

28 ISMOR 2011

Book of Abstracts



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## Presentation Abstracts

### **Prospects for New Revolutions in Military Affairs in the Uncertain Future Security Environment**

**M Arikan**  
**Turkey**

The global trend in military affairs and the security affairs at large is of change rather than continuity. As the future security environment is best described as uncertain, there are a number of potential paths that the international security could take. So, as the social structure of the security environment is expanding and the military dominance is losing ground, threats are changing from armed formations to a more urbanized groups with different ideologies and means. The militaries and other national security establishments search for new ways and methods of conducting war in this changing security environment.

The term of “revolution in military affairs” (RMA) is subject to interest both among the academia and the military professionals. The philosophy of RMA is based on the understanding that developments in the technological domain, if applied in a completely unique way, can revolutionize the nature of warfare and the way militaries practice it. However, the search for a new RMA is not isolated from the environmental setting and is always restricted with the contemporary security concerns. The American experience is the prominent example of the search for an RMA in the face of the drastic change in the security environment. Moreover, the study of the American RMA project reveals that the RMA is not an end in itself but a process of change. While the US aims at transforming its military in a revolutionary fashion, the recent practices in Iraq and in Afghanistan are supportive of a more traditional military posture.

On the other hand, the development of the European security apparatus is indicative of change in another direction. The EU understanding of the future warfare includes a complete merger of the civilian and military spheres in conflicts. The EU approach employs civilian and military means in a comprehensive manner, as theorized by the EU Security Strategy. One would argue that, instead of accepting that the American way of war will dominate the future security environment, we can improve solutions by thinking over the combination of security assets developed by the EU and the US military structures.

## **C-IED Balance of Investment – A Mixed-Method Approach**

**P Bailey**

**Dstl, UK**

The many disparate and interrelated strands of Counter Improvised Explosive Device (C-IED) make taking coherent decisions about how best to improve our C-IED capabilities difficult. As a result, attempts to undertake a quantified analysis of the relative effects of the various elements of C-IED across the whole C-IED domain have been limited. This paper describes an analytically feasible way forward which will enable us to answer the higher-level Balance of Capability (BoC) and Balance of Investment (BoI) questions around C-IED. It fleshes out the issues and provides sufficient detail to show that the problem is tractable and that we do now have most of the required tools in place.

The method is based on use of the JUNIPER model, developed for a Ground Force Protection BoI study, for the core task of representing the 'Defeat the Device' element of C-IED. However, the method described incorporates an essential gaming element in order to represent the evolution of equipment and tactics by both sides. This builds upon previous experience within Dstl in the use of Red Teaming, in particular the Surrogate Red Teaming approach. The method links the 'Defeat the Device' elements to 'Attack the System' at this stage by means of parametric variations, but will investigate in parallel how other research into more explicit modelling of 'Attack the System' could be incorporated in the future.

## **Seminar Wargames for the Analysis of a Wicked, Dangerous, and Uncertain World**

**F Cameron and Colonel J Appleget, US Army (ret'd)  
The MITRE Corporation, Colorado, USA**

Modern wargaming can be traced back to nineteenth century practice in the Prussian Army. Throughout the twentieth century the military community applied wargaming to all aspects of combat, and in all environments – on the ground, in the air, and on and below the seas. A hobby gaming community also developed many approaches that have become common practice, beginning as early as HG Wells' *Little Wars* and continuing through to the latest down-loadable computer games. Seminar war games share many aspects that are common across all formats of wargaming and, as well, they include the elements of civil discourse found in seminars. The flexibility of the seminar war game format allows it to be adapted to the wicked problems of defence and security in the twenty-first century. The methods of seminar war games have often been applied to the purely civilian realms of fighting epidemics and other natural catastrophes, so have been extended well beyond combat situations.

For operational research analysts, seminar war games can be valuable in many respects, perhaps the most beneficial being to uncover the often obscure but critical aspects of some new problem. When poorly done seminar war games lack the rigour usually associated with other OR methods.

