

Operational Analysis in Support of Recent Military Operations

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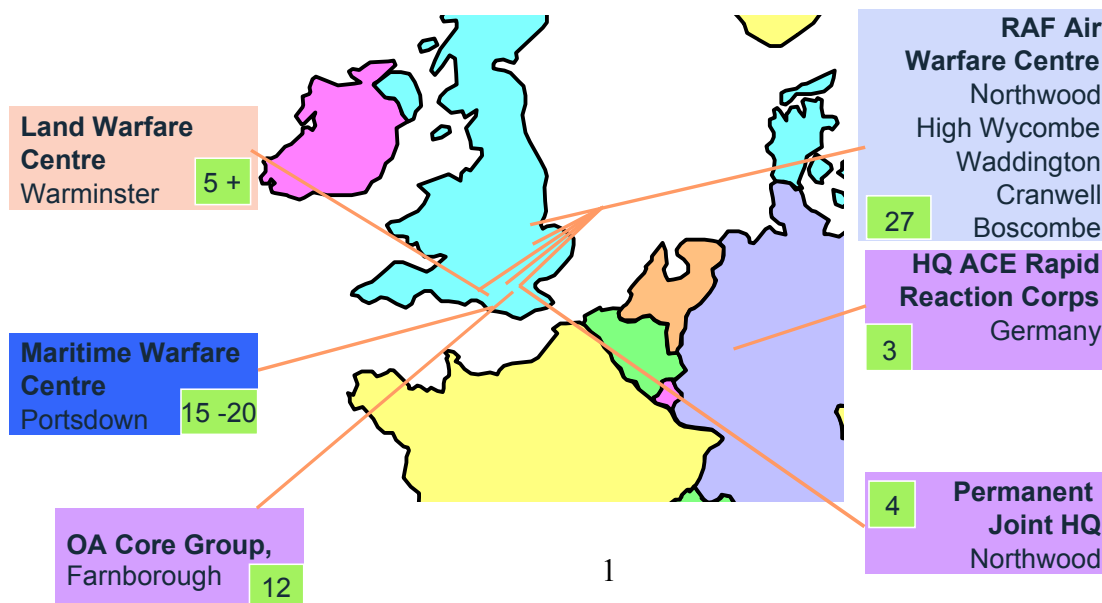
Abstract

At the 1997 IMA Conference the author presented a paper on his personal experiences in supporting the NATO operations in Bosnia and the analysis techniques developed specifically for that 'new' type of operation. Since then the author has been in a unique position as Head of the Defence Science and Technology Laboratory (Formerly DERA Front Line Department) - 'Support to Operations Group' where he has been the focus for analysis advice to many UK military operations. One feature of the group is its ability to deploy analysts to the military theatre of operations - for example - Bosnia, Kosovo, Afghanistan and Iraq. In addition the Group has deployed analysts in support of civil crises- Foot and Mouth, Firefighters strikes etc. This Presentation will review the tools and techniques now needed to give advice in the new scenarios and draw lessons from recent experiences.

Background

This paper will describe the work that has been carried out by UK military operational analysts to support decision-makers on recent operations. The UK has a long and proud history of supporting military commanders with the application of operational analysis. Within the past 10 years there has been a realisation that this support could be more efficiently organised. This led, in the mid 1990s, to the Ministry of Defence establishing a 'Scientific Support in Crisis and War' (SSCW) project and formally giving DERA's Centre for Defence Analysis the responsibility of managing this project. Thus, in 1998, the Front Line Department was established. This brought together those staff in the operational support teams. It also established two 'core' teams to act as a pool of readily deployable staff to give additional exercise and operational support. This concept, although it has undergone small organisational changes, remains to this day. Currently the Support to operations Group has approximately 75 staff in the following locations:

Figure 1: Map of Support to Operations Staff Locations



Another outcome of the SSCW project has been the formalisation of many aspects of analysts training. This covers not only training in analysis tools and techniques but also development of bespoke military awareness courses for the civilian analysts. Finally to allow cross fertilisation and to encourage joint analysis initiatives an overall coordination group has been established on which the heads of the individual teams all sit.

