Representation of Multi-Agency Activities within the DIAMOND Simulation Model

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Stella Croom-Johnson graduated from Southampton University in 1979 with an Honours degree in French, and from the Open University in 2006 with a First-Class Honours degree in IT and Computing. She joined Dstl in May 2003 prior to which she worked as a computer programmer and systems analyst outside the defence industry. Since joining Dstl she has worked in PCS as a project manager for a variety of projects. From November 2005 this has included managing the use of, and identifying required enhancements to, the DIAMOND Peace Support simulation model.

ABSTRACT

DIAMOND (Diplomatic And Military Operations in a Non-warfighting Domain) is an operational/campaign level simulation model which represents Peace Support Operations (PSO). The primary focus of DIAMOND is to assess the effectiveness of variations in force mixes, in scales of effort and in differing command and control structures. The model is mission-based, using a command and control structure to deconstruct high level plans into objectives and thence to missions which are allocated to individual entities. It is truly multi-sided, with no limit on the number of parties, full functionality being available to all parties. Parties may represent a wide range of agents: military forces in non-warfighting roles, Non Government Organisations (NGOs), recruited indigenous forces, civilians etc. Variations to possible courses of action, including rates of repair (or degradation) to the infrastructure can be incorporated to determine how these affect the outcome.

DIAMOND is under continuous development: recent enhancements include the introduction of a representation of insurgency, and of the impact of events such as reconstruction of the infrastructure on the relationships between the parties. The presentation will focus on the recent developments, proposed future enhancements and will provide example results to demonstrate typical uses of the model

INTRODUCTION

As the DIAMOND model has already been presented to this conference in past years this presentation will have a primary focus on recent and proposed enhancements and how these

enable representation of the various actors within a peace support scenario. The first few slides will give an overview of the main features of the model and will then examine how recent enhancements have improved the representation of the various actors in PSO, show some example results, and finish with a look at enhancements scheduled for implementation within the next few months.

BACKGROUND

The DIAMOND model focuses on the core tasks associated with Peace Keeping and Peace Enforcement operations, examining the impact of variations in the military environment, and the operational effectiveness of different force structures. Activities in a typical scenario would include one or more from the following: reconstruction, evacuation of civilians, humanitarian aid and disaster relief operations.

It assesses the robustness of force structures against the various political and military environments associated with PSO and examines the effectiveness of various force mixes, the impact of differing scales of effort and the utilisation levels of the various force elements. The model is extremely flexible, and at operational level can handle all the actors likely to be involved in PSO: it could in theory represent an infinite number of different parties, although for practical purposes categorising diverse agendas into fewer key perspectives, typically no more than 12, is recommended.

Whilst the DIAMOND model can be used at campaign level, the length of time needed to build a campaign level scenario, combined with the length of time required to complete a single run at that level mean it is better suited to use at the operational level. It is also worth noting that a successful proof of concept for model usage at a much lower level exists, but the model has not been validated at this level, and it is probable that other models are better suited to conduct analysis at that lower level.

This presentation will therefore look at how DIAMOND represents the various actors found within a peace keeping or peace enforcement scenario at operational level, focussing initially on the current position, including recent improvements to the model, then progressing to consider planned future enhancements.

OVERVIEW

DIAMOND is an agent-based, operational level simulation model representing peace-keeping forces within a theatre of operations. The focus of the model is primarily land-based, although a limited representation of air and sea can be implemented.

The physical structure of the domain is represented by a node-arc network with variations in possible terrain types: the various actors being represented as entities. Each entity belongs to exactly one party, and there is no limit on the number of entities which may belong to a party. Multiple parties are represented within the model, the only restriction on the number of parties being the extent to which these increase the complexity of the scenario. This allows a wide variety of actors to be represented: military, civilians, security forces, spoilers,

parties with multiple factions etc. This is achievable due to differences between entities being created by varying the state of their attributes e.g. party, strength, movement speed, firepower, logistics etc. Individual military entities are normally represented at company or platoon level, then organised into brigades and divisions: military entities respond to orders generated by a command and control structure on the basis of plans, objectives and missions cascading down from a high-level commander to the entities tasked with the individual missions. In general, insurgents have the same properties as military entities, although the units for these are typically smaller than platoon size, and vary according to the requirements of the individual scenario.

Civilians are also represented and this may include non-military organisations such as private security firms, or civilian engineers whose purpose is to repair the infrastructure, as well as NGOs who provide the service to the local populace. Each party has its own set of Rules of Engagement (RoEs), its own relationships with other parties – which may change within the course of a scenario – and its own set of plans, objectives and missions. A later Figure will outline the factors permitted to trigger the start of a given objective and its component missions. DIAMOND allows both overview and zoomed in views of a theatre of operations. In the overview the nodes, arcs, and various entities that appear in the course of a model run are shown. The number and variety of different parties listed in the left-hand panel should be noted.

