

US Developments in Analysis Support to Operations Other Than War

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Presented at the

Fourteenth
International Symposium
On Military Operational Research

The Royal Military College of Science
Shrivenham, Wiltshire, United Kingdom
September 2, 1997



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INTRODUCTION

The decreasing likelihood of major wars and the increasing commitments to Operations Other Than War (OOTW) by the U.S. military has emphasized the paucity of tools to support the analyses required for OOTWs. The U.S. Pacific Command (USPACOM) initiated a project to define the analysis tool requirements in late 1996. This project generated a set of ten broad requirements for analysis tools [Hartley]. The Military Operations Research Society (MORS) extended this effort through a workshop held in early 1997 [Staniec]. Outputs of that effort included recommendations for research and analytic tools, but also contained assessments of the complex nature of OOTWs and how that complexity influences the development of models and tools designed to support them. That information is now being processed to shape the future of OOTW analysis tool development programs in the United States Department of Defense.

Take, for example, the philosophical shift evident in the area originally labeled Command and Control (C2). Later, Communications and Intelligence were added (C3I). Then Computers were added (C4I). One working group of the MORS workshop addressed the apparent complexity of this area in OOTW by labeling it (somewhat facetiously) C7I3SR. We think this description is warranted and has an obvious effect on the nature of tools necessary to support OOTW operations. We intend to report on this and other findings in the course of describing the potential directions of US OOTW modeling and tool development efforts.

PHILOSOPHICAL BASIS

Hamlet [Shakespeare] says, "There are more things in heaven and earth, Horatio, Than are dreamt of in your philosophy." This could relate to the attitude of the military toward OOTW. The philosophy of combat is simple compared to a philosophy of OOTW. Although a blinding stroke of genius is not required to realize that additional complexity permeates every aspect of OOTWs, that additional complexity must be addressed or success in OOTWs will be accomplished by accident rather than purpose - if success occurs.

Examples abound in both the analysis and the execution of OOTWs. Course of Action (COA) analysis provides one example. In combat, the constraints of the action often restrict COA analysis to route selection. Less constrained situations may support choices among feints, deception and modes of attack or defense. On the other hand, in an OOTW situation the alternatives may be as widely divergent as a naval show of force and playing golf with a high government official!

It may be desirable to approach the problems of OOTW holistically. However, we do not appear either experienced enough or intelligent enough to do so. In such cases we fall back on the traditional method of analysis and synthesis: breaking the problem into smaller parts, looking for solutions to the parts, then hoping that putting the results back together gives a useful result. Replacing C2 or its successors with C7I3SR may not be precisely correct, complete, or entirely necessary; however, it is a step in the direction of coping with the complexity of OOTWs.

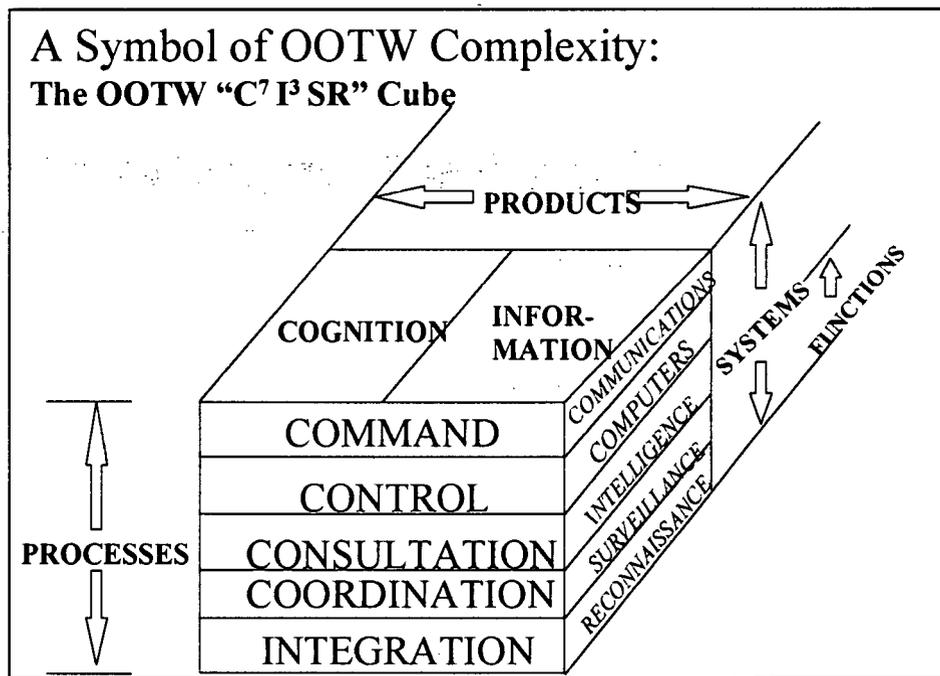


Figure 1: The C7I3SR Cube

Figure 1 shows the components of C7I3SR and their relationships graphically. One set of the components is represented as lying on a dimension labeled Processes. Consultation, Coordination and Integration have been added to Command and Control to complete this dimension.