It has been found that these small teams need augmentation for large exercises or operations and the Support to Operations has established an augmentee pool of analysis from across the analysis community in Dstl. These augmentees (currently ~20) undergo training in order that they can fulfil many of the roles on operational deployments. In addition the Project is the focus for the training of scientists from all Dstl Departments as they prepare to support MOD in a variety of roles.

Recent Operations

This diagram charts the involvement of analysts on recent operations. It should be noted that Dstl analysts have been called on to support national emergencies- both from their home base and by deploying to other 'headquarters'.

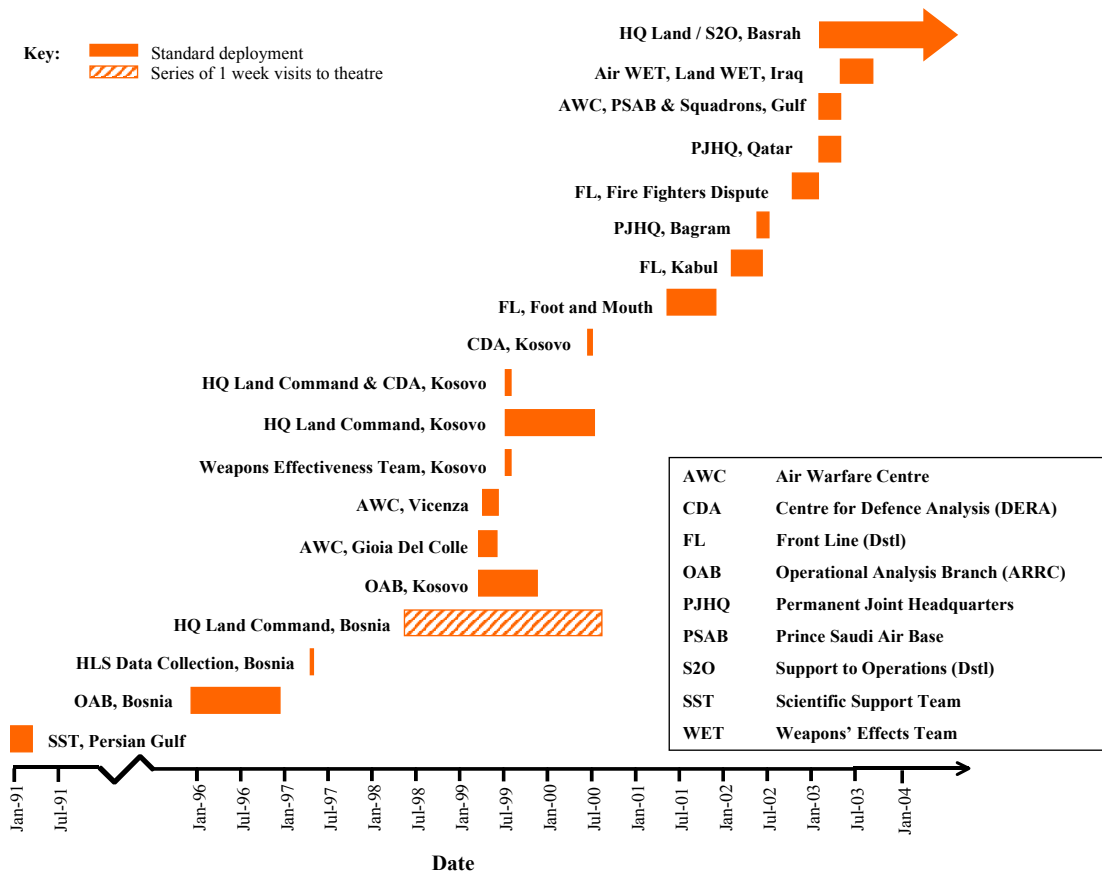


Figure 2: Recent Operational Deployments

Bosnia

When I presented at the last IMA Conference in 1997 my team from OAB HQ ARRC had just returned from a year's deployment in Bosnia to support NATO's IFOR. One of the features of that historic deployment, NATO's first land operation, was what has subsequently been called the 'Return to Normality' analysis. This is the continuous assessment of a range of background measures, which allow trends analysis to be performed. The measures were customised as to the major tasks of the military operation. This was a