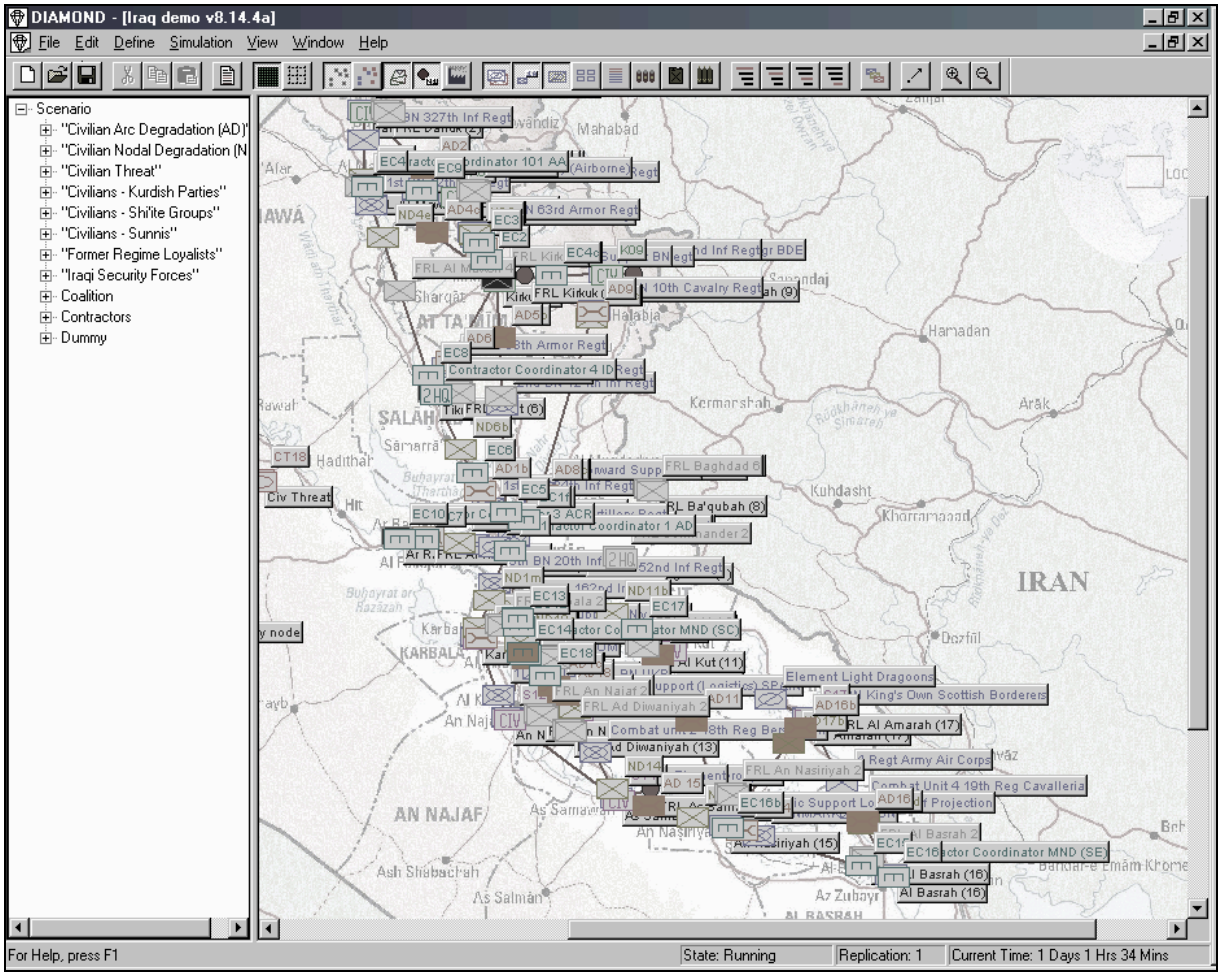

Figure 1: DIAMOND provides overview (including nodes, arcs, and other entities) and detailed views of a theatre of operations.

PARTIES AND RELATIONSHIPS

Relationships between parties in DIAMOND are represented by one of 5 relationship levels:

- Friendly.
- Co-operative.
- Neutral.
- Unfriendly.
- Hostile.

There is no limit to the number of parties that can be set up, but each party must have a relationship with every other party.

Full functionality is available to all sides, although there are differences between civilian and military entity types. Civilians have movement and sensor capabilities: additionally, military entities have logistics, mission and combat capabilities. Included in each of these definitions are NGOs who may be represented as either civilian or military entities. Rules of engagement use the relationships between entities as one way of determining whether an entity may fire on other entities or on facilities belonging to another party.

