Finding Robust Definitions for Feedback Stability Indicators in Counter Terrorist Operations

Mr. S. Anders Christensson

Project Manager
Swedish National Defence College
Department for War Studies
Research and Development Section.
Stockholm, Sweden.
e-mail: S.Anders.Christensson@FHS.MIL.SE

Alexander E.R. Woodcock, Ph.D.

Chair, The Cornwallis Group
Director, Societal Dynamics Research Center
Senior Research Professor, School of Public Policy
George Mason University
Fairfax and Arlington, Virginia, U.S.A.
e-mail: aerw@gmu.edu.

S. Anders Christensson is the project manager for STRATMAS project at The Swedish National Defence College (SNDC), Institute for War Sciences, Research and Development Division. He is also a Ph.D. candidate at Royal Institute of Technology Institute of Numerical Analysis and Data logics. He where project manager for project Aqua at SNDC and co-inventor of a multiple stereoscopic viewing environment as well as other decision environments for medical and military use. He is Associate Director of the Societal Dynamics Research Centre and Member of the Royal Swedish Academy of War Sciences. Previously he was at Swedish Defence Materiel Administration as a project manager for development of research Command and control laboratories.

Alexander E.R. (Ted) Woodcock is Director of the Societal Dynamics Research Centre and a Senior Research Professor in the School of Public Policy at George Mason University. Previously he was Chief Scientist and Vice President at BAE SYSTEMS (formerly Synectics Corporation), Fairfax, Virginia. He is a Foreign Member of the Royal Swedish Academy of

War Sciences. Woodcock is also a Guest Professor at the National Defence College, Stockholm, Sweden, and was a Visiting Professor at the Royal Military College of Science, Shrivenham, England for 10 years. He is actively involved in the development and implementation of societal dynamics models of military, political, economic, and other processes for the modelling and analysis of low intensity conflict, peace and humanitarian operations, and related areas. Woodcock is Project Director for the Strategic Management System (STRATMAS) project that is producing a facility that uses genetic algorithms and intelligent automata methods for the definition and optimal deployment of civilian and military entities in peace and humanitarian operations. Woodcock is Chair, Proceedings Editor, and a Founding Member of the Cornwallis Group. He has a Ph.D. in Biology and an M.Sc. in Biophysics from the University of East Anglia in England, as well as a B.Sc. (with honours) in Physics from Exeter University in England. He is a Full Member of Sigma Xi.

ABSTRACT

What indicates that the desired end state for an operation or mission has been reached? Are the indicators selected for that purpose appropriate to provide an unequivocal output that signifies that a particular mission has been accomplished? Can indicators generate numerical outputs that actually reflect the complex internal dynamics of systems of interest? In particular, is it possible to produce robust definitions for feedback stability indicators for use in Counter Terrorist Operations? What happens when members of a planning staff have different professional, cultural, and ethnic and/or religious backgrounds or national origins? A real need exists for operational facilities that can harmonize and integrate such differences. Strategic military planning requires the definition of an End State and the selection of indicators that can identify when such a condition has been achieved as well as the progress being made during execution of an operational plan. In Effect-Based Operations those activities require a direct statement of the nature of the Effective End State and specification of what effect the planners are striving to create.

The paper describes work that is being undertaken at the Swedish National Defence College and elsewhere to develop a new understanding of operational planning processes and to provide enhanced facilities to support those processes. In particular study of the behaviour of dynamical systems can provide useful information for use as indicators of system behaviour. Indicators that reflect the properties of models of an operational environment can provide significant advantages and support to operational planning processes. Development and use of the DMSCupol facility to support operational planning as well as the Strategic

Management System (STRATMAS) to support the analysis and assessment of operational plan effectiveness and some of the capabilities of those facilities is outlined in the paper.

BACKGROUND

The Swedish Armed Forces are financing development of networked-enabled and focussed defence capabilities. Related work at the Swedish National Defence College (SNDC) is concentrated on the development and use of a decision environment to do research on group decision-making. The SNDC is setting up experiments in the SNDC laboratory involving new software methods, procedures, and hardware in order to produce an increasing understanding of military and other processes and how they might be commanded and controlled in order to achieve desired outcomes.

In order to support these activities and to bring some unity to the various discussions, requirements, and viewpoints, an artist was commissioned in 1996 to provide a rendering of the concepts expressed by project scientists in a visual object. The picture created by the artist and scientist team has served as a starting point for further discussions on the design of a future Swedish command post capable of being responsive to new and emerging challenges (Figure 1). This paper reports on some aspects of that work by describing the need for robust indicators that can provide information on the nature and success of on-going activities and phenomena of interest to military commanders, planners, and analysts. The paper also reports on how production of such indicators can support the ongoing research for a networked-enabled Swedish Command Post of the Future based on these and other concepts.

Figure 1: Artist's concept of the envisioned future Swedish Command Post.

INTRODUCTION

The paper describes efforts that have focussed on the production of indicators and their use to support plan development for a range of different types of operation. Indicators can provide information on the nature of the conditions under which an operation should be undertaken, how well an operation is proceeding, and whether or not a desired end-state for the operation has been achieved. As well as a range of purely military operations, there is also a critical need to provide indicators to identify terrorist threats and support counter-terrorist operations. Such indicators would provide insights into the effect of the operation on both the military and the wider civilian aspects of the overall conflict environment.

Such indicators could be based on, and reflect the nature and constraints imposed by, intelligence data, political resolutions and mandates, and the nature of the mission given to a commander by subordinate political entities. For the purpose of this paper it is generally assumed that a military commander would be involved in dialogs with political executives in order to define a future mission and the political indicators. This commander would also work with other military forces, and perhaps selected civilian entities (agencies), that have

interests in achieving a politically-defined End State[1] with indicators.

The nature of the indicators used to provide information on overall progress is of course dependant on the nature or phase (such as the US-defined Phases I, II, III, or IV) of an overall operation, such as counter-terrorist operations that involve actions by both military and civilian entities. As an example, Phase I activities might involve co-ordinated military and political planning, Phases II and III may involve mainly military actions and relatively high intensity conflict, and Phase IV can be a transition to politically-controlled activities, for example. Different indicators might be appropriately used during these different phases to reflect military, civilian, and other activities.

In the case of the activities of a strategic military staff, each member would generally use their training and experience in different activities and operations to support planning activities. Such individuals would normally be capable of extrapolating from those experiences to create an appropriate level of understanding and knowledge needed to meet the needs and problems associated with the new planning environment. Introspective thought may have permitted a review and analysis of prior events and activities that were initially difficult to understand and the creation of more appropriate perceptions as well as new levels of understanding and knowledge.

The creation and use of models and simulations such as for example the use of SimNet technology by the University of Central Florida to create a representation of the battle of 73 Easting in Operation Desert Storm can provide new insights for military planners and others. Computer-based models can provide an environment for reviewing actual operations and assessing the impact of changes in the planned deployment and use of military and civilian assets on the overall outcome of those operations.

