



Representing the Human Decision Maker in Combat Identification

Presentation to CCRTS June 2006

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 - Validation and Verification
 - Links with constructive simulations

Introduction

- Much has been done in Combat ID (CID) before:
 - there have been numerous projects and studies BUT all single environment, and technology focussed;
 - there is little understanding of how to represent human behaviour.
- The INCIDER model
 - the **I**ntegrative **C**ombat **I**dentification **E**ntity **R**elationship Model
 - it integrates existing knowledge about performance of people and systems in combat situations where ID plays a key role.
- Aim of this presentation
 - To describe the INCIDER model and discuss exploitation and the way ahead.

Dstl

- Dstl is the centre of scientific excellence for the UK Ministry of Defence. Our mission is:
 - “to create the winning edge for UK Forces and Government through the best use of science and technology”
- We provide support to:
 - Procurement Decisions
 - Defence Policy Making
 - Operations
- We deliver defence research and technical services, and track global technological developments.

Combat ID research Question

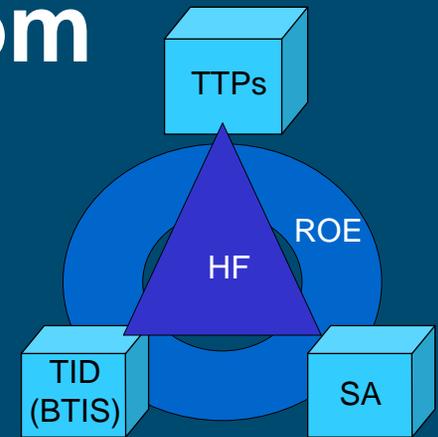
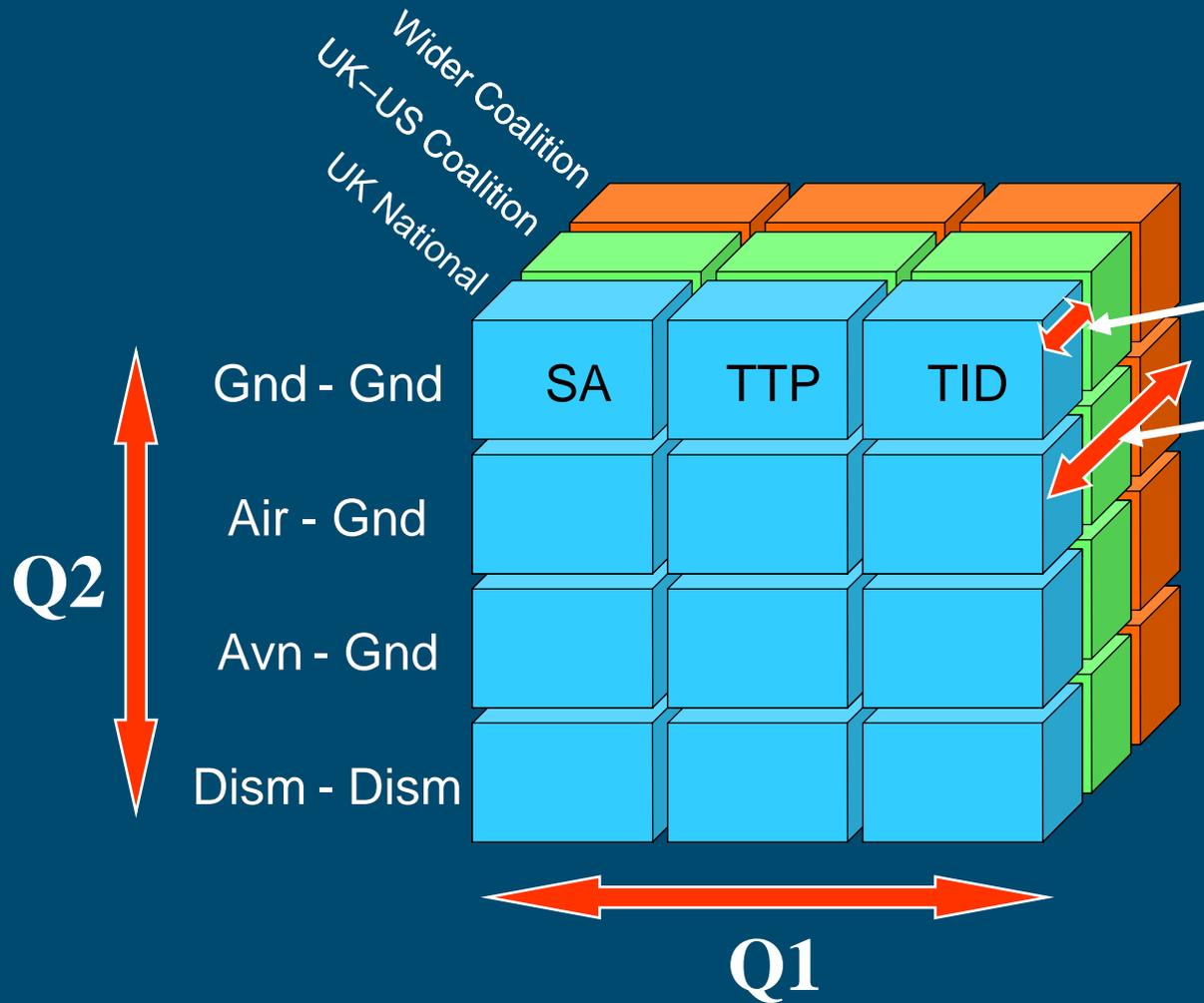
1. Situational Awareness (SA)
2. Target ID (TID)
3. Tactics, Techniques and Procedures (TTP)

What is the optimum balance of effort required between the **three strands** of Combat ID so as to increase **combat effectiveness** without **slowing operational tempo**?