	ACTIVE PARTY									
	Military					Civilians				
Party	Type 1	2	3	4	5	Type A	Type B	Type C	CND	CAD
Military – Type 1		F	F	H	N	N	N	N	N	N
Military – Type 2	F		F	H	N	N	N	N	N	N
Military – Type 3	F	F		H	N	N	N	N	N	N
Military – Type 4	H	H	U		N	N	N	N	N	N
Civilian 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	

CND - Civilian Nodal Destruction
CAD - Civilian Arc Destruction

Friendly
Co-operative
Neutral
Uncooperative
Hostile

Figure 2: Overview of entity relationships for DIAMOND.

Therefore, DIAMOND can represent, for instance, a private security firm which employs only civilians but which is created as a military entity type to allow it to engage in combat.

The relationships are an important driver for the model and this will be looked at in more detail later, but Figure 2 gives an overview of how the relationships work as understanding the relationships is fundamental to understanding the model.

RULES OF ENGAGEMENT

Each party has its own set of RoEs, as a minimum one for each specific stance: defensive, aggressive and pre-emptive as well as a default stance. When a mission is set up one of these stored RoE combinations is selected, or a new RoE is created. The RoEs are user-defined and there is no limit to how many can be created – although it may be seen as unlikely it is possible for the user to give each mission a different RoE.

The impact of ROEs depends on a number of factors:

- Relationship to other party – this may alter during the course of a scenario.
- Whether an entity is permitted to initiate fire, or simply respond to another entity.
- Who or what can be targeted e.g. civilian or military targets.
- Whether response on behalf of a third party or facilities is permitted.
- Quantity of fire.
- Required level of identification.

PLANS, OBJECTIVES, AND MISSIONS

Each top-level commander of a military entity has one or more plans, each of which consists of a number of objectives, which in turn break down into one or more missions. There are 12 possible types of mission:

1. Presence.
2. Escort.
3. Defend.
4. Secure.
5. Strike.
6. Deny Movement.
7. Intelligence.
8. Movement.

9. Transport.

10. Evacuate.

11. Engineering.

12. Reserve.

The success or failure of any given mission can be used to trigger a new objective and its associated missions for any side (see next slide). Substitution of force types is permitted and each mission can have its own set of Rules of Engagement.

OBJECTIVE TRIGGERS

A number of factors (including the success or failure of a mission) can trigger the start of a new objective, not necessarily one belonging to the same party as the original mission. The factors are pre-defined but have a user-defined threshold associated with them to indicate the point at which the new objective is triggered, which objective is to be triggered, and the party to which the triggered objective belongs. It is important to note that an objective need not consist of more than a single mission.

The factors which can be taken into account when triggering missions are listed below: an example of such objective triggers in action could be where supplies in a logistics depot fall below a user-defined level and trigger a logistics re-supply objective to be carried out by NGOs. Similarly the failure of a Blue secure mission might trigger both the start of a Red Strike objective and the start of a Blue Evacuation objective.

- Losses per 1000 deployed.
- % Infrastructure strength: this may be all facilities or one of hospitals, shelter, water, targets, food, airports, seaports, movement channels.
- 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.

RECENT MODEL ENHANCEMENTS

IMPROVED REPRESENTATION OF INTELLIGENCE

- This new functionality allows the sharing of intelligence between Friendly and Co-operative parties.

- The probable reduction in the utility of intelligence passed between parties that are Co-operative compared with those who are Friendly is represented by a user-definable time delay based on the principle that older information is likely to have a lower utility than newer information.

There is currently no representation of information shared by parties who are neutral (or worse) towards each other. Also, there is no representation of incorrect information, whether as a result of a mistake, or a deliberate attempt to mislead.

REPRESENTATION OF INSURGENCY

- As a result of analysing operational data, the probability of insurgent action causing damage has been characterised by a negative exponential curve. This gives a high probability that insurgent activity will create small amounts of damage with a reducing probability of increasing amounts of damage.

- Whether or not a planned insurgent attack will take place depends on a number of factors including the level of Blue presence and the relationship of the local civilian population to the insurgents.

- Should these factors prevent an insurgent attack at one node, the insurgents can carry out an attack at a nearby node instead.

- Unlike conventional forces, an insurgent entity may attack a force much larger than itself.

IMPROVED REPRESENTATION OF LOGISTICS

- Depots are supplied according to need, the distance from central supply and rate of consumption of logistic items being the drivers for this.

- There have always been three specific logistic items – food, fuel and ammunition, but a recent enhancement to the model introduced 10 further generic user-definable items. These can be used to denote any transportable item: water, medical supplies, etc.

DYNAMICALLY CHANGING RELATIONSHIPS

- This is examined more closely below.

DYNAMIC RELATIONSHIPS

At the start of a scenario, each inter-party relationship is denoted by integer values between 0 and 100, 0 representing maximum hostility, and 100 denoting maximum friendliness. This is a sliding scale and events during the scenario increase or decrease the relationship indicator by a user-defined amount, based on the same factors as are used to trigger objectives.

