

13<sup>th</sup> ICCRTS: C2 for Complex Endeavors

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**“Instruction sets to use and test a transformation towards an agreed end non-failing state”**

**Topic 050 Organisational Issues**

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*Abstract*

For a joint force commander to find the instructions set to civilian and military organizations that transform a failing state towards an agreed end state is a problem. The overwhelming amount of dynamics, interactions and generative capabilities hidden in this, is cognitively difficult task to grasp for commanders and practitioners. One difficulty is to represent the initial scene for the failing state. To use this expressed terminology so that practitioners can use it to follow the development in the dynamics, interactions and generative capabilities. To allow practitioners to experiment with their instructions sets and elaborate with these instructions sets as they are incrementally testing them in order to met expressed end state for the non-failing state. A possible solution to support this process of finding the instructions set has been developed. During several explorative exercises the incremental designed systems has been used and proven to be supportive in qualitative terms. Practitioners have in qualitative terms expressed their experiences of its use through out planning in four different exploratory exercises.

***Keywords:***

problem, cognition, modelling, indicators, simulation, and exercises

*Introduction*

The overwhelming amount of dynamics, interactions and generative capabilities hidden in an instable country is cognitively difficult task to fully comprehend. To this direct and coordinate large missions that makes the effects that reaches the stability goals is therefore an endeavour.

*“The factor of space encompasses not only the physical environment and weather/climate but also the so-called “human-space.” Among other things, the human-space includes such elements as the political system and nature of government, population size and density, economic activity, transportation, trade, ideologies, ethnicity, religions, social structure and traditions, culture, and technology.”{Vego, 2007, page 164}.*

National and international actors cause this dynamic change in the country. It is their dynamic behavioural with interactions between political, economical, civilian and military actors that causes sign of instabilities. Hostility between actors may cause effects in the country that is reported, is fused and observed through key indicators. Interactions between actors may lead to increased instabilities periodically reported from inside a nation through media and out to international organisations. Actors' different capability, generative capabilities, which has caused events in a country, is difficult to predict for their future behaving in alternative situations. A systemic view on dynamics, interactions and generative capabilities will therefore support planning.

#### Nations state

The nation of interest may be internationally categorized as an instable or even failing state {Esty et al 1998} and {Rotberg, 2007}. Its national security instability can be monitored by monitoring the indicators when it change within each theme; environment or physical, quality for life, societal, economical, governance and political. Each theme can be studied by following indicators in the theme and their variation over time and space. Each report is part of the monitoring and give data to the theme-based indicator. Reports are of qualitative and quantitative description type over time. This produces a pattern for each theme-based indicator. Monitoring, analyzing, making judgments and decisions upon this theme-based patterns supports to signify the national securities status {JWC, 2007}. A status that can be stable, weakening, negotiating, failing, failed or collapsed state. Depending on this status, the political agenda and legitimacy from international organizations and if an authorization is clear from the weakening nation, a decision, start planning for an operation inside the nations. If this nation is a failed state then the political entities {Rotberg, 2007} have failed to deliver what they have promised to deliver to the population. Population at large may refuse this absence of change over time, this will be a state weakening force. Factions turn to terrorism and insurgent strategies, because they are disappointed. Political theme and its agenda can be as turbulent and change fast. The politics need means their governance apparatus, through which the political agenda is canalized out to the nations population. This apparatus or governance theme fuses incoming report to political domain. This governance give the political domain the inertia if wrong deliverables but also leverage if rights deliverables. This inertia or leverage needs to be addressed through operational engagement space {JWC, 2007}. Although this is other engagement space separated from the military engagement space. In peace building operations the operational plan needs to account for all engagement spaces. Otherwise actions in military space will contradict others activities dealt with in political, civilian or economical engagement spaces and this can move the nation back to instability.

In effect based approach operations a system is defined as

*“A functionally, physically, or behaviourally related group of regular interacting or interdependent elements, which forms a unified whole. Systems associated with national security include inter alia political, military, economical, social, infrastructure and information.” (JWC, 2007)*

This cybernetic view is used in designing our system {Christensson, 2004}, with the systems physical border in spatial sense following the country real geographical borders.