Ability to control tempo in manoeuvre warfare

Reduced Fratricide and civilian harm
Decreased engagement times
Increased engagement ranges
Less uncertainty

What does the MOD need from Combat ID analysis?



Q3

Q4

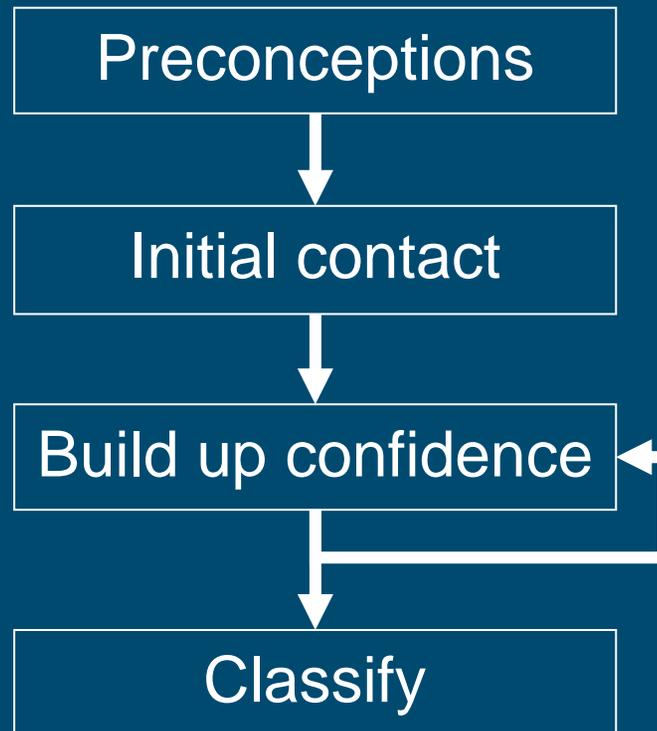
Q1: BoI for best return?

Q2: Priority of domains?

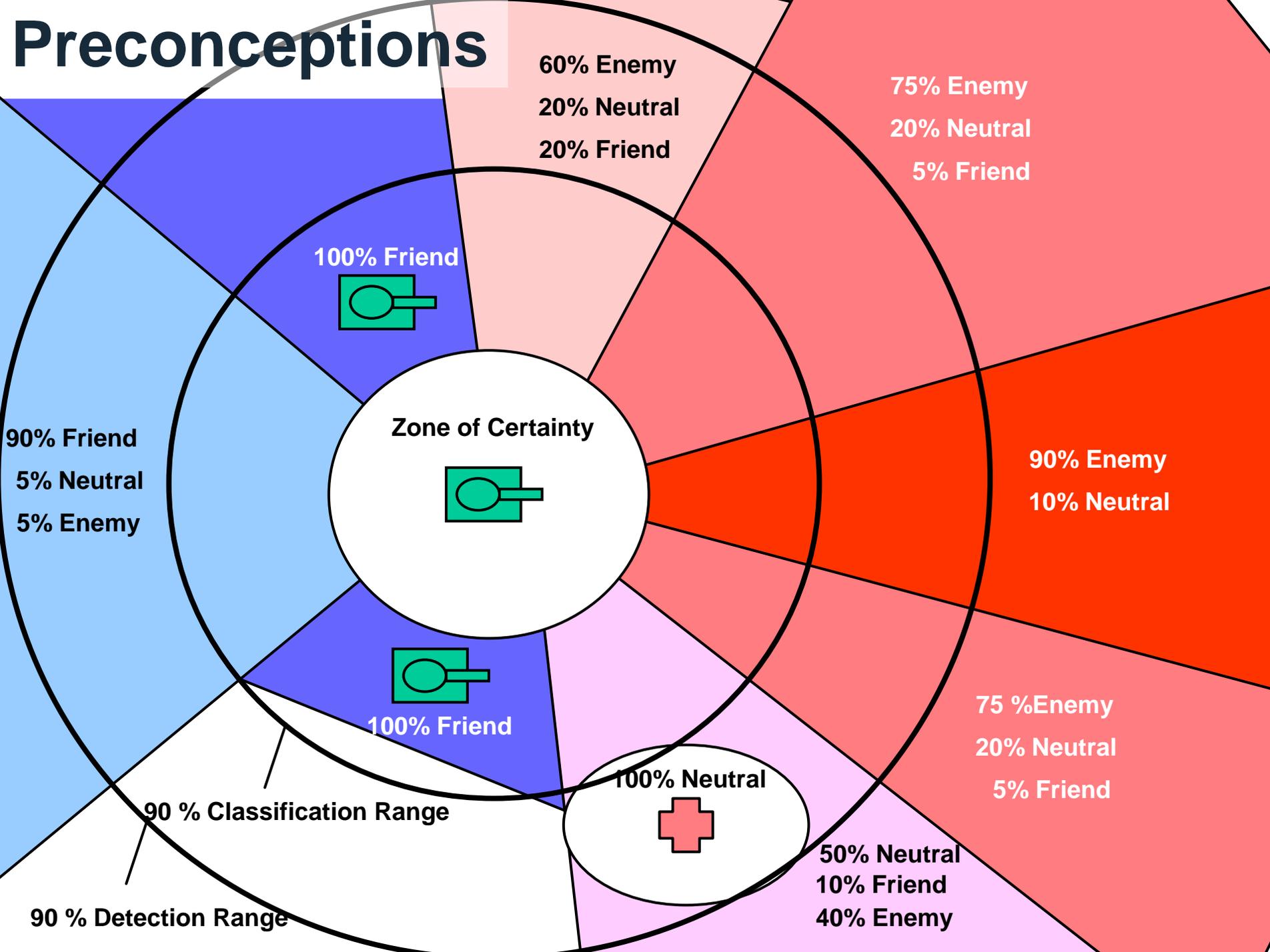
Q3: What do Q1 & Q2 do for UK Combat Effectiveness?