The second dimension is comprised of Systems that support the Processes. Surveillance and Reconnaissance have been added to Communications, Computers and Intelligence to form this dimension.

The third dimension represents the products of the Processes. These products are Information and Cognition.

The nature of the military involvement in OOTWs precludes the effectiveness of a pure Command and Control environment. Consultation with allies, non-military governmental agencies, non-governmental organizations (NGOs), and private voluntary organizations (PVOs) is required for successful operations. The differences in operating procedures, capabilities and organizational goals require extensive Coordination. To the extent possible, Integration is desirable to achieve unity.

In the United States, Surveillance and Reconnaissance are being recognized as having heightened importance in combat situations in which the linear battle concepts of Cold War times are inappropriate. This level of importance is certainly valid in the much more fluid and uncertain arena of OOTWs, hence the explicit inclusion here.

In combat, Intelligence has been regarded as both a process and a product; however, the word carries unwanted baggage among many NGOs and PVOs. Further, military intelligence products normally carry security classifications, preventing their dissemination among OOTW partners. At the same time, certain information must be shared among the partners, much of this information of broader scope than what is normally reflected in military intelligence products. This information is formally labeled Information. The other product, Cognition, is also required in combat; however, again the cognition required in combat is much narrower than what is required in OOTWs, hence its explicit representation. As difficult as it is to model and analyze C4ISR in operational warfare situations, C7ISR is worse!

OPERATIONAL CONTEXT

Faced with this acknowledged level of complexity of operations and, therefore, complexity of analytic tools, our problem is to organize and manage a program of developments meeting the needs of analysts and operators. One approach to accomplishing this is to consider the interrelationships among warfare operations, OOTW, and the general functions supporting planning and operations. In a Venn diagram, this looks like Figure 2. The diagram conveys the idea that, while operational warfare is distinctly different from OOTW in the mid-to-high intensity realm, there is overlap in the operational realm of strikes and raids, peace keeping, or peace enforcement, and perhaps elsewhere. Similarly, in the areas of operational planning and support, some tools may be unique to warfare operations, some unique to OOTW, but there is a core of tools that are common to both.

Conceptual View of Operational Relationships

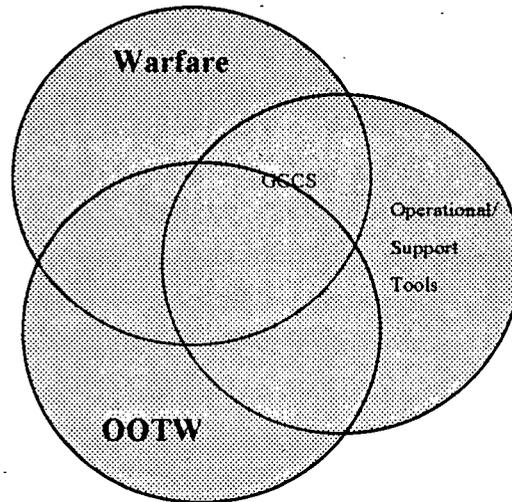


Figure 2: Venn Diagram of Operations Intersections

To see how analytic functions support this structure, consider the following categories of tools and methods (MORS Workshop working groups):

- **Mission Definition and MOE/MOP/ROE Determination.** Tools in this category focus on assisting in defining missions and tasks for an operation, as well as providing sets of measures commonly used in those task areas.
- **Force Planning Tools** support the design of primary mission forces and support forces for use in OOTW, where the primary mission may require forces normally considered as support forces in combat operations.
- **Logistic and Mobility Planning Tools** address the timing and prioritization of logistics support planning and transport planning, including any transport needed for other agencies, coalition partners, and NGOs/PVOs.
- **Effectiveness Measurement and Course of Action Analysis** address COA development, analysis, comparison, estimates of success and casualty predictions, risk modeling, and recommendations. The factors considered include location, intent, cultural and political environment, potential flash points, and centers of gravity.
- **Operational Cost Estimation** addresses methods for computing the cost of conducting OOTW operations.

