



# Human Factors in the DIAMOND model

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# Agenda

- The DIAMOND Model
- Human Factors – Current capability
- Model Outputs
- The Way Forward
- Questions

# DIAMOND

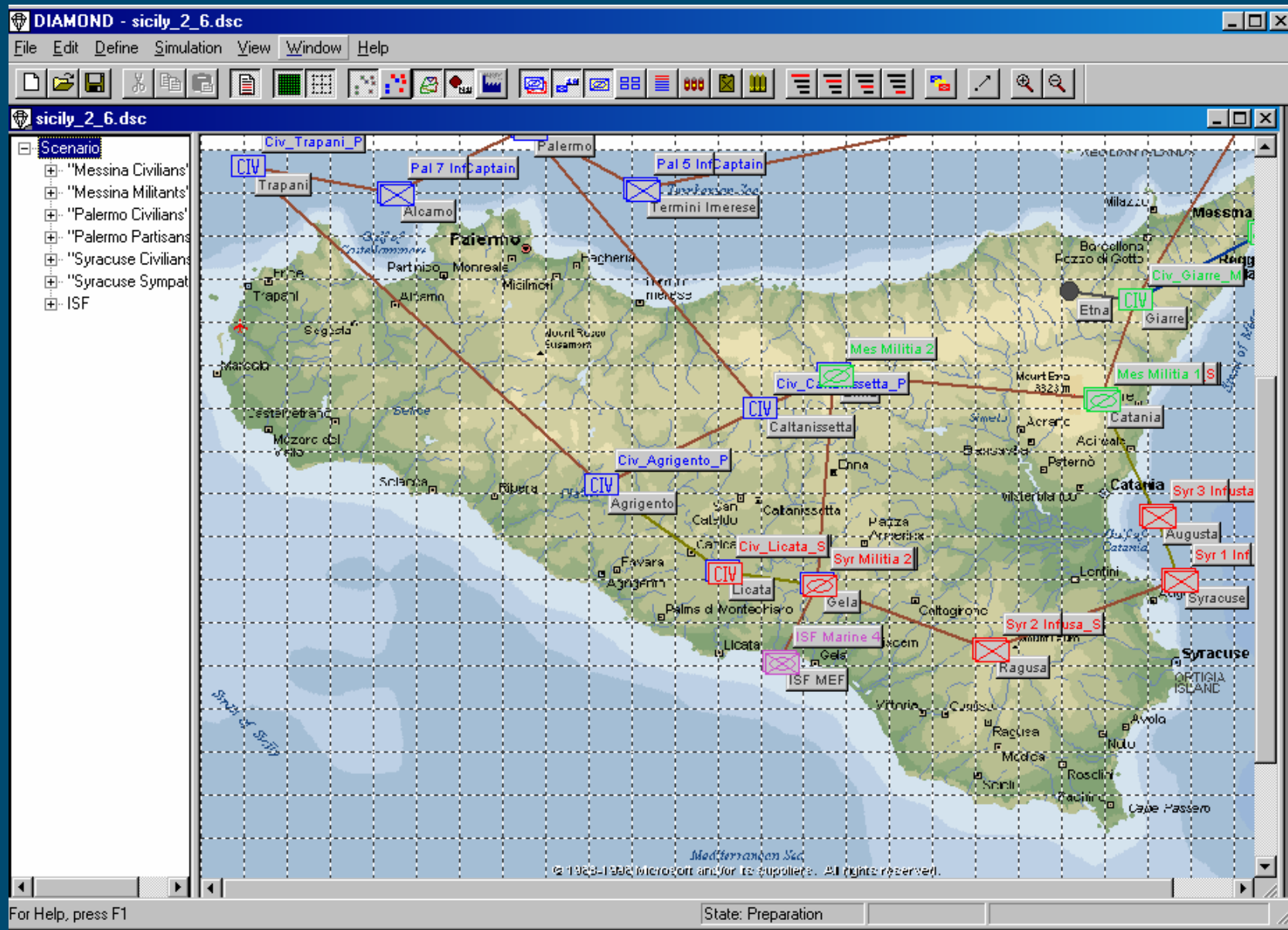
- DIAMOND (**D**iplomatic **A**nd **M**ilitary Operations in a **N**on-warfighting **D**omain) is a campaign/operational-level simulation model representing Peace Support Operations (PSO)
- Represents
  - Theatre of Operations
  - Command and Control (C2) driven
  - Multiple factions
  - Peacekeeping forces
- Key Features
  - True multi-sided modelling
    - Company/platoon level
  - Civilians
  - Insurgency
  - Non-military organisations
    - Repair of facilities
  - Negotiation between parties
  - Rules of Engagement
  - Dynamic changes in relationships between parties
  - Objective triggers

# DIAMOND – Purpose

- Campaign/Operational level model addressing issues associated with PSO
- Assess robustness of force structure against a variety of political/military environments encountered in PSO
  - Assess operational effectiveness of force mix
  - Assess impact of agreed variations in the military environment
  - Assess utilisation of force elements
- Primary use is in capability planning and force estimation
- Incorporates all relevant actors: military, civilian, aid agencies, etc...