Q4: What's best for UK in coalition?

Example of a typical detection encounter



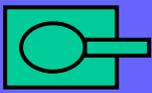
Preconceptions



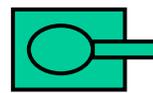
60% Enemy
20% Neutral
20% Friend

75% Enemy
20% Neutral
5% Friend

100% Friend



Zone of Certainty



90% Enemy
10% Neutral

100% Friend



100% Neutral



75% Enemy
20% Neutral
5% Friend

50% Neutral
10% Friend
40% Enemy

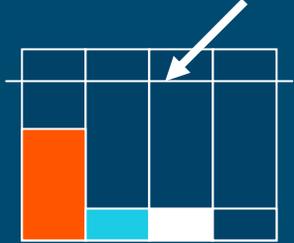
90% Classification Range

90% Detection Range

90% Friend
5% Neutral
5% Enemy

Initial Contact

Decision Threshold



I think it's an enemy!



Actions:

Decide now

Stop/pause

Move closer

Contact HQ

Send in scout

TID
Maximum
Detection
Range

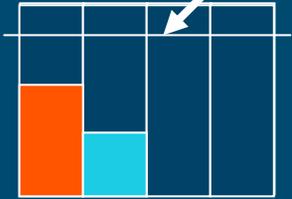
EO Sensor
Maximum
Classification
Range

EO Sensor
Maximum
Detection
Range

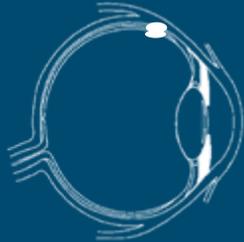


Build Up Confidence

Decision Threshold



I'm reasonably sure it's an enemy tank!



Estimated enemy engagement range

TID Maximum Detection Range

EO Sensor Maximum Classification Range

EO Sensor Maximum Detection Range



There are friendly units in the area

Actions:

Decide now

Stop/pause

Move closer

Contact HQ

Send in scout

Definitely a tank, it could be a Challenger

Build Up Confidence

Decision Threshold



I think it's probably a friend

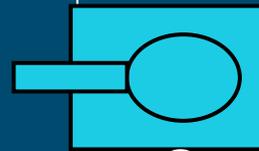


Estimated enemy engagement range

TID Maximum Detection Range

EO Sensor Maximum Classification Range

EO Sensor Maximum Detection Range



Actions:

Decide now

Stop/pause

Move closer

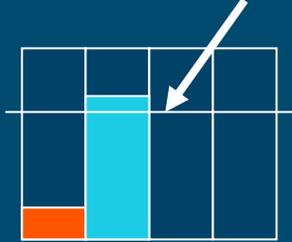
Contact HQ

Send in scout

BTIS Reports "Friendly"

Classify

Decision Threshold



I'm convinced it's a friend



Estimated enemy engagement range

TID Maximum Detection Range

EO Sensor Maximum Classification Range

EO Sensor Maximum Detection Range



Actions:

Decide now

Stop/pause

Move closer

Contact HQ

Send in scout

It's at engagement range, I have to make a decision



The INCIDER Model

What is INCIDER?

Integrates Human,
Physical and
Operational Domains

A repository of parameters that will
impact upon Combat ID, and the
relationships between them

- The **Integrative** Combat Identification **Entity Relationship** Model.
 - a *generic* representation of combat entities observing and identifying prior to engagement
 - can be *tailored* to represent all potential encounters where Combat ID is a contributory factor.

INCIDER Conceptual Model Overview

Physical Characteristics

- Organic Sensor Characteristics
- SA Information

Operational Characteristics

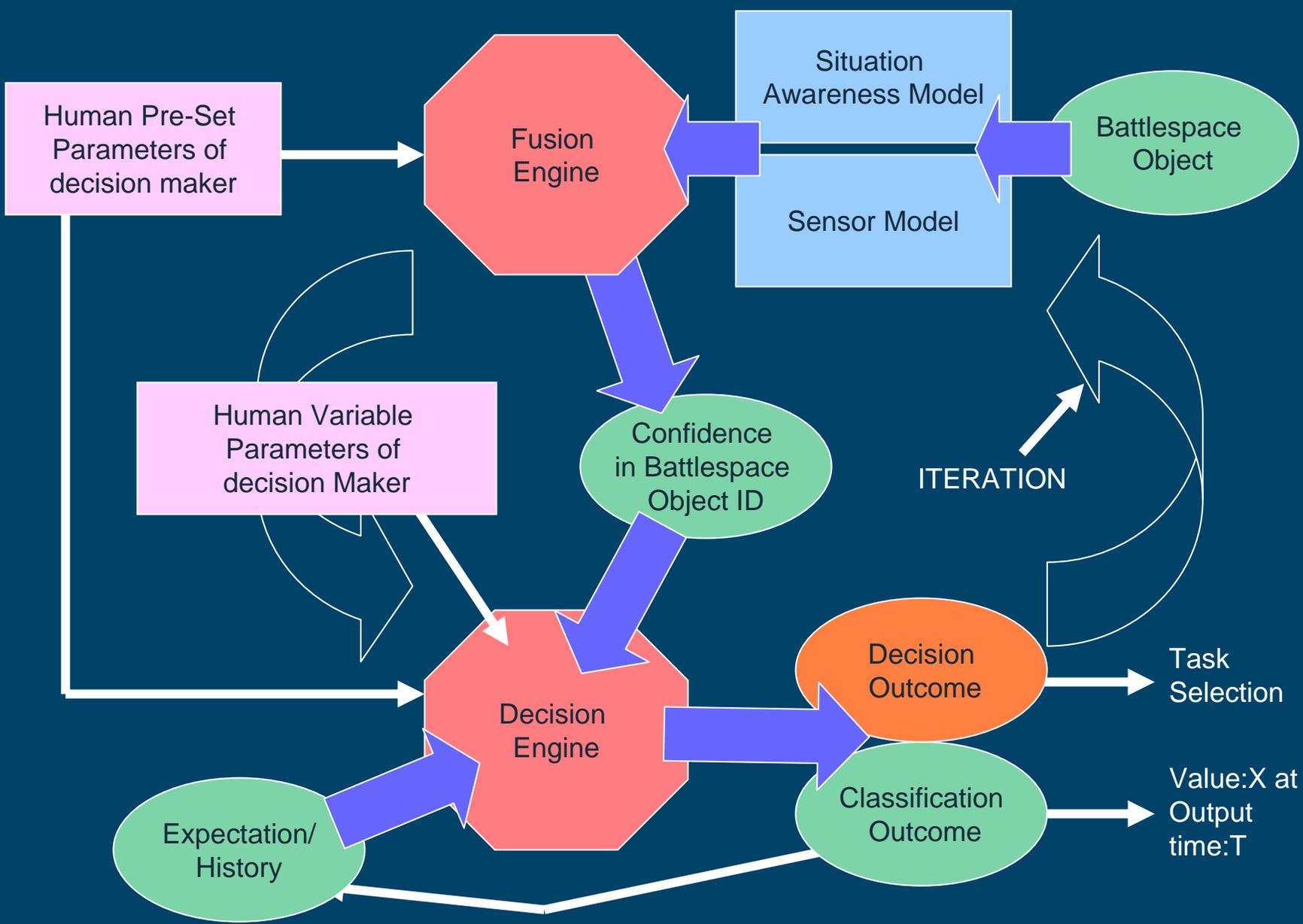
- C-ID Outcome Sensitivity
- Scenario Complexity
- Environmental Impact
- Object Characteristic Set