The US Naval Postgraduate School has a graduate course on wargaming, with one week specifically devoted to seminar wargaming. Seminar war game week takes students of OR through the stages of preparing, executing, and analyzing seminar war games. This paper summarizes essential aspects of seminar war game week, with emphasis on what makes OR-supported seminar war games different from merely a "bunch of guys and gals sitting around a table" (BOGGSAT).

## **A Method for Civilian Damage Assessment from Rockets and Missiles**

**B Corem**  
**Israel**

One of the problems that the Home Front Command needs to deal with is how to prepare to damage that will occur in a war. This problem depends in an uncertainty of many components like the level of damage from the missiles and the accuracy of the intelligence. This talk will describe a method to estimate the damage of buildings destruction and casualties from rocket and missiles.

## **Long Range Forecasting for the Future Security Environment: How NATO Nations use Foresight to Bound the Future World**

**N Corrigan  
CORDA, UK**

In April 2011 the NATO System Analysis and Studies panel held a Specialists' Meeting to explore how NATO nations perform long-range forecasts of the future security environment in terms of methods, tools and process. In this paper the chair of the meeting reviews the ideas presented and reveals some of the findings that will be published shortly in a NATO report.

NATO perceives a need to better understand the implications of the future security environment to ensure future defence forces can establish a coherent strategy and force structure for what lies ahead. The Specialists' Meeting sought to establish a forum to review national and international perspectives, methods and supporting analytical techniques for long-range foresight, covering a range of techniques. The Specialists' Meeting program featured 3 keynote speakers, as well as submitted papers and presentations from various subject matter experts. The objective was to share knowledge, facilitate cooperation and critically evaluate techniques and strategies for estimating medium-to-long term security conditions in order to improve the quality of force planning.

The Specialists' Meeting was organised around three themes:

- Methods - Tools, and approaches used by NATO and its nations for analyzing the future strategic environment;
- Process – How uncertainty is accounted for within a variety of approaches including the handling of “outlier” events, validation, and measures of robustness;
- Integration with Policy - Dissemination of products, including strengthening their impact on decision makers and policy formulation.

This presentation will highlight some of the themes emerging from the 2 day meeting, and the recommendations made.

## **Development of Counter Improvised Explosive Device Metrics**

**S Crabtree**

**Dstl, UK**

IEDs (Improvised Explosive Devices) have historically been and remain the prominent threat to UK forces in Afghanistan. In recent years there has been a lot of investment in improving the UK Counter-IED (C-IED) capability by MOD, with the goal of reducing the number and severity of casualties resulting from IEDs. As a direct result of the IED threat, the Prime Minister and senior MOD leadership requested a team was set-up to provide a measurement of the UK's progress in the C-IED battle. As such, the C-IED Effects Team was set-up with the remit of providing analysis on the effectiveness of the UK C-IED capability. In order to provide the analysis a number of Measures of Effect (MOE) were developed spanning both Offensive and Defensive C-IED strands. These metrics are used to brief senior MOD leadership on a regular basis and help to inform decisions on future C-IED capability investment.

## **OR Support for Planning in the US Africa Command – Latest Developments**

**D Davis and B Wilson**

**GMU, USA**

Operations Research support to the US Africa Command is a process in development. The Final Operational Capability for US Africa Command was 7 October 2008. One of the initial branches within the Command was the Operations Research Branch, within the Strategic Capabilities and Analysis Division, of the Resources Directorate. As is often the case, the OR Branch has struggled to find its place within the Command and to provide value added analysis to the various products, processes and operations that are conducted. Traditional military operations research has relied upon the use of models and simulation of joint combat operations. Tools and techniques to conduct these analyses are taught in the US military and civilian OR education system and are well known. However, the mission of US Africa Command is somewhat non-traditional; in a statement to the US House Armed Services Committee, the new US Africa Command Commander – General Carter F. Ham stated:

“United States Africa Command protects American lives and promotes our national interests by advancing security and stability in Africa. We follow two main lines of effort: building the security capacity of our African partners and preparing for a wide range of potential crises. U.S. Africa Command’s operations, programs, and activities contribute to reducing the threats to our citizens and interests both abroad and at home by helping African states provide for their own security. We seek to enhance regional stability through support to and partnership with African regional organizations. Our planning and training are designed to prevent conflict while simultaneously ensuring that U.S. Africa Command is prepared to respond decisively to any crisis when the President so directs.”