INDICATORS AND THEIR USE

Indicators are developed in many organisations and used for many different purposes. Each of those organisations exists in different environments and cultures and work in different contexts to solve specific types of problem. It is therefore important to develop indicators that represent properties of interest to the organizations themselves. Indicators not for

[1] After the Cornwallis IX workshop we have learnt that this can be compared with the latest hot topic in military domain namely effect based operations, effect based planning etc.

performance of the organisation but indicators of the effect an action the organisations is doing. In this paper two sets of indicators will be outlined. One of these indicators was developed by The Commission of the European Union to represent levels of conflict, the other presented by The Columbia International Affairs Online to provide an indicator-based checklist for post-conflict recovery. Information will also be provided on indicators that are based on the properties of dynamical systems.

Indicators can relate to real or abstract properties or entities. The use of abstract indicators may cause difficulty when attempts are made to use them during rapidly changing crises or in conflict-related actions where there is little time to understand the nature of the constructions used in the formation of abstract indicators. Military actions in phase II&III may cause disruption in societal processes that do not respond within the timeframe needed if Military control was of interest. Social processes that take long time to restore during Phase IV operations.

It should be pointed out that some controversy exists with regard to the development and use of indicators. As an example, Dr. Birger Heldt at the Peace and Conflict Research Centre at Uppsala University claims that according to his research all definitions (with the exclusion of indicators based on the properties of systems dynamics) are generally poor approximations of reality and are not well suited for statistical research analysis. This could create problems for those asked to give advice on the development of indicators to support anti-terrorist activities, for example. However, if we turn to system sciences and system dynamics then those areas may be able to provide advice and guidance on the construction and use of appropriate sets of indicators.

EUROPEAN COMMISSION CHECK-LIST FOR ROOT CAUSES OF CONFLICT

The European Commission checklist on the root causes of conflict is outlined below may provide guidance for the production of a set of indicators to be used for assessing overall political and societal stability and the possibility of conflict and disintegration of existing governmental and other structures in countries of interest, for example. The European Commission Check-list identifies the following types of factor:

- The Legitimacy of the state:

- Are there proper checks and balances in the political system?
- How inclusive is the political/administrative power?
- What is the overall level of respect for national authorities?
- Is corruption widespread?

• The Rule of Law:

- How strong is the judicial system?
- Does unlawful state violence exist?
- Does civilian power control security forces?
- Does organized crime undermine the country's stabilities?

• The Respect for fundamental rights:

- Are civilian and political freedom respected?
- Are religious and culture rights respected?
- Are other human rights respected?

• Civil society and media:

- Can civil society operate freely and efficiently?
- How independent and professional is the media?

• Relations between communities and dispute-solving mechanisms:

- How good is the relation between identity groups?
- Does the state arbitrate over tensions and dispute between communities?
- Are there uncontrolled flows of migrants/refugees?

• Sound economical management:

- How robust is the economy?
- How sustainable is the state's environmental policy?

• Social and regional inequalities:

- How are social welfare policies addressed?
- How are social inequalities tackled?
- How are regional disparities tackled?

- Geopolitical situation:

  - How stable is the region's geopolitical situation?
  - Is the state affected by external threats?
  - Is the state affected by regional stabilities?

European Commission checklist for root causes of conflict may be used to guide the development of indicators to represent the scale of conflict in different scenarios. Subject matter experts may interpret the checklist when plan is generated. However the components of the European Commission checklist are based on European values. Therefore, care should be taken if the checklist is used to define indicators and compare those indicators with properties and events in other cultures. Under those circumstances the use of European-based indicators may be counter-productive since they may suggest actions which would be culturally-inappropriate. Furthermore, it is certain that the checklist needs to be increased in scope in order to provide the basis for defining sets of indicators that reflect the outcome of activities and processes responsible for creating terrorist groups and generating terrorist acts.

One can identify in the writing of Thomas Aquinas (1224-74) patterns for thought that are reflected in the European Commissions' checklist. Aquinas states *auctoritas principis*, in the checklist this is formulated as *legitimacy of the state*. According to Professor Jan Hjärpe, University of Lund Sweden, the legitimacy of the leadership of the state involves acceptance by the overall population of a country or nation of laws, rights, and other entities formulated and the population accepts that. Such an acceptance is instrumental in conferring power to lead the country or nation on the leader. While such processes are the norm for western democracies, that may not be the case for Islamic, and perhaps other, countries, and other definitions of legitimacy, perhaps based on religious doctrine, should be developed for those cases.

With respect to the Commissions checklist and the 'Relations between communities and dispute-solving mechanisms' and 'uncontrolled flows of migrants/refugees' categories, it is necessary to answer the following questions: Is it possible to define an indicator that reflects the flows of refugees and displaced persons that could be measured during an operation? Or should we develop dynamic market indicators that reflect the amount of people that is moving back and returning over the boarder. Is the spontaneous market indicator a better indicator of returning refugees for Afghanistan then a pure flow of refugees since Afghanistan has been involved in war for some 30 years and hadn't time to develop a European relevant indication. Is this relevant if we would like to have indication on

'Relations between communities and dispute-solving mechanisms'. The country may have a market but is it possible to measure their market in the same way that European patterns of behaviour are measured based on a European understanding of what constitutes a stable market? Can we measure refugee flows in Afghanistan in the same way in Europe?

We may define indicators but they may have to be divided into hierarchies that are capable of satisfying the need for indicators that reflect basic properties of an environment (such as percent without food, water, shelter and so on) as well as more abstract properties such as disaffection and ethnic violence, disaffection, and political polarization, for example. What do this hierarchy look like? Can it be used in strategic/operational planning of interventions?

COLUMBIA INTERNATIONAL AFFAIRS ONLINE

The Columbia International Affairs Online (CIAO) focuses on post-conflict recovery analysis. By stating essential elements in different areas they create in informational structure that provides an overview of relevant facts and data for a country during crises, post-crisis, post settlements, and long term reconstruction. The CIAO informational structure appears to be capable of providing guidance for the construction of and definition of indicators for the range of activities mentioned above.

INDICATORS CAN BE BASED ON THE TYPES OF DYNAMICAL BEHAVIOUR EXHIBITED BY SYSTEMS OF INTEREST

A very different approach to the construction of indicators draws on an understanding of the nature of dynamical systems, particularly of the types of behaviour exhibited by such systems. Definition of indicators based on system behaviour requires the definition of the state or key variables at work in particular situations. It is evident that even simple dynamical systems can generate very elaborate, and even chaotic, patterns of behaviour. The following list describes the different types of behaviour that could be exhibited by dynamical systems under different conditions.

- Damped oscillations where key variables tend toward final fixed values

- Changes are getting smaller, and eventually stop.
- Information mimicking; Information is forgotten. Its not carried away.