An example of this might be where a Red Civilian Party A was initially co-operative with Civilian Engineer Party B with a 'score' of 70. Successful repair of the infrastructure by Party B could increase this score by 10 to 80, which might not affect the relationship. However, a further repair of the infrastructure could take the score to 90 which could then make Party A friendly towards Party B. It is also possible to decrement the score by a different value for failure to repair the infrastructure, so if failure in this area were to decrement the initial score of 70 by 15 the relationship could deteriorate from Co-operative to Neutral.

NON-STATE ACTORS

Generic entities within the model represent military and other units, and these can be tailored to represent any organisation. Non-state actors are therefore set up in exactly the same way as local military and civilian entities, and interactions between military, civilians and NGOs have the same means of representation for all entities. This enables DIAMOND to model the interaction between military and NGO activities as fully as for activities carried out by any other entities. Depending on the behaviours required from these actors they could be set up either as part of an existing party, or as a party on their own, whichever would be most appropriate. The required behaviours and missions would then be allocated to the entities.

ENGINEERS

Engineers may be military or civilian entities, and must belong to a party. During humanitarian operations NGOs and contractors enter the scenario and engineers belonging to these parties will repair facilities/nodes that are run down or have been damaged by terrorist attacks or collateral damage from a nearby combat. In order for NGOs to repair facilities they require a certain quantity of raw materials to complete the task e.g. cabling for electricity distribution or fresh bricks for building repairs. Currently engineers in DIAMOND will carry out the repairs at the rate defined by their engineering packages and one drawback at the current time is that the rate of work needs to be defined in relation to an assumption regarding the availability of such raw materials.

NEGOTIATION

There are, in PSO, many types of negotiation that occur throughout the life of any operation. Mediation to resolve local disputes, negotiation to obtain a cease-fire and negotiation to obtain access are just a few. The types of negotiation the model is currently able to handle are:

- Negotiation for access:
  - Roadblocks and other routeblocks are a major hindrance to peacekeeping operations, preventing or delaying free movement of peacekeepers, aid agencies and civilian traffic alike. They occur for a variety of needs, some through a genuine military reason to secure an area, some as a revenue source (tax and theft) and some simply because the protagonists are bored and see it as a means to exert their authority and pass time.
- Negotiation for support:
  - Requests for humanitarian assistance.
  - Requests for escort.
  - Requests for supplies (including demands and theft).

Each type of negotiation plays an important role in restoring normality or ensuring that potentially escalatory situations are resolved with the minimum amount of force by either side. Whilst DIAMOND represents some elements of these interactions and their outcomes, negotiation is confined to the missions represented within the model. For example, a party could request a transport mission or intelligence from another party but it could not negotiate a local cease fire although such a cease fire could result from one or more parties withdrawing from an area.

MODELLING CHALLENGES

One of the main challenges is that understanding of PSO is still evolving, and the domain has changed significantly since the concept of DIAMOND began in August 1998. Although this presentation does not examine the algorithms embedded within the DIAMOND model it may be noted that in producing such algorithms it is necessary to develop ones that are suitable, whilst at the same time being sufficiently generic to allow the model to represent as broad a range of PSO environments as possible. The production of meaningful results is heavily dependant on the quality of the data used, and suitable data is often difficult to obtain, even when it is available.

An earlier Figure stated that one of the strengths of the model is its flexibility, but this creates its own challenges. The expertise of the analyst building a given scenario is crucial, and it is not unusual for a scenario build to take up to twelve weeks. This is especially so when many parties are being represented, as with full functionality available to all parties,

they all need to be fully specified, and their interaction with other parties must be taken into consideration at all stages.

MEASURES OF EFFECTIVENESS

The infrastructure repairs and Measures of Effectiveness (MoEs) regarding civilians are the main difference between DIAMOND and the corresponding combat models within Dstl.

Among the general criteria used as MoEs are:

- Length of scenario (number of days to victory).
- Force required for victory.
- Killed/Wounded/Captured (military AND civilian).
- Damage to infrastructure.
- Rate of infrastructure repair.
- Node/arc capabilities.
- Civilian casualties.
- Civilian refugees.
- Mission details.
- Levels of insurgency.

The impact on the above of variations in Schemes of Manoeuvres, force structure etc., are shown as multiple sets of results which can then be compared and analysed. The model produces outputs relating to these MoEs, and a recent addition is a post processor which aids speedy analysis of the results.

RESULTS

Results from the DIAMOND model are obtained from the output files which are in the form of .csv files which can easily be loaded into a spreadsheet, in some cases supplemented by a chart based on the spreadsheet.

FACILITY CAPACITIES

The model holds the start and current state of the attributes for each node, arc and entity. Figure 3 shows the state of a node, and for each of the facilities gives the maximum capacity,

the initial capacity and the current capacity. It should be noted that in this example, the initial capacity of the hospitals, shelter and water is lower than the maximum, which would indicate that these facilities were damaged at the start of the scenario. The current state shows that this drops again during the course of the scenario, but this does not indicate whether any repairs to the facilities have been carried out.