realisation by military commanders that they could not use the normal 'warfighting' types of indicators to demonstrate 'success'. In this case the military were only one component of the operation and success needed to be based on civil as well as military indicators. This has become a feature of recent such operations.

Kosovo

The Balkans featured again in 1999 when NATO again deployed to Kosovo. This time the OAB team was led by my successor, Mike Neighbour. He has comprehensively captured the types of work carried out in his Journal of Operational Research Paper (2002). One important aspect of their work was the provision of analysis to both the military and other non-military agencies on the situation within Kosovo - its 'Return to Normality'. In addition the analysts were able to give quantitative analysis as to the compliance of the Kosovo Liberation Army as it moved towards de-militarisation.

In both the Bosnia and Kosovo operations the HQ ARRC analysis teams handed over analysis responsibility to NATO's own analysis organisation (NC3A) and they have continued with analysis support to this day (now through analysis teams from the NATO Headquarters based in Naples). Over the years new indicators and initiatives have been developed and they are well summarised- with lessons learned- in Lambert's paper (2000)

Post Sept 11 2001 (Op Veritas)

Within a few days of the September 11 incidents Dstl analysts were supporting a number of UK planning and policy initiatives. These analyses soon concentrated on potential operations in Afghanistan. Over the next few months a range of analyses were completed. For example:

- Regional force balances (using static scoring techniques)
- Assessment of Non Governmental Organisations capability to cope with refugee numbers
- UK public tolerance to casualties
- Troops-to-task and casualty rates for various missions
- Historical analysis of previous Afghanistan operations
- Sustainability of offshore UK maritime units during military operations
- Development of a fast and simple wargame methodology
- Measures of Effectiveness of the 'Global War on Terrorism'

Afghanistan, ISAF (Op Fingal)

With the fall of the Taliban and the establishment of the Interim Administration (IA) the UK took control of the International Security Assistance Force (ISAF) under the command of 3 UK Division. The two person OA team who had supported the Division in the UK and on Exercises deployed to Kabul. The tasks, which they carried out, (Table1) covered both military and non-military aspects of the mission. For example, they analysed daily patrol reports giving advice on the extent that ISAF was being seen by the local population. This deployment was similar to other Peace Support Operations that we had been involved in a similar pattern of analysis tasks evolved.

Afghanistan, Marines Deployment to Bagram (OP Jacana)

Concurrently with the ISAF deployment the UK deployed a force of Royal Marines to Bagram to support the hunt for remnants of the Taliban/Al Qaeda in the mountains. The troops were in a very hostile environment and one, which tested both troops and equipment. Following some ad hoc analysis support through the OA team at PJHQ – a team deployed to theatre to give direct support. In contrast to the ISAF mission this was a traditional warfighting mission and the analysis support given clearly illustrates this. The OA team gave advice on typical military questions such as logistics and equipment performance.

Table 1 below illustrates the different types of tasks the analysts performed.

Op Fingal ('Peace Support')	Op Jacana ('Warfighting')
Patrolling Data Analysis	Support Helicopter Availability
Crime Statistics- comparison across Kabul and with other world cities	Artillery Accuracy in Mountainous terrain
Analysis of Civil- Military Cooperation Data	Rifle trials and analysis
Military Data Analysis (Sightings, Incidents, Equipment Performance etc.)	Marine Equipment Weight trials
Explosive Ordnance Database	Ammunition usage
Information Operations based on opinion surveys	Movement Rates - terrain, climate, altitude effects

Table 1: Analysis Tasks in Afghanistan

Iraq (Op Telic)

Initial Analysis

In late autumn of 2003 a number of options were being considered by Government as to possible contingencies. Analysis contributed to these early discussions- initially at PJHQ then in a small cell at Dstl Farnborough. The initial efforts concentrated on ensuring that adequate maps, data, previous relevant reports, lessons learned from previous operations were available to be able to give timely responses over a broad canvas of possible questions.