INCIDER
Output:
Probability of ID
&
Time to ID

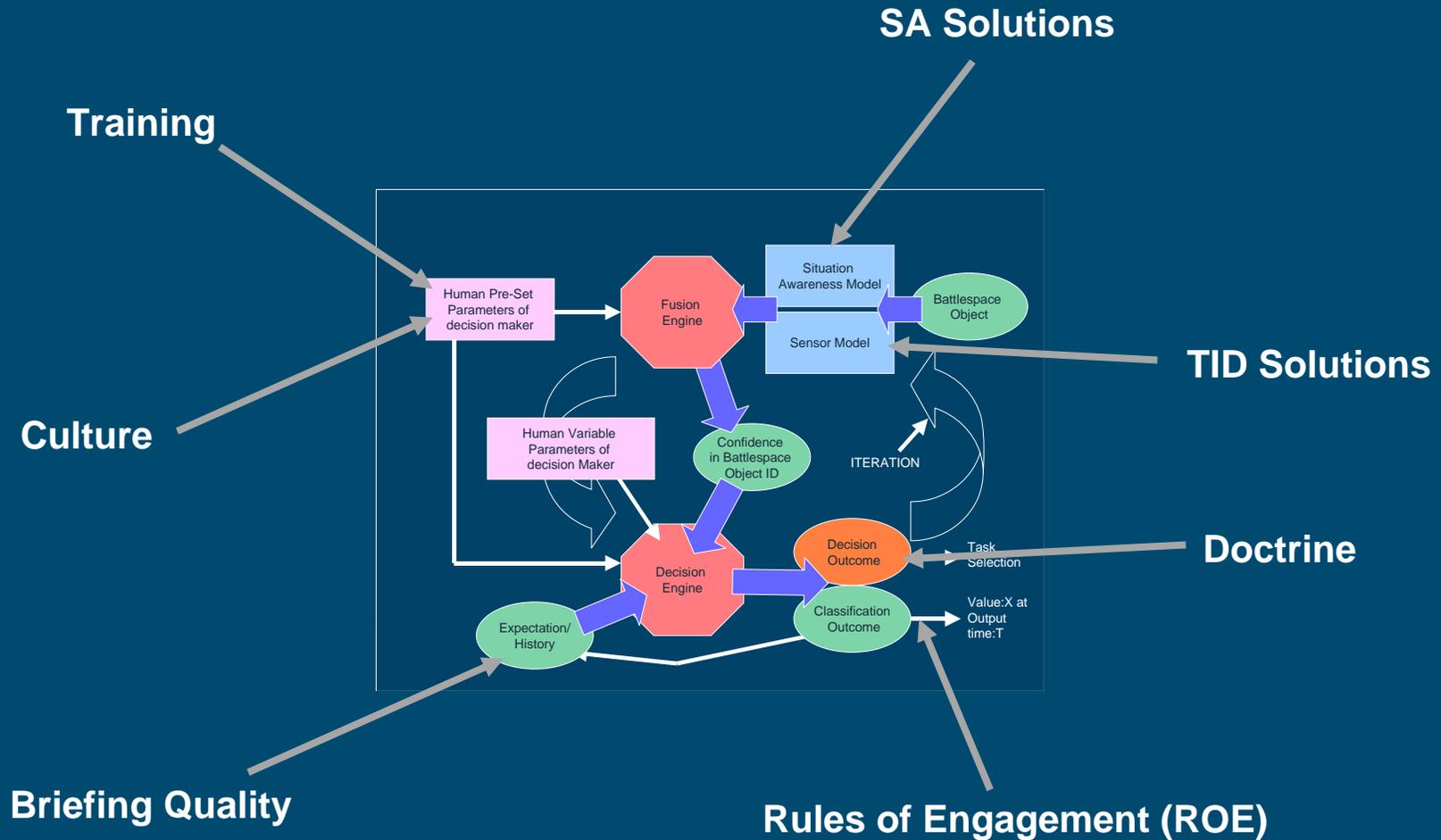
Human Characteristics

- Human Variable Characteristics
- Human Pre Set Characteristics
- Expectation
- Human Driving Characteristics