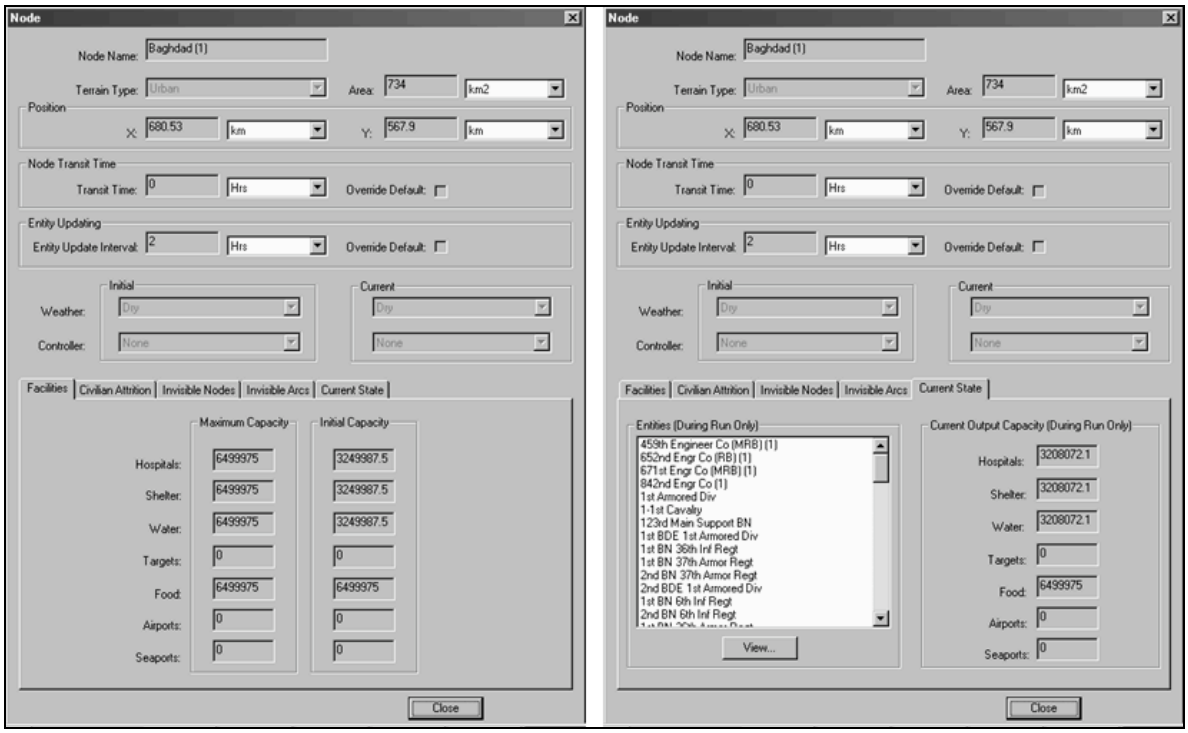

Figure 3: Facilities Status input data.

Examination of the spreadsheet created by the output reports reveals that the hospitals at the node suffered further damage at the start of the scenario, were repaired, then right at the bottom further damage is evident (Figure 4). In fact, this cycle of damage and repair continues throughout the scenario, until in the later stages the spreadsheet shows repairs outstripping the damage

ENTITY STATUS

The records showing the status of an entity give the initial 'strength' of an entity, and the initial logistics for that entity (Figure 5). During the course of a scenario the Current Status shows both the current strength of the entity and the current state of their logistics. Also displayed are details of the current mission, and whether or not it is succeeding. As with the facilities, the spreadsheet based output file gives the history of attrition and logistics usage (Figure 6). For certain pre-defined data, a post-processor within DIAMOND will also produce detailed charts, the example for Entity status shows the ammunition usage for a single entity (Figure 7). Additionally, that for the entity summary shows the strength of an individual entity, and clearly indicates the point at which attrition was suffered by that entity (Figure 8). .

Microsoft Excel - 8_14a_R1_facilities

B257 Baghdad (1)