- Cyclic solutions, repetitive or spiral, sometimes nested or fractal to its solution

  - Change is still taking place, but is concentrated into small regions.
  - Information mimicking; Information is not communicated.

- Chaotic patterns that emerge from the dynamics

  - They can have periods with pure stochastic pattern and suddenly switch to patterns of local regularities.
  - Change is spreading and is involving all parts of the system.
  - Information spreads over large distances. Local interactions generate global patterns.

- Pure stochastic patterns where finding any order is difficult

  - Change is spreading sporadically.
  - Information is switching between to not be communicating and suddenly spreading regionally over large distances. Interaction is not involving the whole system.

If we where to construct indicators we will probably look on direct and indirect indicators. These may behave according to the four archetypes provided by the study of dynamical systems. Still each indicator that reflects either the European Commission list or the CIAO checklist has to be defined at planning stage and hopefully be useful as a measur.Is a merge between system dynamics view on European and CIAO checklist possible? If this is possible when in the planning procedure should we define them? How should the method be constructed to define a systems dynamic guided indicator for European checklist or CIAO checklist?

THE PLANNING PROCEDURE ADOPTED BY THE SWEDISH ARMED FORCES

The Swedish Armed Forces have adopted the NATO Guidelines of Operational Planing

(GOP) to support their operational planning activities. This procedure can involve the activities of strategic planning group(s) who are involved in receiving data and information, assessing its validity and using those inputs to address the problems at hand. We can consider the actions of an overall planning staff involved in analysis, assessment, and plan development. The input data may contain the following generic elements as taking place internally, or within some form of notional black box environment.

- United Nations resolutions and related information, generally received from international sources, which defines the need and provides justification for the mission of interest.

- The overall mandate and supporting documents and other materials for the mission, perhaps provided by national government-level sources in for the troop-providing nations in an international mission.

- Data and information on the country of interest.

- Current and timely Intelligence from the country of interest

These data and information elements can be input to the planning staff. In the secure environment, the staff might be involved in reading data and information inputs, assessing the reliability of those inputs, inferring the meaning of the input, and developing concepts of operations that address the essential components of the overall mission. The output from the secure analysis, assessment, and planning environment could contain the following elements.

- Who should do what, if just military resources are used then this '*who*' should contain military unit names, a specification of what they are assumed to do and the nature of the effect the staff is expecting to accomplish. In order to assess the effect of planned activities it will be necessary to define an appropriate indicator set that permits an assessment of the effectiveness of planned activities. The plan might also contain lists of default or back-up entities that would perform specified tasks where primary units were not capable of action, for example.

- Where the activity should take place. Location-related information should be provided as a key element of an operational plan in order to insure that all key operational areas are covered, and that inappropriate deployment does not create errors or vulnerabilities.

- When should the activity take place. Time-related information should be provided in order to insure that the overall plan does not contain any time-gaps, or the requirement that entities perform tasks at times and for durations that are physically reasonable.

If a measure of staff performance is needed it could be obtained from measurements of the output from the staff in different ways. One such measure could involve the time taken to produce an order that contains who, what, where, and when list? Another performance measure could be based on an assessment of the completeness of such lists. A third measure could reflect the relevance of outgoing list seen from a military theoretic point of view. Againwe assume military resource are dominating the scenario. If one could measure one could state questions if best of military practice is considered? Given a fix repertoire of scenarios and background data the staff can have procedural support or not and this will reflect the out coming result of there planning activities.

If we are able to look inside the 'black box' that we have created to contain the staff planning activities, we would be able to identify process, procedures, and procedural products associated with planning staff activities. The methods actually employed by the staff might either hinder or facilitate plan production. Procedural planning products would provide co-ordinated lists of who does what, where, and when. These planning products would be defined according to the NATO GOP version specified in 1999 (used because that version was available as an open-source document). We argue here that these procedural planning products are the items that the staffs have to develop because otherwise the staffs have not understood the meaning and context of the mission. The strongest use of the procedural planning products is to mediate the staff awareness of the content of the orders, how those orders should be formulated and the indication of effects.

THE TIME PLANNING PERSPECTIVE, ROBUST PLANNING, AND DIRECT AND INDIRECT INDICATOR REQUIREMENTS

The staff in the black box, military officers (as well as diplomats, non-government officers, and international based organisational officers under appropriate circumstances) may be tasked to develop plans to intervene in an appointed country or to undertake other types of mission. By tasking members of a staff to co-operate in the development of a plan they are struggling with many different problems at the same time.

Each of the staff members and other participants brings their own perceptions, training, and experience to the planning process. As a result they will possess different internal models and perceptions of external processes and could make different projections about future behaviour. As an example, we will describe possible planning and future assessment activities of a notional planning group formed from six individuals with different experiences and training who have been asked to asses the levels of future violence over the next 1 to 2 years in an notional area of operations. Figure 2 shoes the results of this request and displays the superposition of the time traces of the six individual patterns of projected violence formed as a series of colour-coded dots. In this case, the number of dots has been reduced to a minimum in order to prevent over-crowding of the illustration.

Figure 2 shows the perception of the level of violence at different times during a future operation of six notional individuals involved in the operational planning process. The six planning staff members are involved in activities that are trying to sort out the type of end state to which they should aim as well as the critical issues or centres of gravity that can be resolved in order to achieve the desired end state. Most if not all of the planners may have experiences in the planning and execution of similar operations. Such experiences may represent the best knowledge available to support the planning for the subject operation. As a team, it will be necessary to build common ground and exchange experiences and apply their joint knowledge and understanding to the mission operational mission planning through the identification of an event trail through which they define a desired series of events aimed at achieving a specified end state.

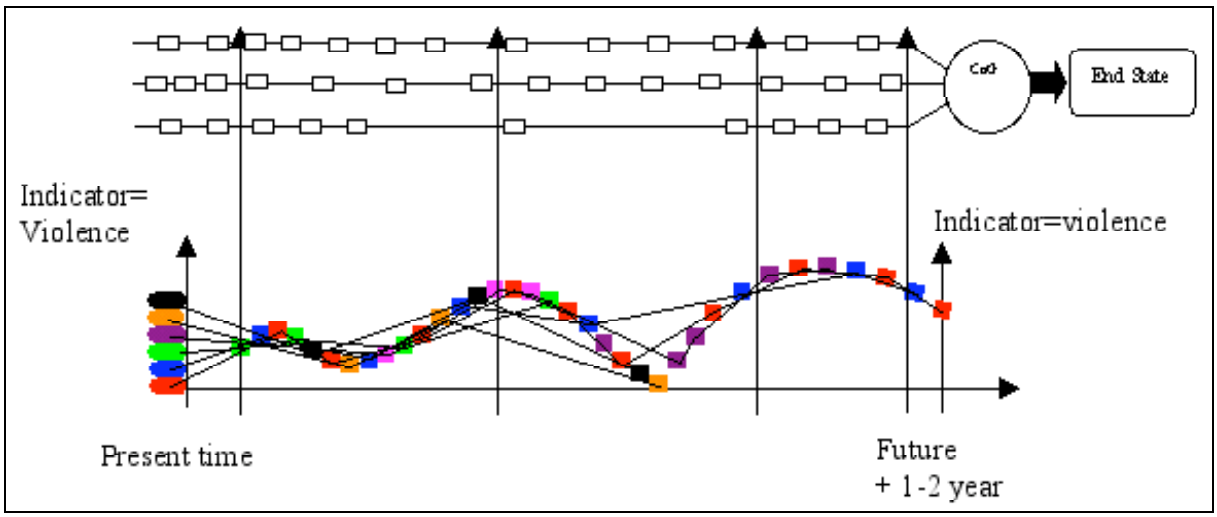

Figure 2: Strategic military group modelling of a plan.