Advancing security and stability, potential crises, partnerships and conflict prevention: objectives that have not normally been part of the military priorities of the United States now are concurrent with crises response such as the actions in and around Libya. This has made the professionals in the OR Branch relook the need for tools and techniques in support of analysis of these new, uncertain, objectives. This is especially true now that the Command is reverting to ‘J Codes’ and the branch is now known as J-80 O.

This presentation will discuss the relationship between analysis and assessment at the US Africa Command and the changing focus of the OR Branch.

## **Value Focused Metrics**

**D Davis**  
**GMU, USA**

Several years ago I made a presentation at 25ISMOR that was the initial description of what is now known as Valued Focused Metrics (VFM). This paper expands the concept to its use as an analysis technique and provides an example. The central concept behind VFM is that the observed value of a metric depends on the actual state of the objective that it is meant to measure. A decision network is developed that places end states at the apex and provides a network of objectives to support it. Each objective node can be the parent of metrics and the child of actions that are meant to influence the state of the metric. End State, or Fundamental, nodes in the model are measured using Multi-Attribute Utility Theory techniques. The network of objectives, sometimes called a Means Ends Objective Network or MEON, is evaluated by viewing each node as an uncertain probabilistic proposition and applying the techniques of Bayesian Belief Networks.

The example presented is of the adjudication model used for an analytic game conducted by US Africa Command. The decision network that formed the model was developed to represent the end states and objectives of a Command planning requirement. A description of the model development and use will be presented. The actual planning requirement and names of the objectives will not be presented.

## **Quantitative Assessment in Military Intelligence: Predictive Analysis and Risk Assessment in Current Security Environment**

**P Dobias, P Eles, J Schoden and J Wanliss  
CORA–DRD, CNA and Presbyterian College. Canada.**

Present-day conflicts have seen an unprecedented increase in the availability and diversity of quantitative and qualitative information; however, the quality of this information is often less than satisfactory. The available information is frequently one time reporting; even for recurrent information, methodologies and means of reporting often vary. The availability of diverse data sources of varying quality, combined with the complexity of the operational environment makes predictive analysis and risk assessment very difficult.

Possibly the most used and reported information is counts of various types of violent actions. This information tends to originate from official channels, and is usually somewhat reliable. The internal structure and trends of violence data can provide valuable insights into the dynamics of an analyzed conflict. However, such quantitative assessment needs to be accompanied by a contextual narrative to render it truly informative and relevant.

This paper presents an outline for an analysis of violence data from Afghanistan. It begins with more or less conventional approaches using combinations of various factors and counts of subsets of violence data. It highlights the applicability and limitations of these approaches for predictive analysis and risk assessments. Finally, the paper identifies how fractal-based methodologies can provide insights into internal coherence of the data, identify cross-points, and in general allow an analyst to capture the internal complexity of an assessed environment at multiple scales. These supplementary methodologies can be used to further enhance a situational picture built with conventional analytical methods, and possibly provide enhanced predictive capabilities which might in turn lead to improved risk assessment and management.

## **The Historical Characteristics of Non-Combatant Evacuation Operations**

**S Dudin**

**Dstl, UK**

Non-combatant Evacuation Operations (NEOs) are one of the most common types of military operations conducted by British forces, with approximately 20 conducted since WWII, including eight within the last 20 years. An enduring requirement to conduct NEOs on a semi-regular basis seems to exist, and the chances of successfully conducting these operations will probably be improved if their historical characteristics are properly understood.

To this end, 29 case studies of British, French and American NEOs were researched, gaining insights into the swiftness of these operations, the forces typically used, the types of threat encountered and the importance of forward deployment.