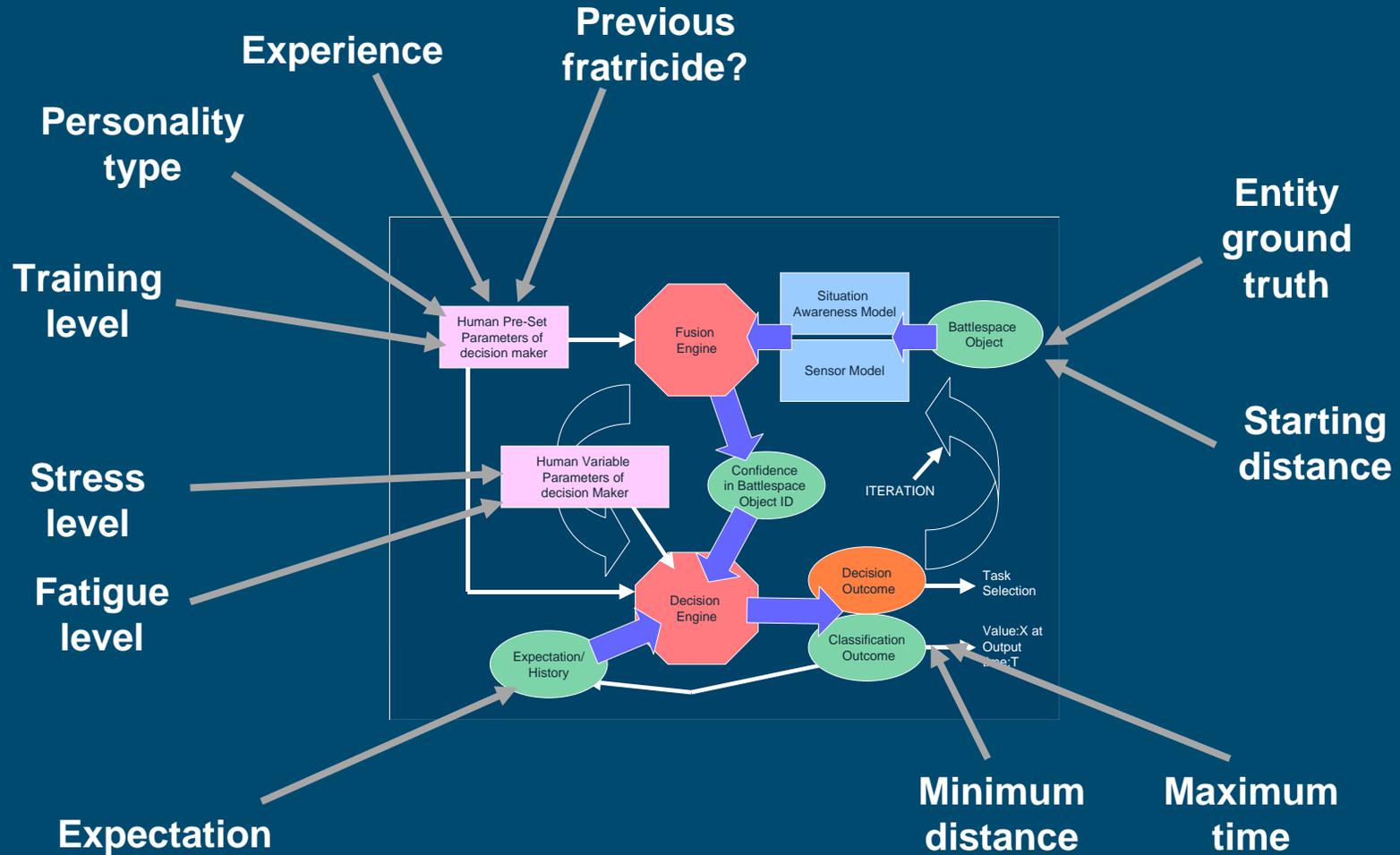
INCIDER Demonstration Model Overview



Linking CID Solutions to INCIDER



INCIDER Inputs



[dst1] INCIDER Results

INCIDER Initial Results

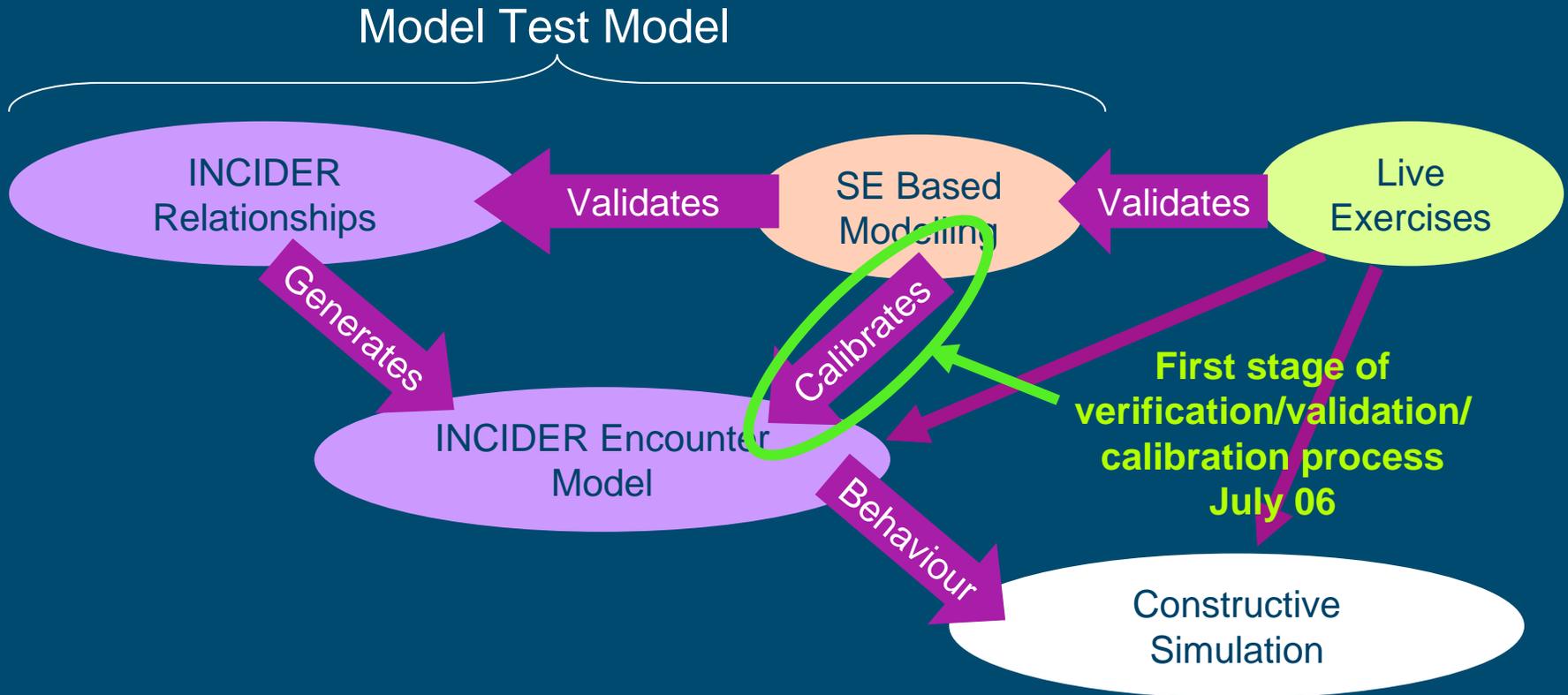
- A generic model has been created that can be specialised to represent armoured, airborne and dismounted troop encounters.
 - INCIDER represents the required aspects of human behaviour
 - INCIDER has replicated misidentifications representing
 - potential fratricide
 - potential civilian harm
 - INCIDER has provided data on factors contributing to Combat Effectiveness
 - Time to ID
 - Range at ID

INCIDER Current State

- INCIDER is only partially validated
 - The behaviour captured represents current understanding of the relevant Human Factors, but has not been fully calibrated or validated.
 - A validation programme is being implemented.
- INCIDER has been used to support UK balance of investment (BOI) investigations
 - Military Judgement was used to calibrate parameters.
- Extensions to INCIDER have been investigated
 - new environments (air defence and maritime)
 - higher levels of command.
- We are currently looking at how to implement them.