It was not long before we were asked to develop a methodology for simple fast wargaming of potential military plans- and a sequence of 'games' took place- at the strategic/operational, operational and the tactical levels. The assumptions and insights from the higher level gaming feeding downwards to the lower levels. Other tasks being undertaken at this time used historical analysis to look at such topics as the size and shape of future Iraqi military forces and possible draw down times of our own forces after conflict.

In late December there was an increasing likelihood that a UK military force would be deployed to the Gulf region and a small cell of civilian analysts readied themselves to deploy with the UK HQ. They deployed initially to Kuwait and as events transpired were with the HQ throughout the build up and the combat phase of subsequent operations and then until the end of hostilities and the Establishment of the HQ in a permanent location in Basra. The analysis contribution covered such topics as:

- Strategic Political Military Wargaming
- Operational Wargaming Methodology development
- Support to Tactical Wargaming/analysis at Divisional level
- Casualty profiling and medical requirements analysis
- Chemical and Biological advice to MOD
- Logistics analysis - ammunition requirements
- Review of impact of weather and heat on Combat Operations
- 'Aftermath' Measures of Effectiveness

The SSCW team quickly arranged a number of training courses as Dstl departments were asked to provide a wide range of analysis and scientific support . Over 100 staff were trained in a six week timeframe.

In Theatre Support

At the same time as the team deployed to Kuwait the focus for analysis quickly expanded to supporting all the Services. Teams deployed to Qatar to give scientific and analysis support to the Joint Force HQ, analysts from the Air Warfare Centre deployed to The Joint Force Air Command Centre in Saudi Arabia and with RAF Squadrons at bases in Saudi Arabia and Kuwait. Reachback analysis was given to our Maritime units through the Maritime Warfare Centre.

Air Warfare Centre (AWC) Analysis Support

At the beginning of 2003 the Operational Analysis Element (OAE) deployed 10 staff to theatre in support of the Operation. This is the largest UK deployment of Air Operational Analysts since World War II, and covered support to the National Headquarters in Qatar, the Coalition and the UK Air Component Headquarters in Saudi Arabia and Deployed Operation Bases for the Tornado GR4 and Harrier GR7 in Kuwait and Qatar. Staff provided support to the campaign planning process, the provision of combat assessment and targeting advice, as well as specialist weapon and sensor advice.

The data collected by the deployed analysts on UK air operations have also been used to support a range of activities within the Operation TELIC Lessons Identified process. For example reports have been issued covering weapon employment and performance data.

Maritime Warfare Centre (MWC) Analysis Support

The mechanism of analysis support from the MWC differs markedly from other analysis agencies. The electronic connectivity between the MWC and deployed maritime units is such that timely analyses can be given through a 'Reachback' concept- that is the analysis questions can be routinely 'exported' to the analysts working out of the operational theatre at their normal work locations. The priorities were to conduct studies in these subjects:

- Force protection
- Situational awareness and prevention of fratricide
- MCM operations
- UK Amphibious force operations

Predictive OA in support of the planning process included studies into:

- Susceptibility of maritime forces to shore-based artillery
- Impact of the summer environment in the Arabian Gulf (effects on systems and personnel)

Reactive OA in support of specific problems included

- IR identification of Mine Counter Measures Vessels (MCMV)
- Disruptive camouflage pattern schemes for MCMVs

Current Analysis Support

After the cessation of major hostilities the analysis focus has been in theatre support to the UK led Multi National Division (South East) MND(SE) Headquarters based on the outskirts of Basrah, supplemented by 'Reachback' to a Operations Support Team in Farnborough. The tasks they are carrying out include routine analysis of the attitudes of Iraqi civilians, assessment of all military incidents in the area of operations involving coalition forces, day to day assessment of the fuel situation and a range of analysis on Measures of Effectiveness.

