air Base

A8

Determine if Enemy will Threaten

Deconflicted Assets

G6: Understand Mission

A2

Asset's Mission

Asset's Location

Evaluate Mission and Current Situation

Asset's Planned Location

G7: Maintain Situational Awareness

A10

Current Attention

Determine Where to Direct Attention

Needed Attention

Current Attention

G3: Direct Appropriate Asset

A5

Controlled Asset

Evaluate need to be directed

Asset Needs Direction

Asset does not need direction

A6

Determine Schedule--Which Asset to Direct Next

Asset Receiving Direction

Asset Waiting for Direction

# Information Space Characterization

- **Dimensionality:** The “size” ...

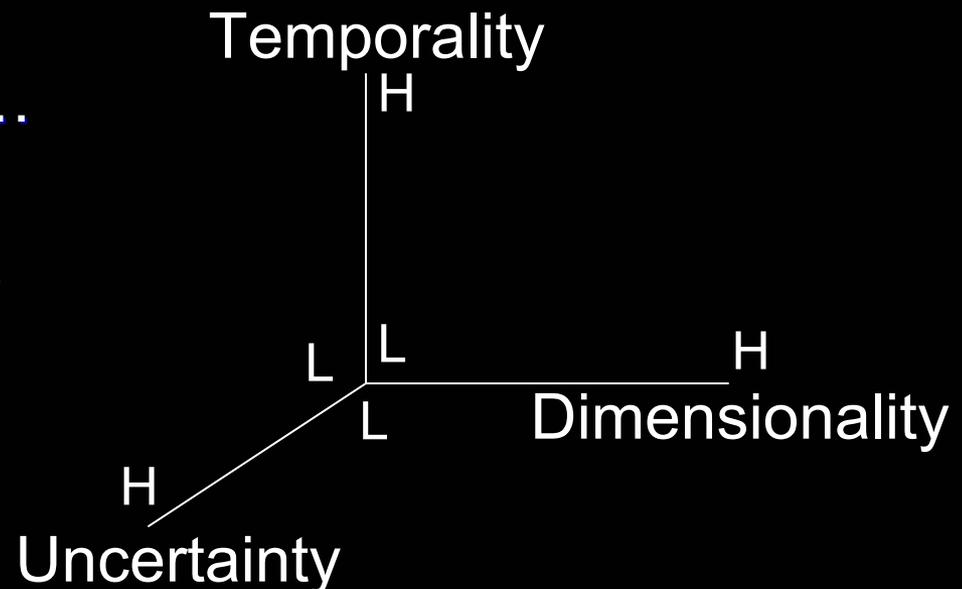
of information that must be processed, including the number of inputs and the number of outcomes that the decision maker must consider.

- **Temporality:** A “change” ...

in information that must be processed, including the need for making future predictions from current information.