# Scenario Build in DIAMOND

- Mapping
- Nodes (areas of interest e.g. towns)
- Arcs (movement channels e.g. roads)
- Parties to which entities (actors) belong
- Rules of Engagement
- Plans, missions and objectives (C2 cascade)
- A data driven model



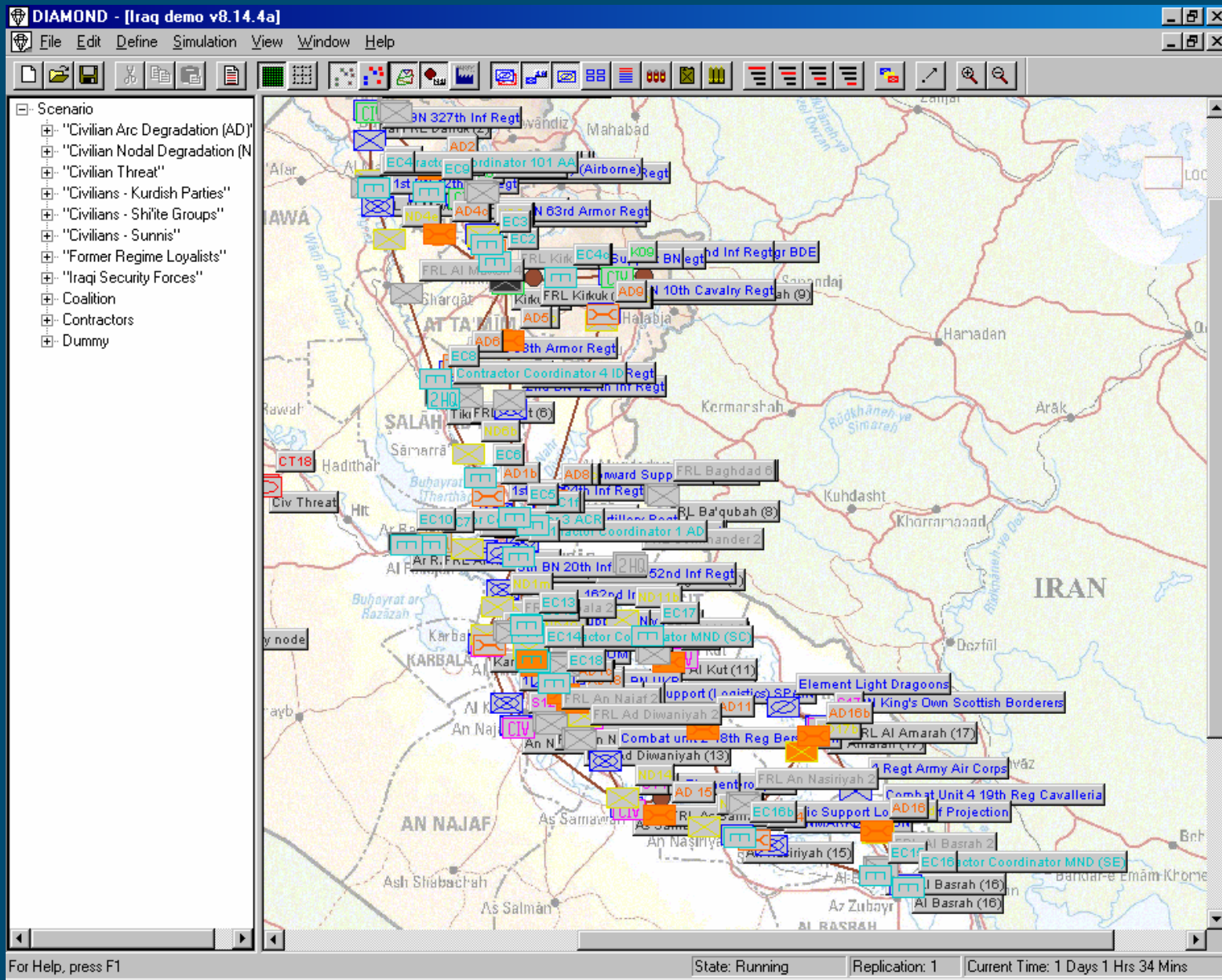
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# Parties