Data Collection

One important feature of the Iraq operation was the emphasis on the collection of data and information from the deployed units. There has been a feeling in the analysis community that we have not been particularly successful in collecting operational information, which could be used to benefit the wider studies and research. Whilst efforts have been made in recent operations there is some evidence that it is getting better- in particular - the successful air weapons data collection was carried out after the 1998 NATO Kosovo Air Campaign. For this operation an analysis team started very early to devise and implement a comprehensive data collection plan. Mixed civilian/military teams were trained and made ready to deploy and collect data. The Air team based itself on the successful Kosovo concept and they deployed as part of a joint US- UK Weapons Effects Team. The Land team also used the lessons from Kosovo but it became clear that the land environment was a more complex battlespace. The data of interest were not just weapon effects but logistics, artillery usage, communications, system performance etc. Also there was a need to collect information which could be used in the procurement of new equipment. In the end there was a 29 page table as the Data Collection Plan! By May -all was ready - the Air Team deployed with the US for a 4-6week visit. They visited the majority of the sites which had been attacked and assessed the damage, accuracy etc of the main weapon systems. The Land team deployed in June for two weeks and collected considerable valuable information. On both the Teams return an immediate data exploitation and analysis took place and the quantitative results fed into Lessons Learned and other Op Telic initiatives. Archives of the data were also developed to ensure that these data were available to future analysts.

Support to Other Government Departments

Fuel Crisis (2000)

A team of analysts gave support to the Home Office during the Fuel Crisis of 2000 - their task was to analyse the various plans from different emergency agencies and consider their overlaps and gaps to ensure a coherent plan if the crisis became critical. The technique used was called 'The Day After' first developed by the RAND Corporation. This methodology relies on a three-step policy and strategy exploitation exercise in which participants react to possible future events and develop appropriate responses to these events, and then develop nearer term actions based on the new experiences. From being given the task to final report the team had 20 working days!

Foot and Mouth Crisis (2001)

As the Foot and Mouth crisis developed MOD analysts based at Farnborough considered a number of possible scenarios and gave advice on logistics requirements, and possible spread of the outbreak.

In addition small teams of analysts deployed to the London operational centre and over many weeks gave day to day analysis support to the decision-makers. Examples of their support included predictions using Imperial College data and MAFF Census data, giving

- likely number of animals by type by region by week
- numbers of vets needed
- number of vehicles needed
- disposal facilities needed
- also, advice on vaccination contingency planning.

By early July the crisis was under control and the analysis emphasis moved to a series of specific studies. For example three simple spreadsheet models were used to give advice. These were:

- Serology Model: used to predict restocking sampling requirements
- Correlation Model: investigating local outbreaks and their correlation to movement licences issued in infected areas
- Contiguous Culling Study: looking at success of the contiguous culling policy.

The Firefighters Industrial Dispute (Op Fresco) (2003)

General

With the likelihood of nationwide Firemans strikes the military were tasked to give support to non striking fire crews. Strategic and operational contingency planning commenced in late May 2002 and Commander in Chief LAND was appointed the overall Joint Commander. Large numbers of troops were involved: the Navy and RAF each contributed about 3000 and the Army 12,500. In total almost 19,000 regular, reservist and TA personnel were deployed. For much of this time these forces could not be used for any of the other tasks demanded of the UK Armed Forces. Furthermore these forces had to remain at high readiness for much of the time and were unable to get home, take holidays or conduct normal training. Strikes and threatened strikes, which were suspended, often at the last moment, were spread across almost six months from October 2002 to March 2003. To further complicate the situation operations in Iraq (Op Telic) coincided with the most demanding period of the dispute!