- **Impact Analysis** addresses methods for predicting where OOTW missions may occur in the future and how to assess the impact of OOTW missions on other missions (e.g. Major Regional Contingencies), defense strategy, and Joint Strategic Capabilities Plan (JSCP) tasking.
- **C4ISR Tools** address the collection of information and intelligence to support the OOTW missions, including information concerning threat, friendly and neutral elements and the environment.
- **OOTW Data Bases and Data Availability** address the gathering of data, what data to gather, how to use data (i.e., answers what questions), and how to maintain data.

If we place these analytic areas into the operational Venn diagram considering the demands of OOTW ranging from strikes and raids through humanitarian assistance, we produce the diagram in Figure 3.

Mapping Tools to Operational Framework

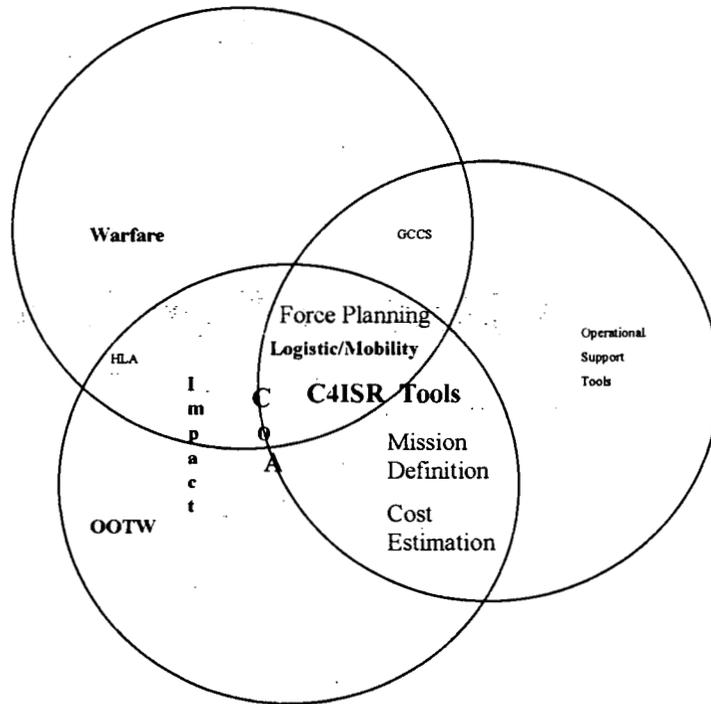


Figure 3: Venn Diagram of OOTW Analytic Tools in Operational Context

Through a careful assessment of the ramifications of these placements, we can arrive at a program of developments of analytic tools for supporting OOTW and operational warfare. Each area of analytic interest can be reviewed and assigned to one of the following categories:

1. Having similarities to operational warfare functionalities, it will be included in the new joint model development, JWARS;
2. Being largely dissimilar in functionalities to operational warfare, but of value to the joint community, it will be managed under a joint development program (This may include joint operational support tools); and
3. Not fitting 1 or 2 above, it will be left to local development.

This assessment is ongoing in the Department of Defense, but based on the PACOM and MORS efforts to date, certain trends and recommendations are evident. We present our assessment of those trends next.

Course of Action Analysis and Impacts Analysis

Across the range of OOTW missions, both Course of Action Analysis and Impacts Analysis have areas of overlap with operational warfare analysis. However, the range of OOTW missions causes us to draw greater distinctions.

Take, for example, Course of Action Analysis. To highlight the disparities in course of action analysis between operational warfare and OOTW, consider the use of the operational planning mnemonic, METT-T (mission, enemy, troops, terrain, time). LTGen Anthony Zinni pointed out the danger of approaching OOTW using this military mindset [Zinni]. He asserted that the trained military mind tends to interpret these in a limiting fashion, characterizing every mission as one having a dominant, operational action as well as a clear "us" and "them." His point was simply that the approach to mission planning for OOTW must be considerably more flexible.

Interestingly, careful thought tends to lead you back to a similar sequence for a mnemonic, but the associated definitions take on drastically different meanings. The MORS working group generated "MASS-PEGIE" (Mission, Actors and Capabilities, Synchronization and Sequencing, Physical Environment, Geopolitical, Informational, and Economic considerations), but frankly we doubt it will catch on.

However, the important point is that the conceptual models of OOTW evoked by "MASS-PEGIE" are quite different from those of operational warfare, and even some basic functionalities are ill-defined for many of these mission areas. As a result, it is likely that a few missions (perhaps strikes and raids, peace keeping, and peace enforcement, for example) will be included in the JWARS requirements, while others will be included in the jointly managed program.