- Relationships between parties:
  - Friendly
  - Co-operative
  - Neutral
  - Unco-operative
  - Hostile
- No limit to how many parties can be set up
- Full functionality available to all parties
  - Military entities
  - Civilian entities



# Relationships

Party	ACTIVE PARTY									
	Coalition	SF	Cont	FL	Civ Threat	Civilians Type A	Type B	Type C	CND	CAD
Coalition		F	F	H	N	N	N	N	N	N
ISF	F		F	H	N	N	N	N	N	N
Contractors	F	F		H	N	N	N	N	N	N
FRL	H	H	U		N	N	N	N	N	N
Civ Threat		N	N	N		N	N	N	N	N
Civilians – Type A	C	C	C	N	H		N	N	N	N
Civilians – Type B	C	C	C	N	H	N		N	N	N
Civilians – Type C	C	C	C	N	H	N	N		N	N
CND	H	H	U	N	N	N	N	N		F
CAD	H	H	U	N	N	N	N	N	F	

SF - Security Forces  
 FL - Former Loyalists  
 CND - Civilian Nodal Destruction  
 CAD - Civilian Arc Destruction

Friendly  
Co-operative  
Neutral  
Uncooperative  
Hostile

# The Question

- How best to represent the human factors in PSO operations within the constraints of a simulation model
  - Decide what really matters
  - Looking at effects rather than actual behaviours
  - Must not materially increase the scenario build or run times
- Impact of differing courses of action
- Creation of outputs to enable analysis of results (MoEs)

# DIAMOND – What we have now

- Dynamic relationships
- Representation of civilians:
  - NGOs, Engineers, Local Populace, Local Police, Security Forces
- Intelligence sharing
- Access/negotiation
- Insurgency
- Infrastructure repair
- Logistics
  - Supply/resupply
  - Civilian/military

# Dynamic relationships

- Relationships score between 0 (maximum hostility) to 100 (maximum friendliness).
- Relationship changes are triggered using a set of pre-defined factors
- User defined decrement or increment to integer values when criteria fulfilled.
- The relationship between parties is a major driver for the Rules of Engagement (RoEs)

# Dynamic relationships

- Relationships score between 0 (maximum hostility) to 100 (maximum friendliness).
- User defined decrement or increment to integer values when criteria fulfilled.



# Relationship change triggers

- A number of factors can trigger a relationship change
  - Losses per 1000 deployed.
  - % Infrastructure strength.
  - Force strength present.
  - Presence of mines / roadblocks.
  - Success or failure of another plan or objective.
  - A specified time.
  - Depot monitoring.
  - Civilian casualties.
  - Mission type presence.
  - Another party's relationship.
  - Losses per 1000 deployed rate.
  - Civilian casualty rate.
- **These apply equally to all parties: Red, Blue, White (civilians) , Green (NGOs etc)**

# DIAMOND – HF representation

- Representation of civilians:
  - NGOs, Engineers, Local Populace, Local Police, Security Forces
  - Move for food or out of danger
- Intelligence sharing
  - Time delay
- Access/negotiation
  - Roadblocks
  - Requests for humanitarian assistance
  - Requests for escort
  - Requests for supplies (including demands and theft)

# DIAMOND – HF Representation

- Insurgency
  - Attacks on infrastructure
  - Stochastic probability of damage
- Infrastructure repair
  - Repair by engineers
  - Self-repair
- Logistics
  - Supply/resupply
  - Civilian/military



# Results - Entity status

**Entity**

Entity Name:  Initial Location:

Type:  Commander:

Party:  Initial Strength (BAMS Points):

Maximum Strength (BAMS Points):

Initial Logistics Per Component

Food:  Fuel:  Ammo:

Generic1:  Generic2:  Generic3:  Generic4:

Generic5:  Generic6:  Generic7:  Generic8:

Generic9:  Generic10:  Override Maximum:

Initial Mission Queue | Attached Media | Escort | Current Mission Queue | Current State

Current Location:

Current Position

X:   Y:

Current Speed:   Current Strength:

Current Logistics Per Component

Food: 0.00, Fuel: 77540.41, Ammo: 0.78, Generic1: 0.00, Generic2: 0.00, Generic3: 0.00, Generic4: 0.00, Generic5: 0.00, Generic6: 0.00, Generic7: 0.00, Generic8: 0.00, Generic9: 0.00, Generic10: 0.00

Current Mission:

Current Activity:

Mission Status:

**Entity**

Entity Name:  Initial Location:

Type:  Commander:

Party:  Initial Strength (BAMS Points):

Maximum Strength (BAMS Points):

Initial Logistics Per Component

Food:  Fuel:  Ammo:

Generic1:  Generic2:  Generic3:  Generic4:

Generic5:  Generic6:  Generic7:  Generic8:

Generic9:  Generic10:  Override Maximum:

Initial Mission Queue | Attached Media | Escort | Current Mission Queue | Current State

Current Location:

Current Position

X:   Y:

Current Speed:   Current Strength:

Current Logistics Per Component

Food: 0.00, Fuel: 1000000.00, Ammo: 0.00, Generic1: 0.00, Generic2: 0.00, Generic3: 0.00, Generic4: 0.00, Generic5: 0.00, Generic6: 0.00, Generic7: 0.00, Generic8: 0.00, Generic9: 0.00, Generic10: 0.00

Current Mission:

Current Activity:

Mission Status:

# Output files – Entity status

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	A	B	D	E	F	G	H	I	J	K	L
1	Time	Name	Party	Location	Strength	Activity	Mission	Total foc	Total fuel	Total an	o
360	0	ISF Baghdad 1	Iraqi Security Forces	Dummy node	100	Inactive	Untasked	0	1000000	10	
833	6	ISF Baghdad 1	Iraqi Security Forces	Dummy node	60.6	Inactive	Move To M	0	367387.4	3.7	
1306	12	ISF Baghdad 1	Iraqi Security Forces	Dummy node	49.3	Inactive	Move To M	0	243117.4	2.4	
1779	18	ISF Baghdad 1	Iraqi Security Forces	Dummy node	38	Inactive	Move To M	0	144410.5	1.4	
2252	24	ISF Baghdad 1	Iraqi Security Forces	Dummy node	26.7	Inactive	Move To M	0	71266.7	0.7	
2725	30	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.4	Inactive	Move To M	0	23686	0.2	
3198	36	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1	
3671	42	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1	
4144	48	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1	
4617	54	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1	
41038	516	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1	
41511	522	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1	
56647	714	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1	
57120	720	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
57593	726	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
58066	732	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
58539	738	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
59012	744	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
59485	750	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
59958	756	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
60431	762	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
60904	768	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
61377	774	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
61850	780	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
62323	786	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
62796	792	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
63269	798	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
63742	804	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
64215	810	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	
64688	816	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3	

Ready

# DIAMOND – The Way Forward

- Logical Influences workshop
  - Campaign Authority Criteria
  - Spiral of +ve and –ve effects
  - Concepts affecting Norms and Trust
- Human Factors workshop (first impressions)
  - Overlap with Logical Influences
  - Much currently down to the way a scenario is built
  - Understanding needed of impact of HF on C2 issues
  - Understanding needed of when not to start an activity, as well as when to stop

# DIAMOND – Issues

- Understanding the issues
- Identification of what is important
- Availability of suitable data
- Developing the right algorithms
- Model boundaries

# Summary

- **DIAMOND** is a simulation of PSO addressing
  - Dynamic and auditable assessment of PSOs for UK and coalition forces
  - Representation of infrastructure repair, and activities of the local populace.
  - Multiple sides/factions with dynamically changing relationships.
  - Human Factors are already represented, but the representation needs to be refined and extended.

# Questions?



# DIAMOND – Validation

- Real life comparisons
  - Bosnia
  - Iraq
  - Afghanistan
- Used in Dstl to advise MoD on PSO issues

# Human Factors

- Concepts affecting norms and trust
  - Context and culture.
  - Western vs. Indigenous viewpoints.
  - Religious factors.
  - Social differences (e.g. community construct).
  - Ethnic differences.
- Spiralling effects
  - Negative or positive
  - Need to better understand how the non-military levers in PSO work.



# Insurgency

- Insurgent activity dependent on the relationships between insurgents and other parties (including civilians) in the area.
- Presence of security forces can also prevent an insurgent attack.
- If the attack is prevented, it will either be abandoned, or move to another node.
- Insurgent attacks have a high probability of causing minor damage, and a low probability of causing major damage.
- User defined limit on size of force an insurgent will attack, but this may be much greater than that of the insurgent.