[dst1] The way ahead

INCIDER Calibration and Validation



INCIDER Fitness for purpose

SME based Calibration
of individual
parameters

Coarse BOI investigation

Relative impact of
parameters

SE based Calibration
of individual
parameters

Refined BOI investigation

Relative impact of
parameter behaviour

SE based Calibration
of INCIDER model

Accurate BOI investigation

Relative impact of
parameter behaviour

Validation of SE
against live exercise

Validation of INCIDER
against live exercise

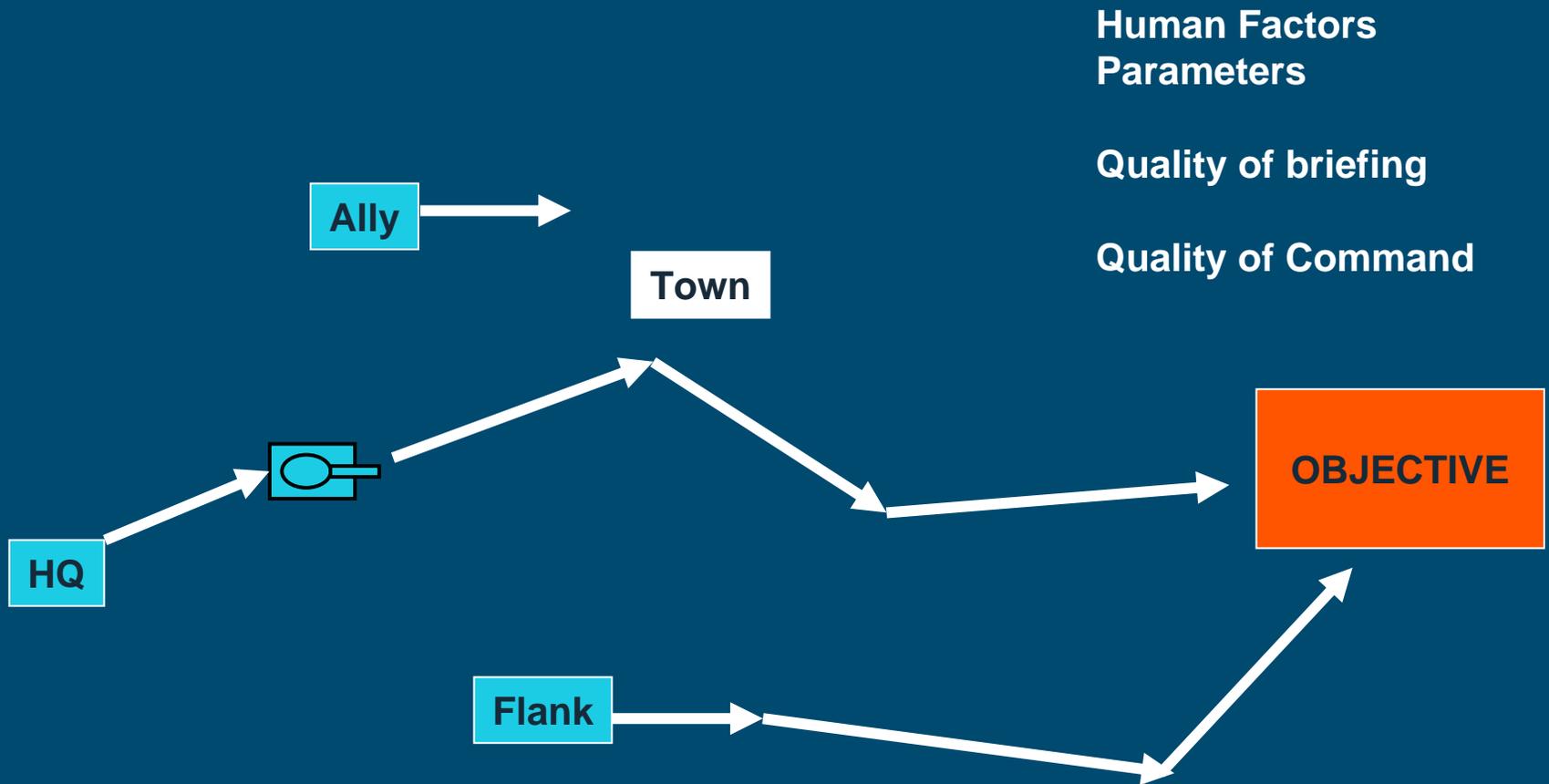
Accurate BOI investigation

Absolute impact of
parameter behaviour

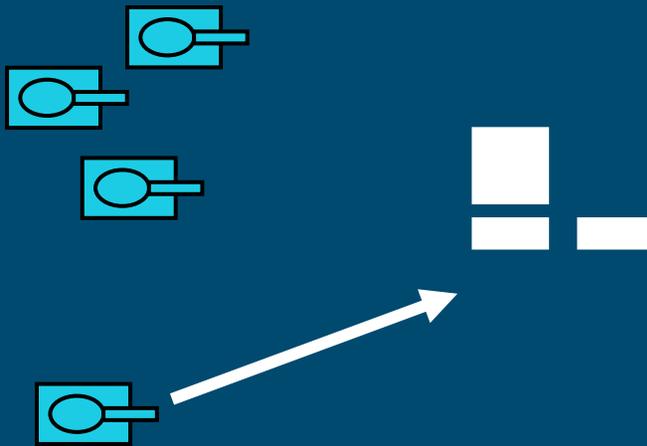
Constructive Simulation Exploitation