These events are matched to their knowledge, experiences, intelligence and logic. This is illustrated by the trail of dots shown in Figure 2 that are linked to the combined experiences and logic possessed by the team. If the team members where to choose and define indicators that represent violence levels then their resulting consensus might be plotted like the coloured dot-trail of events along the time axis indicating defined events that were needed to happen during the execution of an operational plan. The levels shown by indicators representing the actual level of violence associated with a societal system of interest, for example, could be estimated at specific times and reported to the planning staff in order to provide estimates of the success achieved in plan execution.

Following the patterns created by the coloured dots on the time axis (Figure 2) it is possible to observe that each staff member may be extrapolating from current activities to possible future events without the use of feed-back knowledge that could be used to support plan modification and enhancement. It is possible that the combination of the experiences, internal world models, and perceptions of the six notional planning staff members might lead to the production of a more robust plan that could provide contingencies for a wider range of possibilities than a plan produced by a single individual in isolation. The planning process could be further enhanced by the construction of facilities that support the definition and use of indicators that provide feedback information in a precise and timely manner and support plan modification, for example.

It is also necessary to consider the two different mechanisms of direct and indirect interaction caused by an intended, planned tasks and the effects that they will cause. Different activities and processes should support caused effect in order to support the development of a suite of indicators that can provide sufficiently comprehensive operationally based information to a planning staff. The STRATMAS facility, mentioned below, uses both direct indicators (such as the percentage without food, water, and shelter) as well as relatively indirect indicators such as disaffection and level of ethnic polarization) to provide feedback to its users.

Direct and indirect interaction mechanisms may require the definition of different types of indicator in order to provide appropriate levels of information to a planning staff, for example. Direct interactions occur when a task directly causes an event concern. An indirect interaction appears when a task is indirectly leads to an event, through its interaction and impact on other factors that in turn will interact and produce an event of concern. Our planning team may tend to see fewer effects coming from indirect interactions than direct interactions effects. Indirect interactions effects may occur when blue soldiers take action on resident population and the population is responding in a violence level. This raise in

violence level may produce a growth environment for terrorism. To identify an individual as a terrorist based on his or her pattern of behaviour before they have undertaking a terrorist event can be extremely difficult. Even more difficult is the task of unravelling the reasons why a particular individual might actually be a terrorist. Such reasons may be based on events only indirectly interactions and linked to other mechanisms. Direct interactions such as interactions between soldiers on a battlefield are easier to develop tactics for.

If we do not see the result of indirect interactions as clearly as we do the results of direct interaction, we mostly need support to infer the indirect interaction. This support needs to be developed. We argue that the staffs has to consider in the future planning processes more indirect interaction indicators as well as the direct interactions indicators in stated End State, the Centre of Gravity, the Lines of Operations or operational functions, the Phasing of tasks and the Decision Points that they define.

There is a need for notational systems that capture the dynamics of political and other types of systems and generate information that could be readily parsed and analyzed by man and/or machines. This notational system should support a user when (s)he experiments with direct and indirect interactions either alone or in groups. There is also a need to identify who should have the responsibility to define the indicators needed to support operational planning and assessment. Should this task be undertaken by political executives, by strategic military executives, or by specialists in political science based on their research on failing states and related issues?

Furthermore, is there a possible relation between the indicators that the political executive branch is using and those that a strategic military planning staff could use? If so what would those indicators look like? If it is the strategic planners who construct the plan they also should be directly involved in defining the indicators, as well as their dimensions and scale. These tasks demand the attention of a skilled staff who, ideally, might make choices from a pallet of indicators already constructed by analysts and other specialists based on extensive research and practical experience. These matters are of continuing interest.

DEVELOPING AN INTERVENTION PLAN

As mentioned above SNDC adopted the NATO Guidelines of Operational Planning (GOP) to support her operational planning activities. In doing so Sweden discovered that the procedure lacked mechanisms to trace the internal processes (which we refer to here as ‘black box’

processes) used by a staff when developing planning products. SNDC then undertook studies of the nature and location of this demand in the overall operational process. These studies showed that the NATO Guidelines of Operational Planning was a procedure that needed additional software support. Identified needs included the following.

- The processes and procedures for assigning planning tasks as well as the product or output created by those tasks should be able to be stored, retrieved, altered, and stored again.

- The product and information on the context within which the plan was developed as well as all relevant planning products created by a planning staff should be able to used on-demand in a distributed, group-oriented, manner.

The 1999 version of the NATO GOP has been interpreted according to SNDC strategic and operational procedures. Although this was well documented it was not really sufficient to SNDC needs. This led to requests to industry in order to identify the ways in which industrial processes trace who-does-what? when? where? how? and why? within an overall organization. This request led to the identification of the Quality Function Deployment (QFD[2]) methodology as a possible solution to the needs identified above. The QFD methodology has been demonstrated both to cut costs and to reduce the length of the time-to-market period of manufactured goods. The Defence College has supported research activities that interfaced the QFD technology with the NATO GOP procedure and provided enhanced functional capabilities for the overall entity. These activities led to the production of the DMSCupol facility, which is described in more detail below.

COURSES OF ACTION ARE PRODUCED IN DMSCUPOL

DMSCupol consists of many interacting components. The output of some of those capabilities that are responsible for generating the schema for the operational planning process of DMSCupol are illustrated in Figure 3. All DMSCupol documents are stored within a folder hierarchy, elements of which are shown in Figure 4. The core of the facility is a networked client server-based document management system (DMS). All storage, retrieval, and on-line and off-line functional capabilities are interfaced through an XML-based schema format.

---

[2] QFD was also used to structure The Defence of the Homeland process.