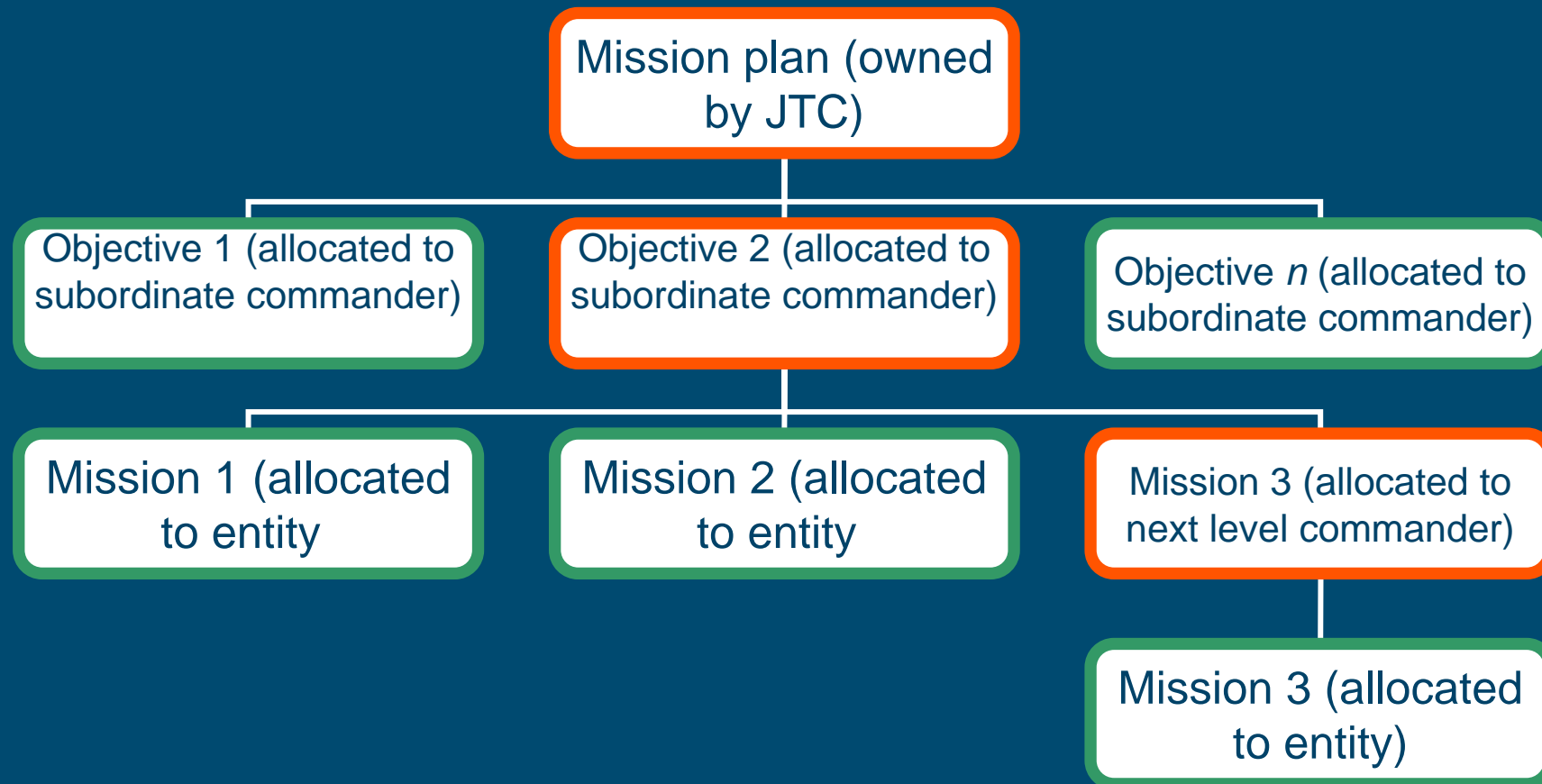
# Rules of Engagement

- Specific Rules of Engagement template for each mission
  - Default, defensive, aggressive, pre-emptive
  - User defined
- Impact of ROE defined by
  - Relationship to other party
  - Open fire first? Or response only
  - Who or what can be targeted e.g. civilian or military targets
  - Response on behalf of third party or facilities
  - Quantity of fire
  - Required level of identification