- Aggregated Simulations
 - Calculating attrition-based fratricide and civilian harm rates
- Entity Level Simulations
 - Calculating PID and PmisID for engagements
 - The result of this calculation will contribute to force behaviour
- Virtual Simulations
 - Initial use to validate INCIDER
 - Could use INCIDER as part of intelligent agent behaviour for automated forces

Implementing INCIDER within constructive simulations - Briefing



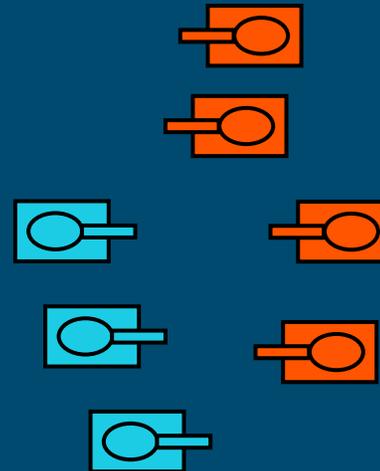
Implementing INCIDER within constructive simulations – Ground Truth



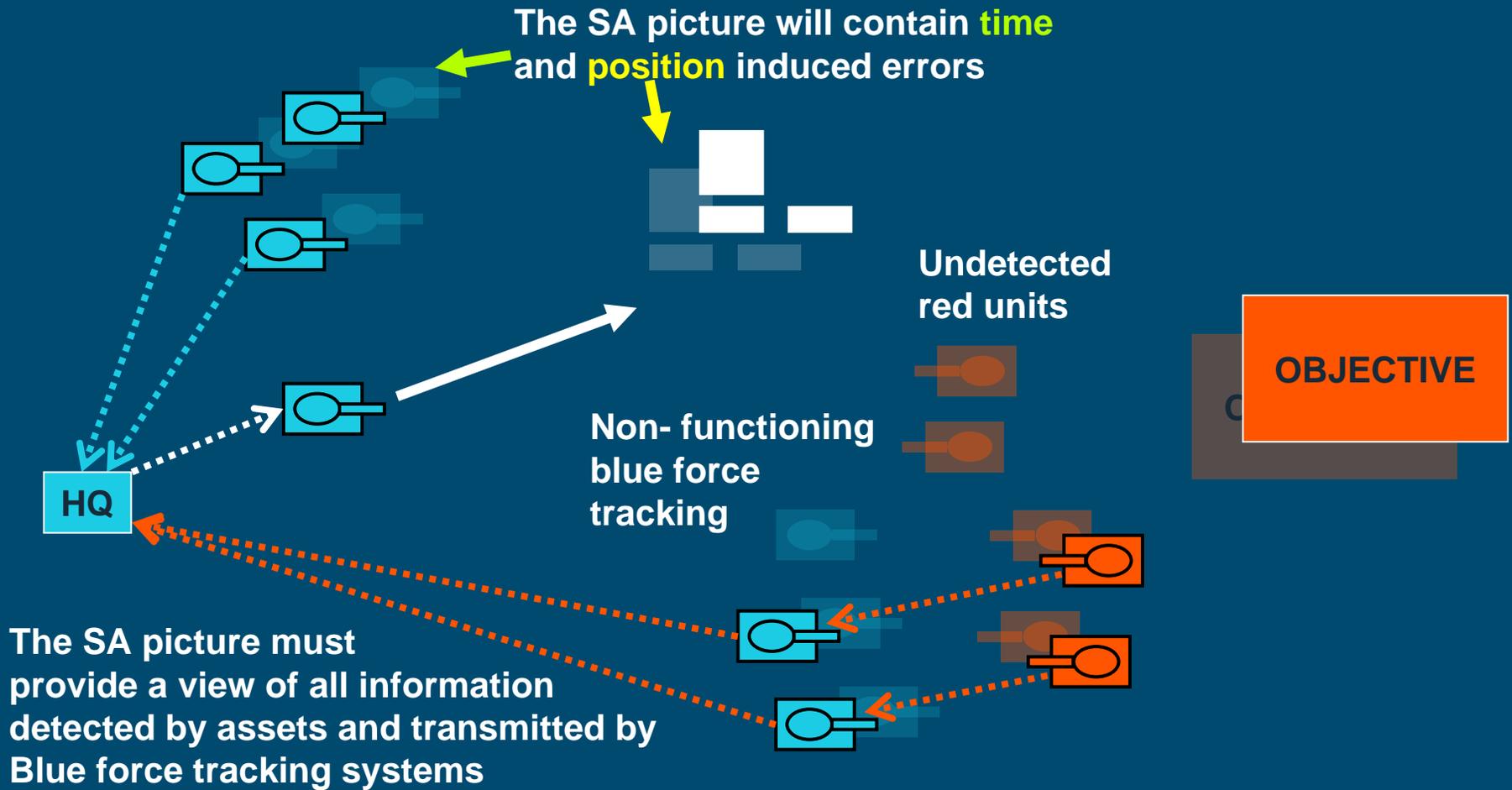
Aspects of unit behaviour will also need to be implemented