It appears that NEOs should not be treated like other operations. The timescales are very short, requiring forces to be deployed within days, typically from forward deployed locations, and usually without the support of Joint Fires or the protection of heavily armoured vehicles.

The operating environment is often uncertain or dangerous, although historically Blue casualties are rare. Typically, harassing fire, or small scale attacks on isolated forces, is the most likely threat to Blue forces. But narrow misses have occurred, such as leaving evacuation points minutes before enemy bombardment of the area. Furthermore, historical precedents exist for ambushes in an urban environment, gunmen merging into crowds of demonstrators, and an assault on a town held by 500 rebels who were holding over a thousand hostages.

## **Achieving a Cost Effective Live, Virtual, Constructive (LVC) Training Balance**

**S Foale  
Dstl, UK**

The Strategic Defence and Security Review has identified a need to make financial savings and enhance training by transferring live training to virtual, constructive and simulation. The substantial investment in simulation in recent years has meant that a wide range of tasks can potentially be trained in a virtual environment either as a replacement for live training or as a precursor to enrich the live training experience. The presentation will give examples of modern simulation methods developed for the MOD and discuss Dstl's approach to providing guidance on which areas of training may be moved from live to simulated systems without loss of operational effectiveness.

## **European Defence Cooperation in an Uncertain Security Environment**

**R Huber and J Moffat**  
**UBM Germany and Dstl UK**

The changing character of conflict is described in recent works in the public domain, and acknowledged in a number of recent documents on national security and defence. For example, in the UK, the National Security Strategy (NSS) sets the context for UK defence and security in terms of the *Ends* and *Ways*, while the Strategic Defence and Security Review (SDSR) deals with the *Means*. Germany is in the process of updating its Defence Policy Guidelines of 2004 and restructuring its military forces to better meet the demands of the changing security environment that largely match NSS views on future conflict, some differences in national perspectives notwithstanding.

The NSS characterises the nature of future conflict in the following terms:

“Around the world the character of conflict is changing. Many future wars will be ‘among the people’, resembling in some respects the counter-insurgency that we are currently fighting with allies in Afghanistan. But there will also be wars between states. Critically, both types of conflict will share some common characteristics that affect our own military requirements.

In the future we should expect that securing access to and freedom of manoeuvre in conflict environments will be difficult. Battle lines will be unclear and the battlefield may contain local people and the media, as well as adversaries. We need to be prepared for the fact that our lines of communication will be vulnerable to disruption; and our actions will be subject to scrutiny in the media and courts and by society at large. The implications of this are examined in the Strategic Defence and Security Review”.

In this paper we will discuss the implications of these factors in more detail, illustrate their impact within a complex emergency (dealing with the aftermath of Hurricane Katrina) and then discuss what they might imply for Europeans in terms of greater defence cooperation to meet defence and security requirements.

## **Competitive Analysis to Achieve Solutions in Irregular Warfare**

**A Idhe  
USA**

While the United States has studied conventional warfare for years, only recently has the emphasis within the analytical community shifted to the study of irregular warfare. Recent conflicts require analysts to seek new tools to assess the suitability of new technologies, command structures and tactics in an irregular warfare environment. Johns Hopkins University Applied Physics Laboratory has recently begun employing two-sided competitive games in this role. Though considered more suitable for training in the past, these tools are useful to identify potential weaknesses in new technology and to conduct Course of Action analysis for interagency task forces. We will introduce two such tools: Competitive Influence Gaming using the Green Country Model and Red Teaming.

The Green Country Model, an interagency wargame that allows analysts to apply instruments of national power besides kinetic Military operations (i.e., Diplomacy, Intelligence and Economic influences) has been used recently to examine a variety of international crises where the application of kinetic military force is not desirable. We provide a brief overview of these wargames and their results.