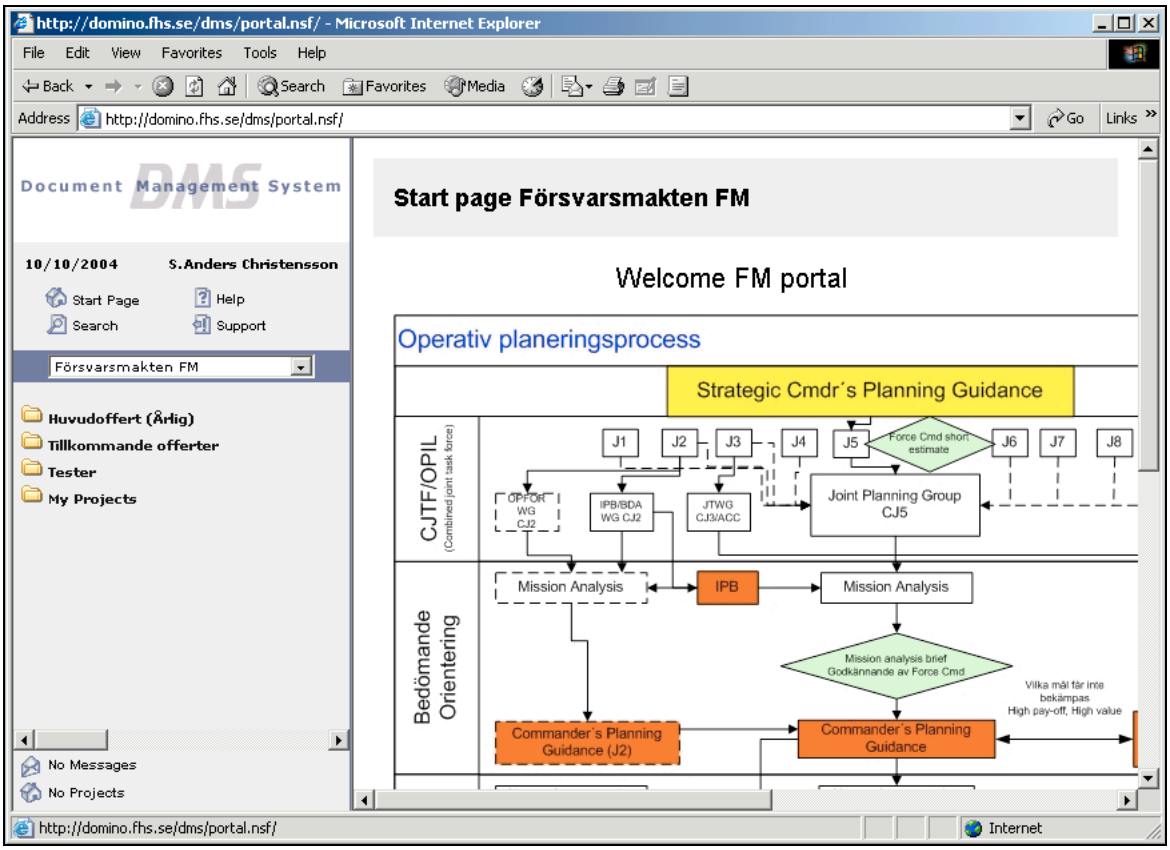

Figure 3: DMSCupol. The operational planning schema is shown on the right-hand side of the illustration.

The document management systems of DMSCupol is interfaced to various types of MS Office software such as Visio™, Word™, PowerPoint™, and Excel™. A staff member or group of staff members may draw the structure of a plan with MS Visio™. The NATO symbols are added as templates in order to support user activities during their development of Courses of Action (COA) in support of overall operational plan development. Figure 5 shows a COA score. Each NATO symbol appearing in the COA is interfaced with XML-based routines in order to link all produced documents to the overall COA document.

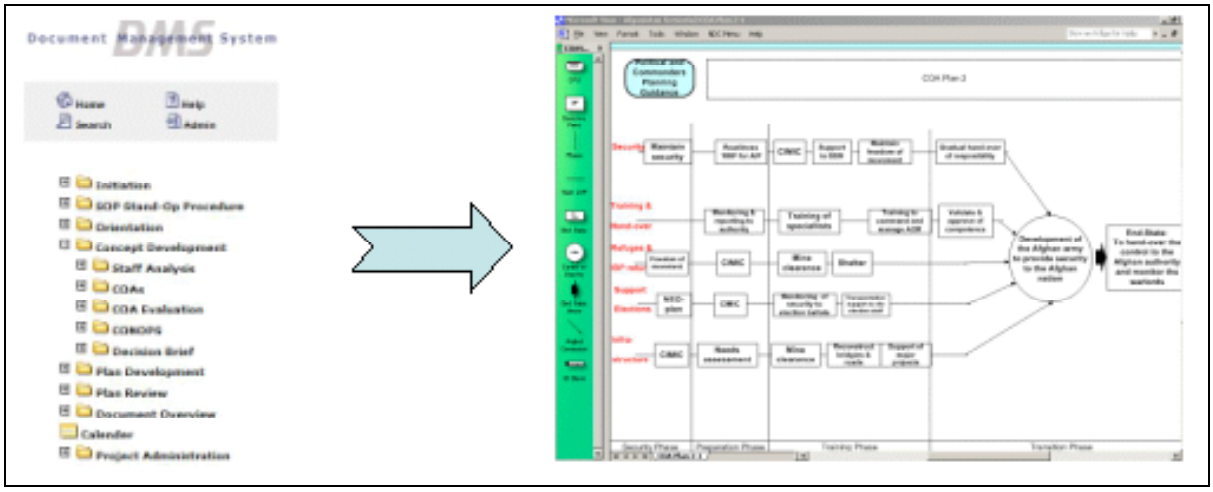

Figure 4: DMS Folder hierarchy. *Figure 5:* A COA Operational Score.

ALL PLANNING DOCUMENTS ARE MANAGED
THROUGH DMSCUPOL

The document management system in DMSCupol administrates all associated documents through its drawing capabilities, which are functionally supported by MS Visio™. The choice of MS Visio™ was made because it was the drawing tool most widely used by top executives. The user draws a COA Score with MS Visio™ and through XML tagging can inter-link all documents and store all components in a database. Adequate data handling capabilities can be provided by use of the IBM Domino-server. That server can handle several thousands of simultaneous users involved in producing and up- or down-loading documents from remote platforms.

The Document Management System (DMS) was developed initially in response to the demands of a construction firm and had been used for several years with several thousand of simultaneous users that uses and administrating 3-4000 separate projects all over the world. DMS has successfully interfaced MS Word™, PowerPoint™, Excel™, map-based or BLOB-based software in the production of documents for the construction industry. Analysis of the DMS facility demonstrated significant potential for its use as a basis for production of the facilities needed to support Swedish operational planning activities. The Swedish National Defence College, together with the vendor (Develop Europe AB), interfaced the NATO GOP procedure with QFD and the DMS system.

Figure 3 shows a NATO GOP structure that supports the composition of the process-related products that a staff should generate during a planning activity. Figure 4 presents the

folder hierarchy that is generated by the procedure. Here it is possible to load up and provide templates to support staff members during their planning process activities. Figure 5 shows a specified operational planning product linked to the operational scenario. It provides a representation of specified NATO planning products, the specified operational End State, the Centre of Gravity, Lines of Operations, Decisive Points and the appropriate Phasing of the complete set of planned actions.