	Time	Node	Facility	Initial Ca	Old Inte	New Inte	Internal	Old Out	New Ou	Output (	Reason
8	0.1	Baghdad (	Hospitals	3249988	3249988	3245568	-4420	3249988	3245568	-4420	Damage
11	0.1	Baghdad (	Hospitals	3249988	3245568	3241148	-4420	3245568	3241148	-4420	Damage
14	0.1	Baghdad (	Hospitals	3249988	3241148	3236728	-4420	3241148	3236728	-4420	Damage
164	3.2	Baghdad (	Hospitals	3249988	3236728	3232462	-4265.1	3236728	3232462	-4265.1	Damage
170	3.2	Baghdad (	Hospitals	3249988	3232462	3231462	-1000.6	3232462	3231462	-1000.6	Damage
203	5.6	Baghdad (	Hospitals	3249988	3231462	3227042	-4420	3231462	3227042	-4420	Damage
206	5.6	Baghdad (	Hospitals	3249988	3227042	3222622	-4420	3227042	3222622	-4420	Damage
224	7.2	Baghdad (	Hospitals	3249988	3222622	3218202	-4420	3222622	3218202	-4420	Damage
254	12	Baghdad (	Hospitals	3249988	3218202	3218296	93.8	3218202	3218296	93.8	Repair
257	12	Baghdad (	Hospitals	3249988	3218296	3218389	93.8	3218296	3218389	93.8	Repair
260	12	Baghdad (	Hospitals	3249988	3218389	3218483	93.8	3218389	3218483	93.8	Repair
263	12	Baghdad (	Hospitals	3249988	3218483	3218577	93.8	3218483	3218577	93.8	Repair
266	12	Baghdad (	Hospitals	3249988	3218577	3218671	93.8	3218577	3218671	93.8	Repair
269	12	Baghdad (	Hospitals	3249988	3218671	3218764	93.8	3218671	3218764	93.8	Repair
272	12	Baghdad (	Hospitals	3249988	3218764	3218858	93.8	3218764	3218858	93.8	Repair
275	12	Baghdad (	Hospitals	3249988	3218858	3218952	93.8	3218858	3218952	93.8	Repair
278	12	Baghdad (	Hospitals	3249988	3218952	3219046	93.8	3218952	3219046	93.8	Repair
281	12	Baghdad (	Hospitals	3249988	3219046	3219139	93.8	3219046	3219139	93.8	Repair
362	24	Baghdad (	Hospitals	3249988	3219139	3219327	187.5	3219139	3219327	187.5	Repair
365	24	Baghdad (	Hospitals	3249988	3219327	3219442	115.4	3219327	3219442	115.4	Repair
368	24	Baghdad (	Hospitals	3249988	3219442	3219558	115.4	3219442	3219558	115.4	Repair
371	24	Baghdad (	Hospitals	3249988	3219558	3219694	136.4	3219558	3219694	136.4	Repair
374	24	Baghdad (	Hospitals	3249988	3219694	3219844	150	3219694	3219844	150	Repair
377	24	Baghdad (	Hospitals	3249988	3219844	3219994	150	3219844	3219994	150	Repair
380	24	Baghdad (	Hospitals	3249988	3219994	3220144	150	3219994	3220144	150	Repair
383	24	Baghdad (	Hospitals	3249988	3220144	3220311	166.7	3220144	3220311	166.7	Repair
386	24	Baghdad (	Hospitals	3249988	3220311	3220404	93.8	3220311	3220404	93.8	Repair
389	24	Baghdad (	Hospitals	3249988	3220404	3220498	93.8	3220404	3220498	93.8	Repair
485	33.5	Baghdad (	Hospitals	3249988	3220498	3219478	-1020	3220498	3219478	-1020	Damage
491	36	Baghdad (	Hospitals	3249988	3219478	3219666	187.5	3219478	3219666	187.5	Repair

8_14a_R1_facilities

4378 of 37452 records found

Figure 4: Facilities Status output.