The U.S. Office of the Secretary of Defense often contracts APL to study selected new weapon or sensor systems before they are deployed for operation in order to identify what countermeasures might be developed against them. When using APL's approach to Red Teaming, specialized groups selected for their areas of expertise are assembled to act as enemy forces. These groups are provided with scenarios that have been developed to challenge a potential flaw in the system or to cover the range of environments in which the system will operate. Initially, teams are given very limited information to simulate threat force reactions under uncertainty. As the event progresses, additional information is provided the teams until, at the end, a full system brief is provided and the participants are challenged to defeat the system with full knowledge of its capabilities.

## **Strategic Force Development: The Route to the UK's Next Defence Review**

**W Jones**

**Dstl, UK**

Following the UK's Strategic Defence and Security Review (SDSR), the Strategy Management department in MOD has redesigned the Strategic Force Development process. This has led to the creation of 3 connected processes each focussed on a part of the overall challenge: Future Force Development, Future Force Development (Forward) and Conceptual Force Development.

This presentation will give an overview of these 3 approaches and the overlaps and connections between them.

## **Quo Vadis?**

**J Kettelle  
USA**

*Pace* the atomic bomb, another "World War" is THETC (too horrible even to consider). Although this should long ago have been obvious, thanks to our Military-Industrial-Complex has failed miserably to exploit this fact. This paper discusses ways to do just that. Force all countries except the U.S. and China to demonstrably "denuclify". And second, establish some sort of a world-wide military alliance that can "keep (or establish) the peace" in situations such as Korea and Afghanistan. A twenty-first century *Pax Britannica*.

## **Evidential Reasoning in Support of Counterinsurgency Intelligence Operations: Combining Evidence from Disparate Sources**

**Dr. W Perry  
RAND, USA**

Perhaps the most difficult problem facing designers of command and control systems is that of combining evidence from disparate sources to form an agreed recognized picture of the environment – especially in support of counterinsurgency operations. More uncertainty exists in counterinsurgency operations and this exacerbates the process. The difficulty generally occurs when we attempt to combine intelligence reports to discern any aspect of the enemy's operations. The combining techniques used in these applications are usually manual assessments of probabilistic estimates. Assuming the probabilities are available, the dynamic nature of counterinsurgency operations generally leads us to the use of Bayesian techniques. The difficulties with Bayesian analysis center on two problems: (1) rapid convergence on a single hypothesis and (2) the need to assess the effect of evidence on the probability of all hypotheses. These and other problems with Bayesian analysis have led researchers to search for alternative methods of analysis. One of these is the Shafer-Dempster belief function methodology. Belief functions avoid these difficulties by allowing belief to "grow", i.e., it is acceptable for total belief in all hypotheses and their disjunctions to exceed 1. In this way, rapid convergence is obviated. In addition, there is no need to evaluate conditional probabilities at each iteration. However, belief functions have a few problems of their own that must be addressed before implementation. The most serious is the Dempster rule of combination. This is the belief function equivalent to Bayes rule. With the Dempster rule however, the combinatorial complexity can be prohibitive if the number of hypotheses is large. There are heuristics to mitigate the severity however. Another problem is dealing with disconfirming evidence. Usually one or the other sources must be accepted and the other discarded. In this paper we develop the Shafer-Dempster combining technique and apply it to a simple counterinsurgency example.

**Reflections on SDSR and its Implications for the UK's Future Analysis Capability.**

**A Robinson  
Dstl, UK**

The UK has recently completed its Strategic Defence and Security Review – so now is a good time to take stock of the analytical challenges for the future. This paper will discuss some of the key implications for our current modelling capabilities and approaches, indicate where some of the key challenges lie, and illustrate some of the work in hand to address identified shortfalls in our analytical capability.

## **Flexibility – Valuing and Measuring it**

**Dr C Smith**

**Future Systems, MBDA, UK**

We all inherently value “flexibility” but how can we measure how much of it we have? In everyday life we may be prepared to pay for greater flexibility, but is the same true for more flexible military capability? What if there is a trade-off between flexibility and performance – how do we decide the balance? If our criterion is cost-effectiveness, then what is the relationship between flexibility and effectiveness?