In summary, all documents developed staff members are linked to the Operational Score. Under these circumstances, a commander is able to get a quick orientation of all the resources in the same way that an orchestral conductor can get an overview by looking at a musical score. A commander and his (or her) staff can easily determine the total production of documents produced by the planning process by just clicking on symbols in the Operational Score. A staff member can either work on-line or submit his documents in batches to the DMSCupol system. Although these capabilities are very helpful to some extent, experience has shown that additional support for the overall planning process is needed.

As the planning procedure matures, the staff can begin to identify the nature of the indicators needed to provide information on the success of planned operations. The indicators that later will signify the achievement Decisive Point objectives during an execution of the OPPLAN are identified during the Course Of Action development stage and can be put into their appropriate location in DMSCupol. Figure 6, shows a screen shot where the indicators are defined or selected from a candidate list. A Staff could pick as many indicators needed or just use specific key indicators and link them directly to the appropriate Decisive Points in the DMSCupol system. Multiple viewing capabilities have been introduced in order to provide a better view of the overall COA within DMSCupol for the Commander, planning staff, and others.

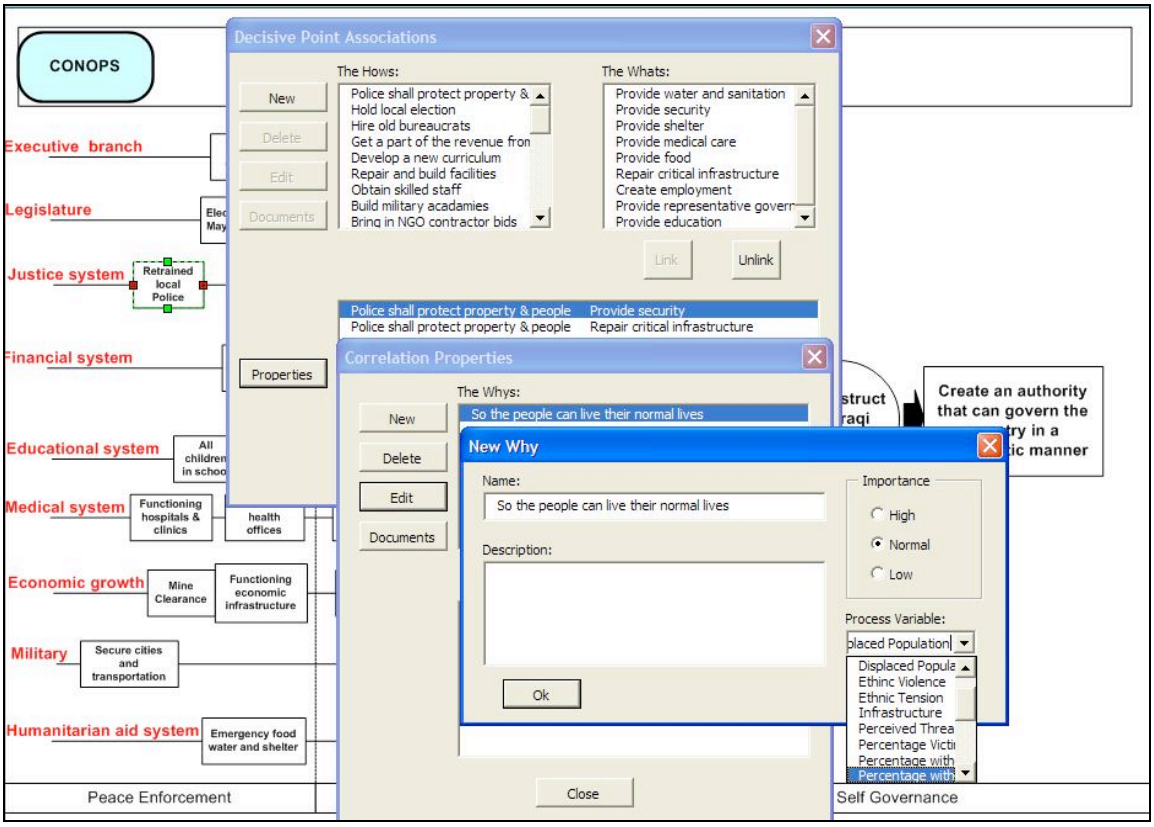

Figure 6: A DMSCupol screen shot, showing the editor and indicators definition capabilities.

THE DECISION-MAKING MATRIX 3, DM3, CONTAINS LISTS OF INDICATORS

One view of the results of the operational planning activities is provided, as described above, by inspection of the Operational Score. Another view can be provided by inspection of the DM 3 Matrix (Figure 7). Construction of the DM3 matrix involved ordering the COA data into rows and columns. At the left of the Figure, the column contains all the *What's to do*, consisting of the staffs' perceived and complete list of operational objectives that has to be undertaken. Comparing this with NATO procedure support tool[3] provided guidance on the

[3] TOPFAS (Tool for Operational Planning, Force Activation and Simulation) Author Håkon Thuve Chief, Operations & Logistics Planning Branch Operations Research Division NATO C3 Agency P.O. Box 174 2501 CD The Hague, Netherlands. Phone: +31-(0)70-314-2313 Fax: +31-(0)70-314-2158 e-mail: 'thuve@nc3a.nato.int

sorting of three different defined objectives that had to be achieved, for example. The upper row of the DM3 matrix provides a list of all the *How's* that would be developed by the staff officers during the planning process.