Dstl Analysis Support to Op FRESCO

The permanently deployed analysis teams in HQ Land, AWC and MWC gave direct support to their normal military commanders as the military took command of the Fire Service during the strikes. In addition a team from Dstl Farnborough worked in the Civil Contingency Secretariat (CSC), the overall Government coordination centre.

Civil Contingency Secretariat (CCS) Support

The role of the team was to develop simple databases and spreadsheets to support the day to day operational control of the crisis. Using Rapid Application Development (RAD) techniques the team developed a range of operational tools, based on the MS Office (Access/Excel/PowerPoint) applications. These simple tools (Figure 3) clearly demonstrated the potential of CCS desktop applications.

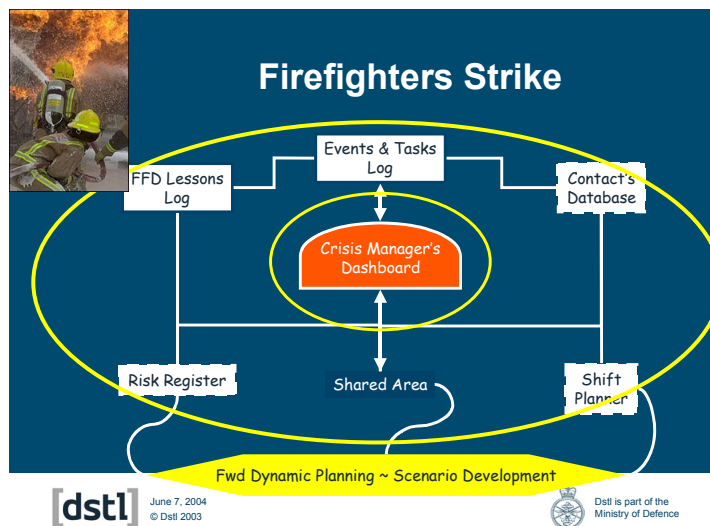


Figure 3: Tools Developed for the Civil Contingency Secretariat

Land Warfare Centre Support

Sharpe (2003) has summarised the analysis support given to Army commanders during OP Fresco. For example, analysis showed that the Regional Equipment Support Teams (REST) (1 per county) should be

held in reserve for serious road traffic accidents and there was also potential for sharing REST units between counties. Throughout the dispute a series of analyses gave options and advice on the size of fire crews and using data from the early strike advice could be given on potential military manpower savings.

AWC Support

Cowdale (2003) has described the support given to the military commander for the County of Norfolk. Military staff assisted local authorities by manning fire-fighting equipment and provided command and control. Simple simulation modelling was used to provide insights into the type of issues that the military would face in undertaking these new roles. Two models were developed; one using SIMUL8 to investigate asset utilisation, and the other using Visual Basic to generate a master event list for use in mission planning and control centre training.

Cowdale concluded that the analysis illustrated that relatively simple simulation modelling was able to provide valuable support to the decision making process. An important aspect of the support was the fact that the staff who had developed the simulation were directly involved in the discussions surrounding the key decisions. As a result the models could be quickly modified to meet the developing requirements and to provide quantitative input to the decision-makers.

Analysis tools and methodologies

Since the IMA Conference in 1997 there has been has seen at least a 20 fold increase in the computing power of PCs. In 1996 in Bosnia the analysis team had 120MHZ/1GB hard drive computers (!) whilst now 2.8GHZ 120GB PCs are routinely available. Linked with an equivalent enhancement of graphics gives performances we could only dream about in 1996.

The near monopoly of MICROSOFT Office set of applications has set a de facto set of standards and a basic interoperability. The rise of the Internet has unleashed a vast storehouse of data, some information and a little knowledge. Analysts can harness these tools to be able to give timely analysis with regularity. The speed of communications has also been able to be harnessed to make 'reachback' analysis a reality - although experiences have shown that there a loss of situational awareness the farther one is from the 'front line'. Hence care needs to be taken in the use of reachback tasks. However military operations still have limited communications channels and this is still a significant limitation to analysis support from outside the operational theatre. Table 2 is a summary of the types of tools and methods that have been used to support recent operations.