However, even peace keeping and peace enforcement are the subjects of some debate because of the peculiar nature of the interactions that should be modeled. For an operational model to function with minimal scripting, it should be able to emulate the change in attitudes of the non-US "actors" due to our actions -- tracking when and how

neutrals turn belligerent, for example. This sort of activity leads into the realm of Impacts Analysis.

Impacts Analysis

Impacts analysis is an active area of research and development among some groups in the United States and Great Britain [Woodcock and Davis]. This category tends to be broad and difficult to characterize simply. As we grouped it for discussion here (and in the MORS workshop), it addresses needs in two areas: predictive assessments regarding where OOTWs are likely to occur, and true impact assessments of how U.S. actions affect perceptions and thereby influence adversary and coalition partner actions.

Predictive models themselves involve multiple horizons. One application may focus on 7-10 yr. forecasts to influence procurement and force-structuring priorities. A second use may address two-yr. forecasts to allow prioritization of resources, training and proactive ramp-up for vulnerability to natural disasters, presence and persistence of internal conflict, economic conditions, presence and persistence of political crises. Still a third may produce three-month forecasts mainly concerned with identifying which potentially unstable countries are most likely to transition to actual conflicts, or are most vulnerable to natural disaster threats and other conditions which drive the National Command Authority to task combatant commands.

Similarly, impact assessment tools may be used in planning and executing operations to study perceptions internal to the operation. Or they may be used to study external perceptions concerned with how U.S.-led actions, including successes and failures, affect our ability to deter other adversaries or attract support from allied forces for joint actions. Moreover, they could be used to study how success and failure influence the way future U.S. operations are conducted. For example, we may wish to assess the message sent to terrorists when U.S. remained in Saudi Arabia after the residential area bombing, or to consider the impact on future operations after the death of the Rangers in Somalia.

Models and tools in this category have a long list of desired characteristics to provide maximum utility: empirically time-tested, robust, adaptable, quick and easy to use, cost-effective in data collection, useable in combatant commands and above, variable by mission and operational level, transportable, with assumptions available, but unchangeable by user. Fully proven tools are in short supply, but there is a significant need that is being filled by existing models in the short-term, rather than denying operators use of any tools until they are perfected.

Promising models found by the MORS workshop include, among others:

- Forecasting Political Instability Model [Evidence Based Research],
- DEXES,
- SPECTRUM,
- CANs,
- SIAM Influence-Net Modeling,
- Conceptual Model of Peace Operations (CMPO) [Davis],
- Normality Analysis Process, and
- Grey Team Gaming.

Of particular interest are DEXES, being used and developed by US Southern Command for instability analysis and for training exercises, and George Mason University's CMPO, because of its applicability to mission analysis. However, the feeling of the MORS working group was that substantial research is required in this area before widely applicable and accepted models will be available. Development of prototypes, development of a supporting OOTW database, and basic research on past operations are among the activities proposed. As we consider the positioning of these tools within the warfare/OOTW domain, the conclusion is emerging that whatever tools are finally designated for development in this category will not be part of the JWARS model, but rather developed within the oversight of the joint management program.

Command and Control:

We have already addressed the complexities of OOTWs that elicited the C7I3SR framework in the MORS workshop. In a separate white paper, Starr, Haut, and Hughes developed the dimensions in which OOTW and conventional warfare differ in the categories of mission, operational principles, information, and analysis [Starr, Haut, and Hughes]. They observed that OOTWs tend to be characterized by unity of purpose rather than unity of command, and that situational awareness involved a more complex set of information, where similar information might be disseminated differently in many limited circles. It was their conclusion that analysis would depend more on individual behaviors and "soft" factors focused on political-military and societal measures, resulting in difficulty performing and integrating analyses.

As a result of these considerations, they saw a need for specialized information management tools to support OOTW. The MORS workshop described these tools as a strategic information framework supporting the C7I3SR concept, a database to instantiate it, and tools for analysts to mine data, to compress information from it, and to visualize that information. Finally, recognizing that any strategic database will be incomplete, the working group suggested an "electronic rolodex," perhaps implemented via the internet to connect operators and analysts with world-class data sources and experts in support of OOTW operations. These recommendations, while not explicitly adopted, are being discussed and considered in DoD.