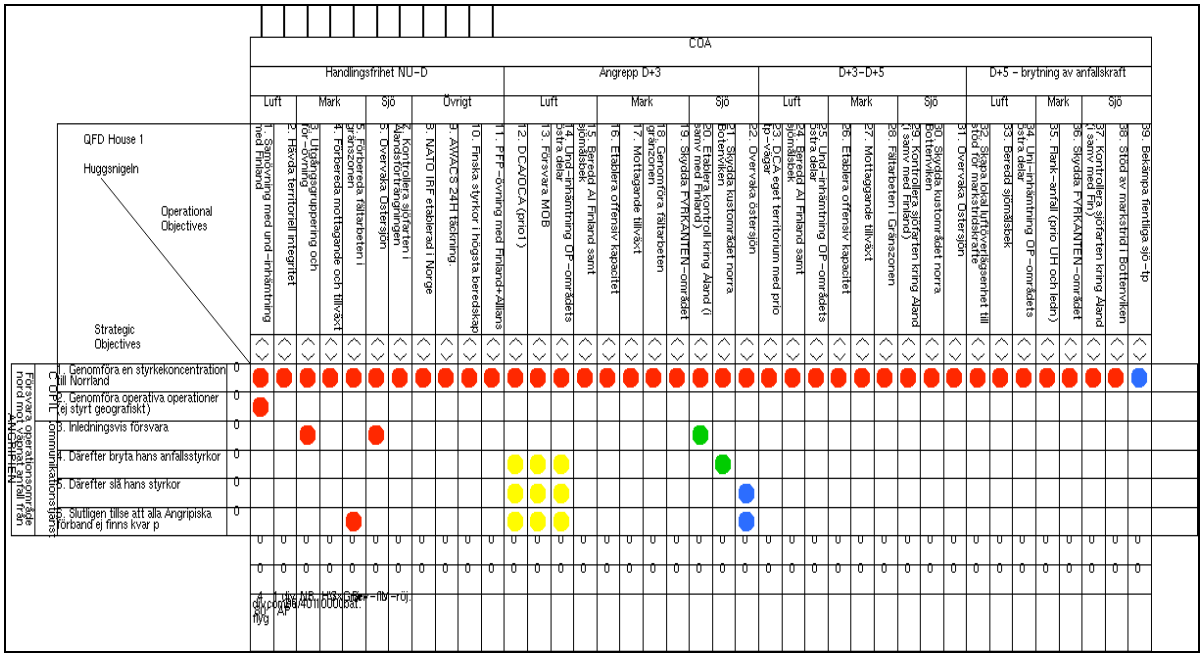

Figure 7: The DM3 matrix for DMSCupol.

When structured in this way, the DM3 matrix gives a overview for the commander where it is possible to determine in a rapid and comprehensive manner the stated objectives (presented in the left-hand column of the matrix) and the staff analysis and development of the *How's* to achieve those objectives(presented in the upper row of the matrix). This is indicated by all the dots in the matrix. The dot signifies a *Why* and its colour indicates the importance of that *Why*. The dot is relating a *What*, (left-hand column) to a specific *How*, (located in the upper row of the matrix.).

Inspection of the clustering of all the (colour-coded) dots in the DM3 matrix permits a commander and his staff to identify the possible concentration of dots in relation to achievement of specific objectives. Such a review might lead to that *What*, and perhaps no other *What* objectives, receiving increased attention. Or if inspection reveals that a listed objective does not have a *Why* linked to a *How* it is possible to question why was the task (the *How*) listed and to provide additional information as needed.

By having two views or perspectives of all the *What's* to do comparable to all the *How's* to conduct and the linking of the *What's* to appropriate *How's* with the use of the dots in the

matrix, it is possible to provide an overview that permits one to see *Why* a *What* to do has its *How* to do it. A user can use the overview of the Operational Score and the DM3 Matrix to develop a better understanding through the use of two perspectives on the same data than if only presented with a single perspective.

During the group modelling procedure in the staff when the shifting between COA score and the DM3 view, Figure 7, it may be possible for the staff to define indicators that signify that a specific task is producing the required effect. By placing the indicator on the row just under the rows of all the *How's*, in the upper portion of the matrix we give an overview for the staff when they are moving over from Operational Score (Figure 5) to the DM3 matrix (Figure 7). By defining and placing the indicators in the DM 3 matrix, Figure 7, it is possible to create a control panel for execution of operational plans. In this panel data from the battle rhythms are reported as shift in colours of the indicators as the input data increase or decrease in value reflecting changes in the operational environment, for example.

COMBINED DATA FROM DEVELOPED COA AND THE INDICATORS TO THE SIMULATION

Development of formal models of situations of interest requires the development of an appropriate set of indicators that are linked to, or represent, the key processes and structures of the model. Production of an appropriate set of indicators (perhaps based on the European Commission list, CAIO-derived information or information from other sources) could support activities aimed at validating the model processes and verifying the model output. Use of an appropriately validated and verified model can support operational planning by permitting analysis and assessment of the impact of different plans or plan elements on the overall plan-directed outcome. Models can be used for the following types of activity during the planning process.

- Open simulation in order to support war gaming to determine the effectiveness of options selected during plan development.

- Closed simulations in order to support identification and selection of options for planning and/or execution within the operational environment by a commander.

- Evolutionary simulations to examine the available range of friendly and/or hostile force options or to undertake some form of stability analysis.

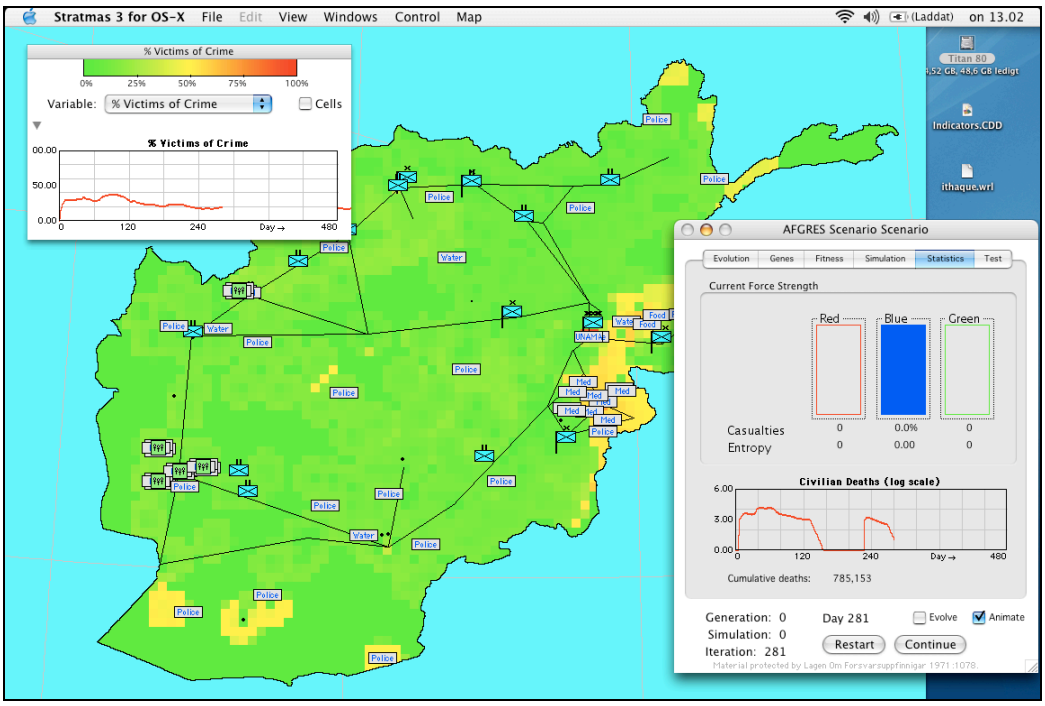

Figure 8: A map of Afghanistan generated by the STRATMAS facility showing the map-based presentation of percent victims of crime indicator data.