Operation	Analysis Support	Tools /Methods
Kosovo Air Campaign	Targetting, Collateral Damage, Data Collection for Evaluation of Weapon Effects	Specialised models for targetting and collateral damage. Measurements, Cameras
Kosovo (KFOR 1)	Compliance to Military Technical Agreement, Measures of Effectiveness Campaign Monitoring	Spreadsheet analysis, databases, visualisation tools, Statistical analysis
Fuel Incidents	Interagency planning cooperation	'The Day After' methodology, influence diagrams
Foot and Mouth (Strategic)	Logistic planning, scenario analysis	Spreadsheets, statistical analysis
Foot and Mouth (Operational)	Serology model- restocking requirements Correlation Model -outbreaks versus movement licenses	Spreadsheets, data analysis, database developments
Foot and Mouth (Tactical)	Estimations of logistic requirements- vehicles, vets, vaccinations etc.	Spreadsheets, data analysis
Fireman Strikes (CSC)	Prototype operational CIS system	Spreadsheets and simple

	tools.	databases,
Fireman Strikes (AWC)	Asset Utilization, Mission planning and control centre training	Simulation - SIMUL8 and Visual Basic
Fireman Strikes (LWC)	Distribution of equipment Graphical representation of daily reports, Data analysis for manpower savings	Spreadsheets, statistical analysis tools
Post Sept 11 (Op Veritas)	Force balances, Troops to Task for various missions, previous Afghanistan operations, MOEs	Structured Brainstorming, Static Analysis, historical analysis, reviews of previous studies
Afghanistan (ISAF) OP Fingal	Information operations, basic military statistics, Civil Military cooperation, crime levels, Loya Jorga organisation	Surveys and questionnaires, Spreadsheets and databases , statistical analysis, simulation model(SIMUL8)
Afghanistan (Marines) Op Jacana	Combat analyses- helicopter availability, rifle trials and analysis, ammunition usage, movement rates in austere terrain.	Simple models, results from previous studies, Geographic Information Systems(GIS), experimental design of experiments, statistical tests, spreadsheets
Op Telic (PJHQ, Head Office)	Strategic options, future scenarios, timelines for plans, urban combat scenarios	Seminar wargaming, review and use of results from detailed military models, historical analysis
Op Telic (Combat, Land)	Combat resolution / force ratios Ammunition consumption, Casualty Estimation, Logistics Reach, Platform Vulnerability	Spreadsheets, Data from studies, bespoke combat models
Op Telic (Combat ,Air)	Support to the campaign planning process, combat assessment and targeting advice, specialist weapon and sensor advice.	Databases, spreadsheets, previous studies, data analysis
Op Telic (Combat, Sea)	Force protection, Situational awareness and prevention of fratricide MCM operations, UK Amphibious force operations	Previous study results, specific domain models
Op Telic (Post Combat)(In theatre)	Data Collection, current status of essential services, Measures of Effectiveness, Information Campaign	IT collection means, cameras, measurements on the ground, unit etc records. Data analysis, simple statistical tests
Op Telic (Post Combat)(In UK)	Initial Data Exploitation, air weapon effectiveness analysis, S&T lessons Learned, support to wider MOD Lessons Learned	Data analysis, simple statistical tests

Table 2 : Summary of Tools and Methods

Trends in analysis

Over the past 7 years deployments have demonstrated that a number of tools and methods have proved particularly useful. These are

- The development of simple models based proprietary on software tools. In particular spreadsheets and databases
- A major task for analysts has been the collection and processing of large amounts of operational data

- The increasing trend for the analysis of non military data
- Prior to operations the increasing importance of historical analysis
- Importance of having access to a large body of previous studies