The future operational environment sets the context for military capabilities. The DCDC Strategic Trends documents and associated papers paint a picture with a wide diversity of situations, with near universal asymmetric aspects that are characterised by rapid evolution of equipment and tactics. So discussion of flexibility seems very relevant, especially in a highly constrained financial climate.

In a recent RAe Society conference (Feb 2011) different aspects of flexibility were discussed from a weapon system design point of view, together with how to engineer more “flexibility” into the system. These were:

- Versatility can be defined as the ability to use a weapon system in different modes, or doing things in a different but planned ways.
- Adaptability is responding to the unexpected, making the weapon system operate differently, either exploiting inherent capabilities within the design or by rapid technology / software insertion.
- Agility in acquisition is used to steer the capability of a portfolio over time, e.g. balancing incremental insertion technology with replacement in the long term research planning.

This paper uses these definitions to probe into how to measure and value these different aspects. The relationship with robustness and resilience is discussed – is this not what we actually value when we say we want flexibility?

There is also impact on how to assess capabilities. SAG scenarios provide spot points for assessment. Measuring flexibility or robustness needs a spread of situations. The paper discusses complementary methods to cover these two aspects and so provide a rounded picture of capability.

## **The UK's 2010 SDSR – Supporting Decision-Making in an Age of Uncertainty**

**P Stockel**  
**Dstl, UK**

Following completion of the UK's SDSR and the subsequent 3 Month Exercise, this paper will take the opportunity to reflect on the support provided by the Defence analytical community to MOD strategic decision-making through the UK SDSR process and the initial implementation of the decisions. It will touch on the challenges for analysis and the lessons indentified.

## **Poster Abstracts**

### **Operational Analysis in support of the Warfare Centres and HQ**

**S Benzies  
Dstl, UK**

Support to Operations (S2O) is a group of DSTL analysts which exists to maximise the impact of science and technology on UK military operations. Deployed analysts provide real time operational analysis to front line commands and warfare centres both in the UK and overseas. The group also provides reach-back support to deployed analysts and can facilitate linkage between operations and the wider scientific knowledge base across DSTL. This allows S2O as a group to deliver a robust and adaptable scientific product, providing vital OA to commands when needed most.

**Cornwallis**

**D Davis  
GMU, USA**

The Cornwallis Group sees itself as a vehicle for excellence in analysis. Through discussion, outreach, and publication, it also sees itself as a bridge between national military agencies, other governmental departments, international and non-governmental organizations that often work together on the ground, but seldom meet in a reflective environment to discuss issues of common concern. The group intends to reach out to those organizations, which do not usually participate in military conferences, to engage with them in establishing a common understanding of the wider constraints under which we are attempting to deal with new operational challenges.

This poster will describe the past workshops and set the stage for Cornwallis XVII, April 2012.

## **Casualty and Medical Logistics Toolset (CAMELOT)**

**M Sinha**

**Dstl, UK**

The Casualty and Medical Logistics Toolset (CAMELOT) Study is developing a suite of interoperable tools for use by deployed Defence Science and Technology Laboratory (Dstl) Operational Analysts in support of operations. The tool suite was produced to fill a capability gap identified during operations in Afghanistan, as tools previously developed to support warfighting operations have limited validity in counter-insurgency operations.

The suite consists of two distinct but interoperable models, one used for Casualty Estimation and the other for Medical Planning. These models can be used in isolation or in tandem to generate a holistic picture. The Casualty Estimation model provides an estimate of Battle Casualty and Disease and Non-battle Injury rates given known inputs and is based on historical analysis. The Medical Planning model takes a casualty profile and uses a stochastic simulation to model the medical requirements such as bed spaces for the expected in-flow, and identifies risks in deployed capability. The outputs and analysis will inform command decisions such as whether to enable mitigations or justify capability surges.

While the initial aim is to provide rapid analysis for operations, lessons identified from the study will also assist capability planning and support changes to defence policy and doctrine.

The poster covers the aims, scope and context of the study as well as the analytical techniques used supported by illustrative results.

## Notes

## Notes