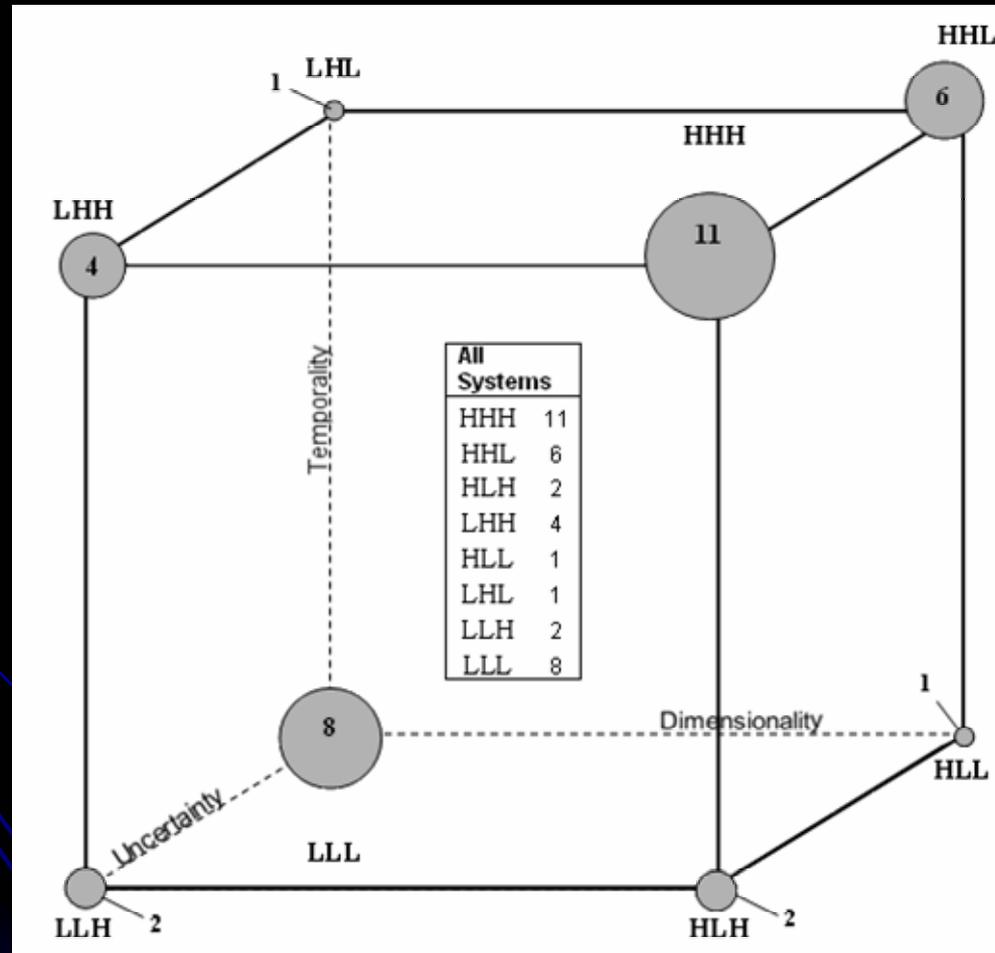
- **Uncertainty:** The “fuzz” ...

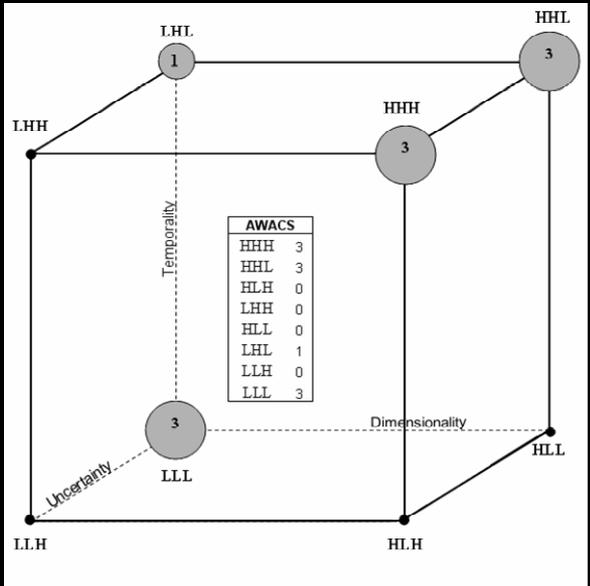
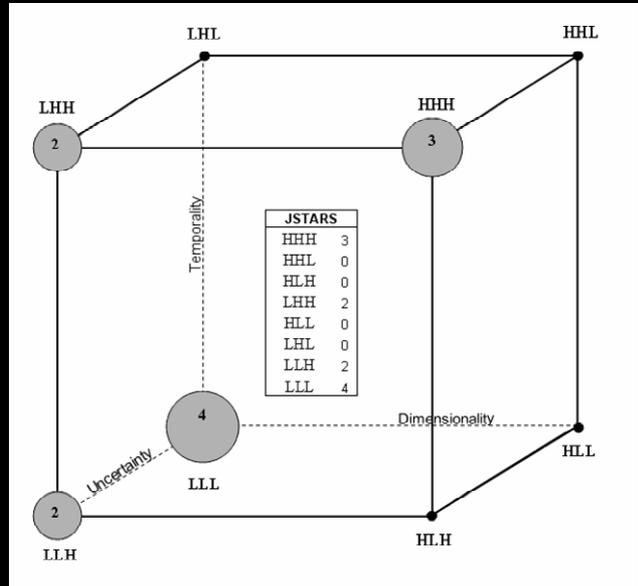
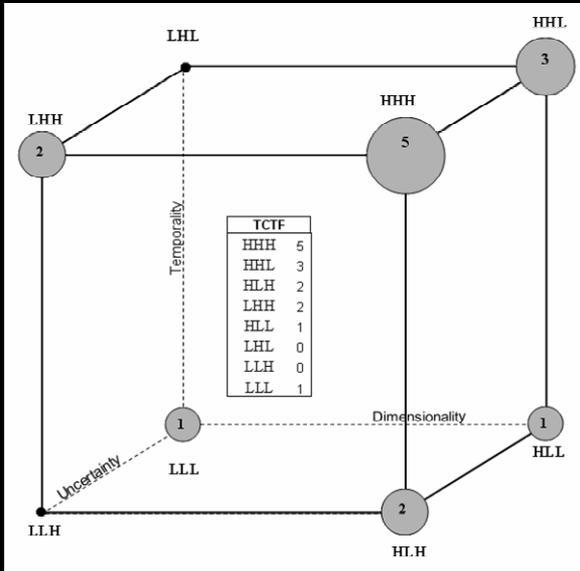
in information that must be processed, including ambiguities and probabilities that the decision maker must consider.