Capturing Best Practice

Over the past few years there has been a realisation that many of the lessons and experiences of analysts who have carried out analysis to support operations has not been captured in a coherent manner. Also the Studies, Simulation and Analysis Panel of NATO Research and Technology Organisation identified that that the successes of recent operational analysis had not been consolidated in a single document. This would allow for further dissemination of good practice. Thus, two years ago a Technical Team was set up to develop a Code of Best Practice for 'Decision Support for Combined Joint Task Force and Component Commanders'. The Author has been the Chairman of the Team and it has recently completed the first edition of the Code. The team had representatives from 8 nations and a wide range of national and NATO military headquarters.

The guidance in the Code is intended to assist analysts and military staff in understanding the principles of providing decision support to Commanders. It is not intended to be prescriptive, nor exhaustive, and is based upon knowledge from experience gained on recent operations. It contains pertinent information aimed at helping prepare, deploy, integrate and support OA teams in the field. In addition to the Code, the Team developed a short summary document (two pages in length), explaining the role of operational analysis in a form more accessible to those working under very short time scales, such as senior military commanders.

Comments on the New Operational Environment

One aspect, which has a marked impact, is the understanding that the military are merely one of a number of 'players' in a modern operation. Especially on those operations where military conflict has either finished or has not featured in the early stages of the operation. There is a greater emphasis on interactions with the civilian and political 'actors'. It is now fairly commonplace for the military planning process to encompass lines of operation, which are non-military in nature. For example the military campaign plan for ISAF identified the 'Security of Kabul' as its major mission but then disaggregated this into a series of tasks, many of which were beyond the direct control of the military forces. An important demonstration of the integrated nature of modern military operation.

A new challenge for operational analysts will be to support the latest military doctrinal concept of 'Effects Based Operations'. Although definitions are still being debated one that has gained some currency is:

'A process for obtaining a desired strategic outcome or effect on the enemy through the synergistic and cumulative application of the full range of military and non-military capabilities at all levels of conflict.' (J9, US Joint Force Command, 2003)

This has led to a clearer emphasis on measuring the 'effectiveness' of military operations. This is not new to operational analysts who have been directly supporting Commanders in the past few years. They have been developing methodologies to do this - but without the background of a military concept to underpin their efforts. This analysis support will require considerable efforts in data collection, definition of relevant measures of effect and then clear and unambiguous analysis to support decisions.

In many operations the military forces are fulfilling many of the roles which would normally be carried by other government ministries and agencies. They need information that is well beyond that needed for purely military purposes. It has been a significant task of the analysis teams to try to find and analyse this wider information - often in the absence of any recent relevant data from the country. Thus the analysts have found themselves having to carry out surveys, and developing questionnaires to provide the base data for this analysis. Future operations should learn from these experiences and attempts should be made to ensure that such base data is made available prior to the start of a likely operation.

Conclusions and Lessons Learned

This Paper has reviewed the direct support given to decision-makers on recent operations. A number of conclusions are drawn, namely:

- Small teams of dedicated analysts can make significant contributions to modern complex military operations and national crises
- The power of computers can make analysis more timely but there still needs to be data to analyse in the first place
- Data collection remains difficult in the field, although military commanders are realising the importance of analysis and are becoming more supportive of data collection initiatives
- Simple data analysis techniques and fast running tools dominate the deployed analyst tool kit
- The range of combat related questions (eg: Afghanistan, Iraq) are similar to those that have been asked of analysis teams in the past
- In operations where the military are clearly supporting a wider civil/political mission/campaign operational analysts have been called upon to develop new techniques which bring quantitative analyses to wider mission objectives. One feature of this has been the number of times some sort of 'Measure of Effectiveness/ Success' have been used.
- There is a growing acceptance of military planners that a wider set of analyses is necessary to allow them to assess the progress of their mission. This has been greatly helped by the Campaign Planning methodologies currently being taught in military staff colleges. This is making the work of the analyst easier.

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