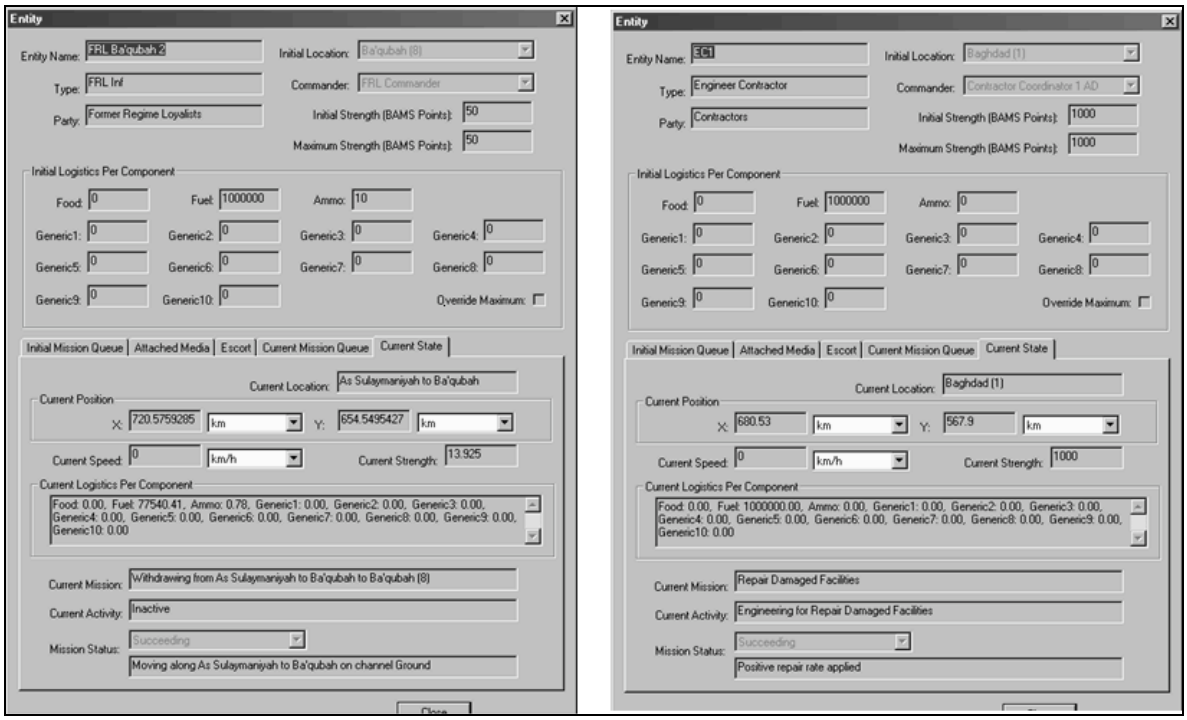

Figure 5: Entity Status Input data.

Microsoft Excel - 8_14a_R1_ent_status

Time	Name	Party	Location	Strength	Activity	Mission	Total fo	Total fue	Total am
0	ISF Baghdad 1	Iraqi Security Forces	Dummy node	100	Inactive	Untasked	0	1000000	10
6	ISF Baghdad 1	Iraqi Security Forces	Dummy node	60.6	Inactive	Move To M	0	367387.4	3.7
12	ISF Baghdad 1	Iraqi Security Forces	Dummy node	49.3	Inactive	Move To M	0	243117.4	2.4
18	ISF Baghdad 1	Iraqi Security Forces	Dummy node	38	Inactive	Move To M	0	144410.5	1.4
24	ISF Baghdad 1	Iraqi Security Forces	Dummy node	26.7	Inactive	Move To M	0	71266.7	0.7
30	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.4	Inactive	Move To M	0	23686	0.2
36	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1
42	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1
48	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1
54	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1
516	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1
522	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1
714	ISF Baghdad 1	Iraqi Security Forces	Dummy node	9.9	Inactive	Move To M	0	9790.1	0.1
720	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
726	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
732	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
738	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
744	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
750	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
756	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
762	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
768	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
774	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
780	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
786	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
792	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
798	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
804	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3
810	ISF Baghdad 1	Iraqi Security Forces	Dummy node	15.9	Inactive	Move To M	0	25343.7	0.3

Figure 6: Entity Status Input data.