Force Planning and Logistics

Extensive work has been done over the years in the categories of force planning and logistics planning tools. In fact, in these categories, the MORS workshop found a number of useable and capable tools ranging from force building, through mobility, and into logistics. However, they were not without some need of work. Current force building tools have been limited in true jointness and, for OOTW, integrated applicability.

The MORS group felt DoD could sort out the models for infrastructure analysis, supply and service estimating, and lift requirements to determine "legacy" models for joint maintenance. The decision has already been made to address these needs through the Analysis of Mobility Platform (AMP) program.

AMP, under development for several years, is a natural choice. Originated as an integrated suit of tools for mobility analysis, it has been designated as a Joint Analytic Model Improvement Program system and is compatible with the Global Command and Control System (GCCS) and the Global Command Support System (GCSS). Its capabilities are already targeted for interface with JWARS. However, it will need moderate changes in the near term to suit OOTW applications by including extensions to cover allied, non-governmental, and private volunteer organizations.

Mission Analysis and Planning

Though a mission analysis and planning tool is one of the first that comes to mind when faced with a possible OOTW, its development has provided a significant challenge to analysts. Again, the diversity and complexity of OOTW missions has been more of a challenge than the technology to implement it. Nevertheless, the value of a good tool, even a fairly simple one, is evident. The MORS working group recommended historical study of OOTWs to help characterize the mission-to-task breakdowns necessary for this capability. However, the process for mission definition evaluations seems to be well-developed in the Conceptual Model of Peace Operations mentioned earlier. The influence-diagram process demonstrated so far for peace keeping and peace enforcement would be equally applicable to other missions. Such a capability, properly interfaced with force building and course of action tools, can save analysts and operators significant time in mechanical operations and allow them more time for analysis and thought. Because of its analytic and operational use, it should be developed within the joint program.

Operational Cost Estimation

The final category of consideration is a tool to provide early rough estimates of the incremental cost of a specific proposed OOTW. Though there are costing tools available, none is widely accepted and supported by accurate data. The goal of this tool would be to provide a single tool, useful at several levels, as shown in Figure 4. It would also interface with several other models and tools to share data and provide fast estimates

of cost implications of various missions and courses of action. The knowledge exists to build this tool now, providing decision-makers better visibility into the resource implications of decisions. Our recommendation is that it be included in the joint development program.

WHO:	Generic	Engagement Decisions	Alternative Course Evaluation	Cost Recovery & Reimbursement	Low Level Budgeting	Cumulative Resource Impacts	"Actual" Cost Accounting
NCA		X					
OSD/JCS	X	X		X		X	
CINC		X	X	X		X	
Services Unit			X	X	X	X	
Policy Analysts	X				X		
Other	X				X	X	X
Type of Costs:							
Incremental	X	X	X	X	X		X
Full			X	X	X		X
Accuracy (+/-)	50	35	30	30	15	50	"actual"

Figure 4: Cost Model Characteristics

Data Management and Data Availability

One observation of the MORS workshop was the identification of data management and data availability as a "center of gravity" for OOTW. Though it has long been recognized that data is the lifeblood of analysis, the need is particularly acute for OOTW. Each analytic category discussed above brings with it its own need, frequently for more and different data from that we have typically collected. The problem is exacerbated by the fact that much of the data we have gathered in the past contributes little value to the kinds of analysis we would like to do. Technology will help somewhat as distributed information becomes more widely available via the internet and other electronic means for planning and analysis, but a carefully designed database is necessary, as well as a way to manage it. Though these things are among the recommendations of the MORS workshop, and have been cited by DoD analyses such as Dynamic Commitment [JCS J-8], the reality is that progress will be paced by availability of funds and our own "dynamic commitment."

Summary and Conclusions

A considerable amount of thought has been invested and a considerable amount of progress has been made in the United States in organizing the analytic and operational communities for Operations Other Than War. We understand much better what it is that operators and decisionmakers are looking for. And we appreciate the complexities of the operations we must deal with. As we discussed here, in several areas, progress has been sufficient to allow us to begin planning for tool implementation. Other areas require more research. However, the DoD has begun necessary steps to fully organize a program of developments that will lead to significant advancement in the tools of the trade for OOTW.

Postscript

Dr. Dean Hartley is currently orchestrating these activities for DoD, with the intent of fully defining the content of the two programs we described above. You, the user and analysis community are invited to assist in the process over the next weeks via the internet. Current information under consideration will be posted on the world wide web at <http://voyager.msosa.dmsso.mil/sig-ootw-open>. You are invited to read, comment, and provide information

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JCS J-8 Dynamic Commitment

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