# C2 Summary

Most decisions are either HHH (most complex) or LLL (least complex)

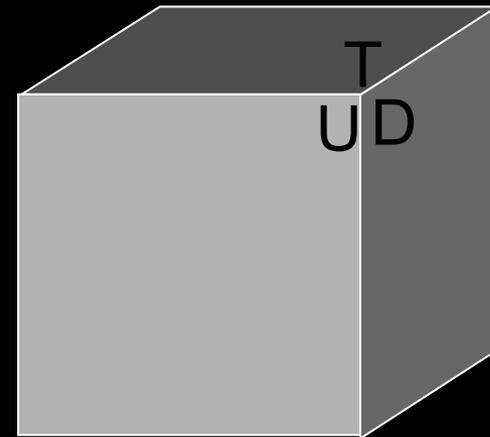
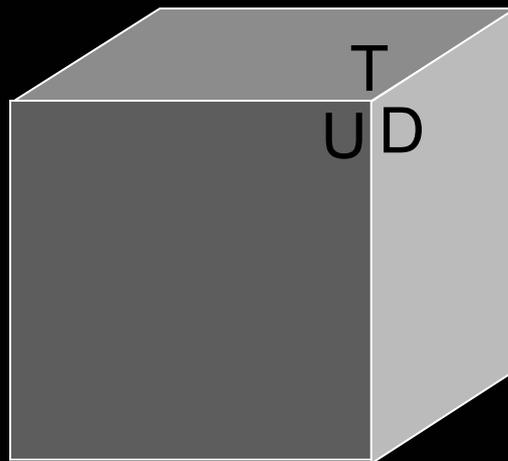
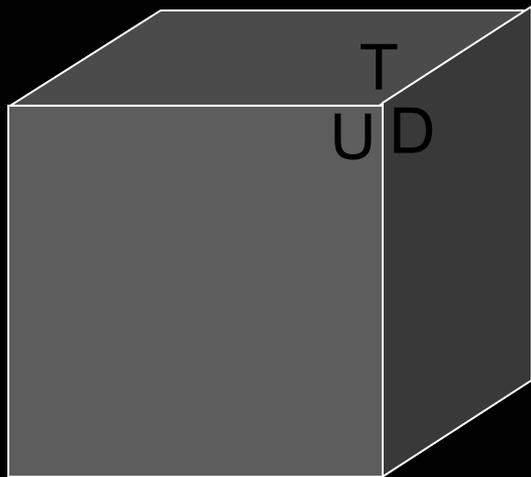




TCTF

JSTARS

AWACS



TCTF

JSTARS

AWACS

# Recommendations

LLL decisions are opportunities for automation

HHH decisions are opportunities for visualizations

For visualizations:

- With High Dimensionality:
  - ensure that information is displayed at the appropriate level of abstraction (drill down/up, component display)
- With High Temporality:
  - ensure that information is timely and that temporal progressions are appropriately displayed (LTOV, Gantt chart, animation)
- With High Uncertainty:
  - ensure that the accuracy of information is appropriately displayed (error bars, sensitivity studies)

# Questions?

<http://mentalmodels.mitre.org/>