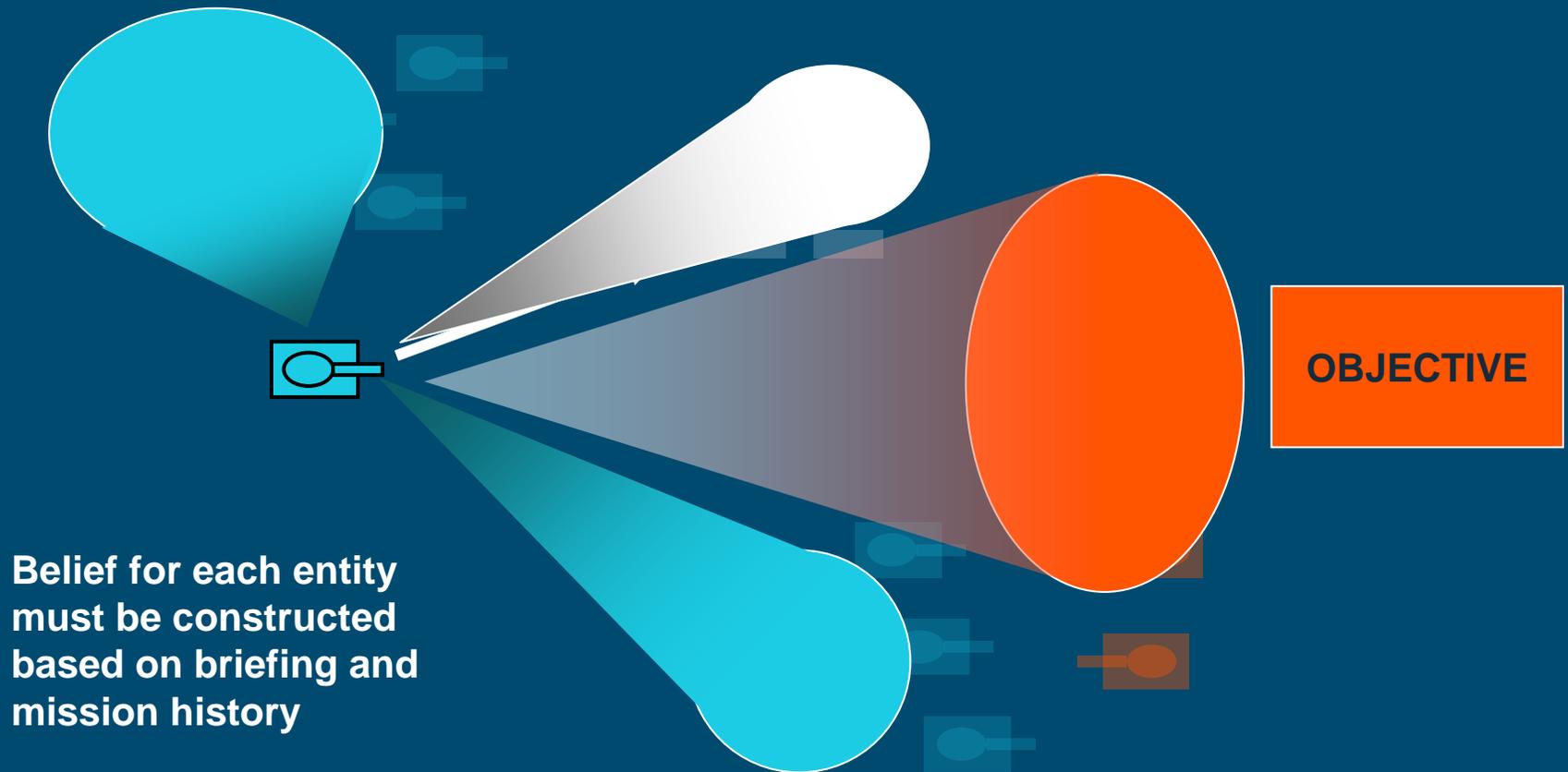
This will contain the unit and terrain representations currently used by constructive simulations



Implementing INCIDER within constructive simulations – SA Picture



Implementing INCIDER within constructive simulations - Preconception



Summary

- INCIDER is a unique way of linking together human, physical and operational factors in a single stochastic model.
- It can represent the aspects of human decision making associated with Combat ID in a variety of environments.
- The model is currently going through the first stages of validation and verification.
- The overall aim is to capture validated behaviour for exploitation by constructive simulations and SEs

Questions?



29 June 2006
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