# C2 driven: Plans, Objectives and Missions

- Each Plan has a number of Objectives, each of which consists of one or more Missions
- Objectives specify the sizing requirements (i.e. force needed)
- Missions can be Primary, Required or Support
- Missions can be one of 12 specified types
  - Presence, Escort, Defend, Secure, Strike, Deny Movement
  - Intelligence, Movement, Transport, Evacuate, Engineering, Reserve
- The success or failure of a given mission can be used to trigger the start of a subsequent (Red or Blue) objective.
- Substitution of force types is allowed
- Each mission can have its own set of Rules of Engagement
- New objectives can be triggered by the factors affecting relationships

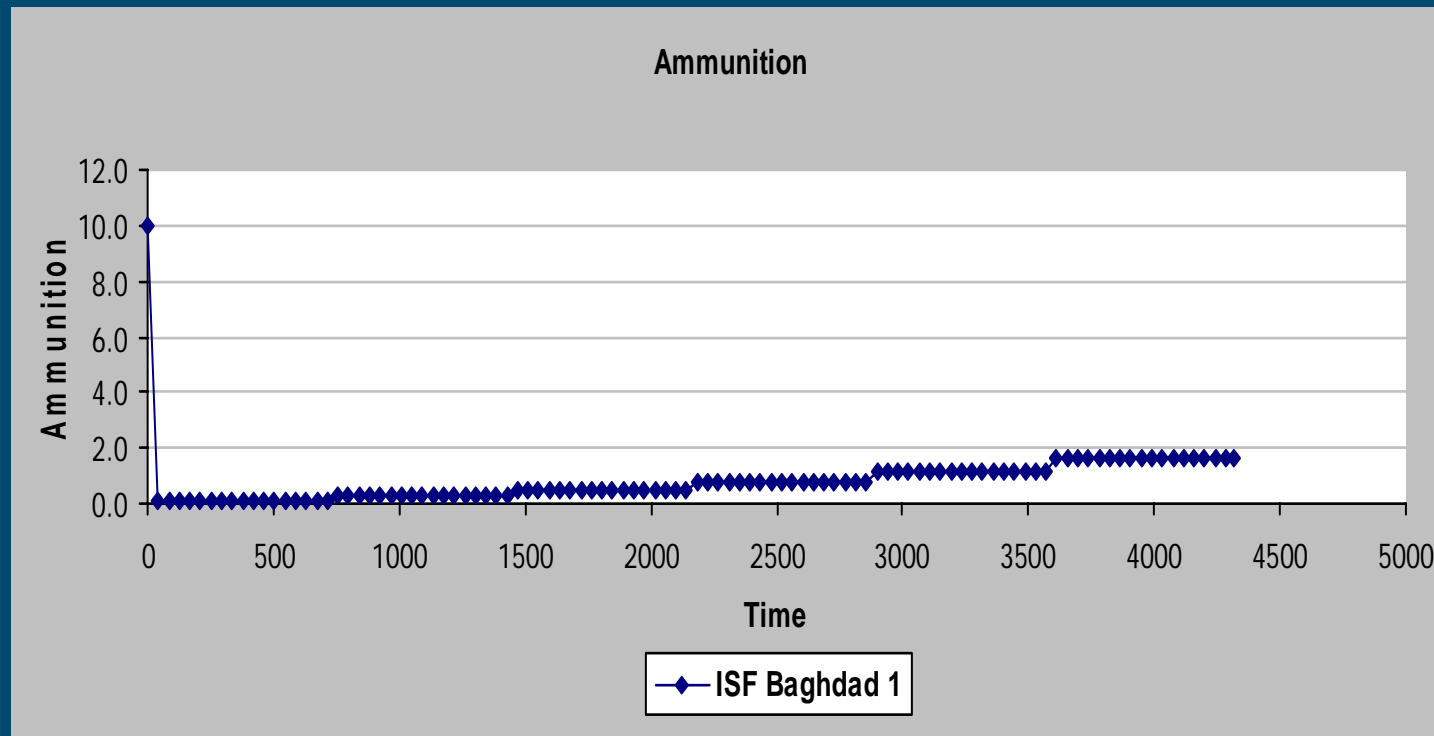
# Plans, Objective and Missions



# What is a model?

- A simplified representation of the real world.
  - Helps us to understand what is happening and why
  - Helps us to understand the impact of differing courses of action and of variations in context
  - Looking at interactions between the components
  - Can be closed (simulation) or 'man-in-the-loop'
- Use of modelling abstractions and assumptions
- Outputs created to allow analysis of results

# Output charts – Entity status



# Output charts – Entity summary