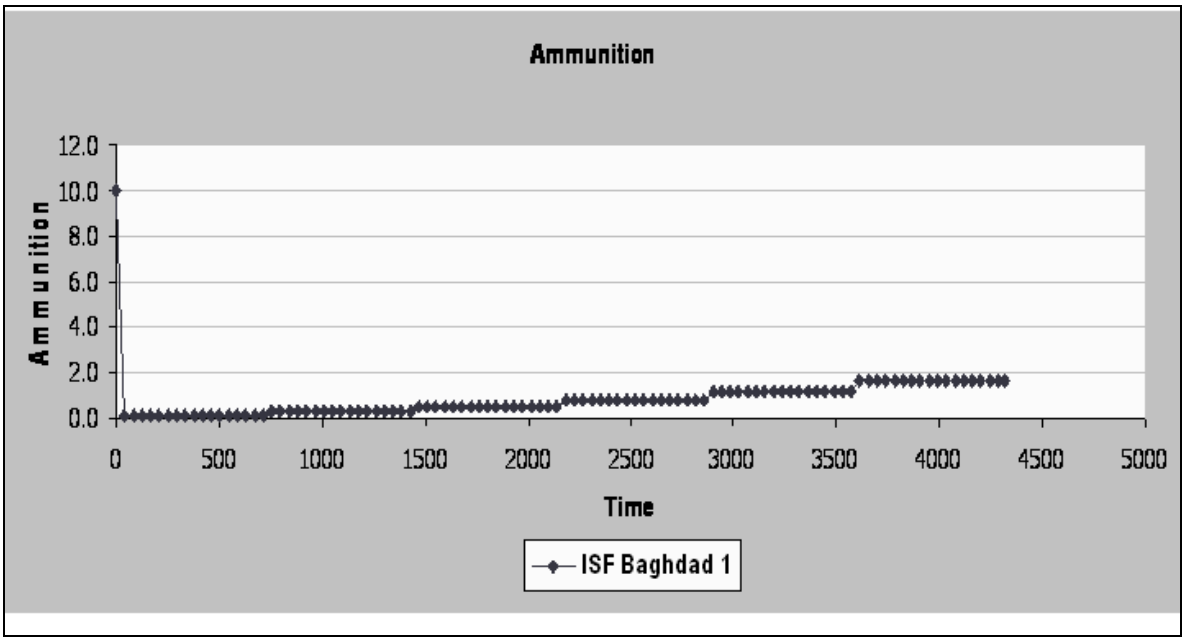

Figure 7: Post processor output for ammunition usage by an entity

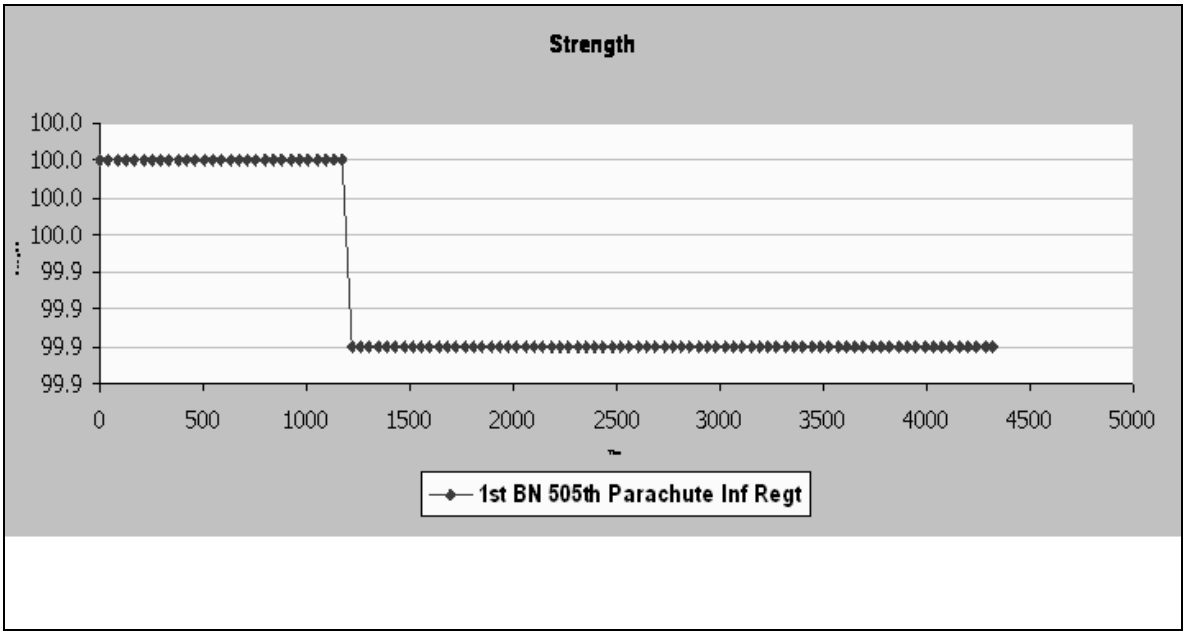

Figure 8: Attrition suffered by an individual entity.

FUTURE DEVELOPMENTS

Current enhancements planned for the immediate future include a specific representation of UAV behaviour, although whether this is to be achieved by the introduction of a new entity type or a new mission type is still to be decided. The intelligence handling within the model was recently improved with the enhancements outlined earlier, and this will be taken further with the introduction of a stochastic element to the acquisition of targets.

The proposed enhancements to the civilian representation will look at incorporating further improvements to the representation and diversity of NGOs, contractors and security forces, including research into the role of private security firms in the creation of jobs and wealth. There are many other aspects which need to be considered: the effects of civilian consent on the rate of infrastructure repair, whether civilians should have a 'memory' so they would attempt to return to their original homes once a given level of stability has been reached, and the generation of a better understanding of the factors which drive the tempo and direction of civilian movements so as to enable the representation of these within DIAMOND to be as realistic as possible.

In October 2006 a workshop was held to try to ascertain how events early in a scenario influenced the later course of the scenario. The main factors identified were:

- Incorporation of the campaign authority criteria (manner, mandate, consent and expectation) into modelling runs, either by enhancements to the model, or by the way in which the individual modelling runs are built.

- A better understanding is needed of the non-military levers within PSO, the effects of info ops, and the factors affecting the concepts of Norms and Trust:

- Context and culture.
- Western vs. Indigenous viewpoints.
- Religious factors.
- Social differences (e.g. community construct).
- Ethnic differences

SUMMARY

DIAMOND is a purpose-built simulation model with the specific aim of looking at issues associated with PSO, and provides a dynamic and auditable assessment of those issues for UK and coalition forces. The simulation is fully multi-sided, and can represent the activities of all actors within a PSO. The model is in current use within Dstl and is proving useful in furthering our understanding of PSO-related issues. It is still evolving, partly because the model has not yet reached full maturity, and partly due to the evolving nature of PSO.

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GLOSSARY

DIAMOND	DIplomatic And Military Operations in a Non-warfighting Domain.
Dstl	Defence Science and Technology Laboratory.
MoD	Ministry of Defence.
MOE	Measure of Effectiveness.
NGO	Non-Government Organisation.
OA	Operational Analysis.
PCS	Policy and Capability Studies.
PSO	Peace Support Operations.
RoE	Rules of Engagement.
UAV	Unmanned Aerial Vehicle.

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