Figure 8 shows the output from the formal models contained within the Strategic Management System (STRATMAS) that was generated during a post-conflict stabilization study of Afghanistan (described in more detail below). In this case, the map-based display of percent of individuals impacted by crime throughout the nation. Indication of hot-spots reflecting high levels of criminal activity could identify a need for changes in operational tactics and strategies for the deployment of police and other law enforcement assets, for example, in order to reduce crime levels in identified areas. Other indicators in STRATMAS reflect levels of other properties of the overall society and information provided by those indicators could be used to warn for the need to address other challenges.

METHODOLOGICAL RESEARCH AND AN AFGHANISTAN EXERCISE-DRIVEN STUDY

The Strategic Management System (STRATMAS) Phase III was developed for the Swedish National Defence College and the United States Joint Staff (J8) by a small international team

led by George Mason University School of Public Policy. STRATMAS was used to support a post-conflict stabilization study of Afghanistan in the Aquarium facility at the Swedish National Defence College, Stockholm, Sweden in January 2003 (Figure 9). The Aquarium facility is the Swedish National Command and Control and Crisis Management Testbed.

Figure 9: The senior political leadership, force commander, and planning staff for the Post-Conflict Stabilization Exercise on Afghanistan in session at the Aquarium facility at the Swedish National Defence College.

STRATMAS III provided a realistic representation of a notional societal environment in Afghanistan within which peace and humanitarian operations could take place. STRATMAS-generated societal data were displayed in both map-based, Figure 8 above, and graphical formats, and used to set the scene for the study participants and to provide a basis for assessing the effectiveness of their actions that involved planning for the deployment of military forces and civilian entities to support post-conflict stabilization. The Post-Conflict Stabilization Study of Afghanistan involved DMSCupol planning activities as well as STRATMAS-supported analysis, assessment, and planning activities for military forces and civilian entities. Two consecutive notional scenarios were used in the post-conflict study.

- Phase 1: Deployment of the Afghanistan Emergency Force (AFGEM). The first scenario described the transformation from a post-conflict situation

involving high levels of violence to intermediate levels of violence. It involved the deployment of the notional Afghanistan Emergency Force (AFGEM) involving some 60,000 individuals under UN authority as well as civilian humanitarian entities.

- Phase 2: Deployment of the Afghanistan Recovery and Stabilization Force (AFGRES). The second scenario considered further transformations to low violence level conditions where societal reconstruction and development become possible. A year after deployment of AFGEM, the UN Security Council notionally authorized deployment the Afghanistan Recovery and Stabilization Force (AFGRES) with a maximum force strength of 25,000, in order to support the recovery and long-term stabilization of the country.

The senior political leadership group in the Study consisted a retired United States Ambassador, currently working in the Peace Operations Policy Program at the School of Public Policy at George Mason University, as well as another senior United States civilian. The group provided strategic political guidance to the Study participants. A Swedish Major General played the role of the overall Force Commander for the Study. The General with the staff assistance of a Swedish Lieutenant Colonel used the political guidance and other information to provide the Commander's Intent and planning guidance for the Planning Staff.

The Study Planning Staff, consisting of military and civilian personnel, prepared 90-day action plans to represent the initial response to the conditions in Afghanistan associated with each scenario. The impact of the plans, which were made in DMSCupol, was then determined with the aid of the STRATMAS facility. Data on a series of key societal variables, displayed in map-based and textual formats, indicated significant reductions in violence levels and the amelioration of the overall societal conditions resulting from deployment of AFGEM and AFGRES and the civilian entities.

Activities during the study in January 2003 at the National Defence College in Stockholm clearly showed that joint use of DMSCupol and STRATMAS permitted development of a very significant understanding of the problems associated with post-conflict stabilization in Afghanistan. Development of that understanding was greatly enhanced by the fact that the study took place in the Aquarium facility. Taken together, DMSCupol and STRATMAS implemented within the Aquarium, provide a unique and proven support capability for studies and exercises involving post-conflict stabilization and related activities. DMSCupol and STRATMAS has been designated by the Swedish authorities as the software system as 'center of gravity' for future development of the Aquarium.

CONCLUSIONS

It is not immediately evident how indicators should be developed to provide information on the status of complicated, or perhaps even simple, scenarios. Some guidance on appropriate political, economic, and other types properties that may provide a basis for the formation of of indicators could come from such sources as the European Commission checklist or the Columbia International Affairs website. Other guidance can come from a study of the dynamical properties of a system or systems of interest. In this case interest is placed on the dynamics of the types of behaviour that may occur rather than on specific numbers associated with the properties chosen as indicators.

The Swedish National Defence College has developed the NATO GOP procedure that embeds indicators with the DMSCupol software environment. This facility can be interfaced with formal computer-based simulations. Such facilities have been tested during a post-conflict stabilization study of Afghanistan held at the Swedish National Defence College in January 2003. This study demonstrated that indicators could be used with benefit to identify conditions that emerge in response to defined operational plans. The studies also pointed out the need to develop additional sets of indicators that represented additional properties of the operational environment as well as the need to undertake model and indicator validation and verification activities in order to create a trusted planning environment.

FUTURE WORK

Future work will focus on interfacing systems that export data from DMSCupol and import data and information to a Scenario Generator. Output from the Scenario Generator will then be sent to a client server-based version of the Strategic Management System (STRATMAS). These new capabilities would permit a staff to be distributed close to an operational or other functional area as well as permitting the staff to carry detailed modeling, analysis, and assessment activities with STRATMAS, perhaps located at a remote location.

Future work will also focus on providing the ability to support reporting on processes and activities that are actually taking place at operational and other locations and providing that

information in a timely and precise manner to support modeling, analysis, and assessment-related activities.

At the Swedish National Defence College we will also interface the output generated by STRATMAS and other model-based facilities to custom-built stereoscopic presentation facilities. Use of those facilities will enhance the ability of a staff to obtain an appropriately detailed overview of new and emerging structures in the societal conflict environment.

REFERENCES

1. http://europa.eu.int/comm/external_relations/cpcm/cp/list.htm, 2004.

2. http://www.ciaonet.org/frame/aboutfrm.html, 2004.

3. Wolfram, Stephen, 2002. *A New Kind Of Science*, Wolfram Media, Inc. ISBN 1-57955-088-8.

4. NATO Guidelines of Operational Planing, 1999

5. Cohen, Lou. *Quality Function Deployment, How to Make OFD Work for You*. Engineering Process Improvement Series, Addison Wesley Longman, ISBN 0-201-63330-2

6. Koza, John R., 1988. *Genetic Programming, on the programming of computers by means of natural selection*. ISBN 0-262-11170-5. Cambridge Massachusetts: The MIT Press — A Bradford Book.

7. Dockery, J.T. and A.E.R. Woodcock (co-editors), 1993. *The Military Landscape, Mathematical Models of Combat,* ISBN 1-85573-077-4. Cambridge: Woodhead Publishing Ltd.

8. Eva Österbergs (red.), 2004. *Våldets mening*, Historiska Media, Lund.