If this failing state becomes a North Atlantic Treaty Organisation, NATO, concern;

*“Strategic planning is conducted by the national-strategic level of command. It deals with the development of plans for the employment of one’s military and non-military sources of power across the spectrum of conflict, from the national-strategic level to the theatre-strategic level.”* {Vego, 2007, page 680}.

NATO own proposal to effect based approach operations, NATO EBAO, doctrine addresses Strategic political level is the North Atlantic Council (NAC). Strategic Military level is the Supreme Allied Command Europe (SACEUR) and Operational level is Joint Force Commander (JFC) and Tactical levels is the Component Commander (JWC, 2007, page 11).

*”Strategy and operational art are concerned with greater spans of space and time than tactics are.”* {Vego, 2007, page 177}.

There is a different problem to develop a military operational plan and to develop a military tactical plan. Although in the military management output from military operational level becomes input to the tactical component commander and so on.

The existence of these levels a Military (‘M’) operational level, imply a existence of a Political (‘P’) operational level, Civil (‘C’) operational level , Economical(‘E’) operational level (Christensson, 2005) level as well. It implies a PECM operational level. Since they all of these operational level’s have the same system environment, the nation, each of them has to develop different engagement means and assign task through their specific space into same nation. This fact renders for requirement on coordination and synchronise of PECM actions and tasks. Each PECM engagements operational level needs to have a relation to one End-State, with its Objectives and Effects. If we consider that the operational level is where the different engagements spaces are to be directed, coordinate, and synchronization it’s at operational level we need to develop the command and control, C2, form to support each engagement staff work. In the military domain;

*In the analytical approach, the commander assesses a military situation and then develops several possible options or courses of action (COA) for the enemy and one’s own (friendly) side., (ibid page, 679).*

But how is this managed in political, civilian and economical analytical environment?

If we compare with enterprise modelling (EM) methodologies (TRIAD, 1998) reasoning this methodology aims to develop four different views on an enterprise. In EM the methodology support development of a plan-view where goal or a vision is stated. The second is the rule-view; rules on the enterprise forced upon neighbouring systems. The third process-view, reflects enterprise internal dynamics and process expressed in enterprise specific forth lexical-view with its definition, symbols and acronyms. This

comparison with enterprise modelling points out the implicit assumption that participants in each engagement space are familiar with their three other views on their own enterprise, that is rules, processes and lexical elements. Figure 1 below, enterprise view on engagement space, is aimed to illustrate this.

To produce a operational plan for one engagement space in one system, a nation, military demands knowledge of how to develop this or have a sense of ‘what to’ do. This sense can be compared with the sensemaking function (Brehmer, 2007) defined in the Dynamic Observe, Orient, Decide and Act, or DOODA-loop. According to this DOODA-loop a second function, planning, is generating ‘how to’ do (ibid). Comparing EM and this theory each engaging organisation tend to define what to do with their own representations and express or state their recognised portion of the problem with the situation of what is in psychological termed a problem {Duncker, 1935}. It exists a problem if we have an initial situation and we perceive we need to come to a different situation, but we do not know how this transformation is to be accomplished.

*“In generic terms, planning is intended to find a logical solution to a problem on hand or one that may exist in the future.” (Page 679, ibid).*

One may compare this ‘what to’ with to define a problem and ‘how to’ do is to solve the problem.

There is no doubt that military practitioners have knowledge of their rules, processes and lexical elements, as well as political (diplomats), civilian and economical practitioners has about theirs. It is as well plausible that a strategic political (‘P’), economical (‘E’), civilian (‘C’) and military (‘M’) level understands each other end-state, objectives and effects. However our doubts are in the four different operational levels procedures to coordinate and synchronize. They all need to develop sub-transformations steps in four different engagement spaces in parallel or at least in a cascade manner. Military practitioners at operational level guided by an effect based procedure or current NATO Guidelines of Operational Planning, GOP (2005) procedure is educated and trained extensively in this before actual operations.

Politicians, civilians and economists are educated and trained in other procedures, different from military. This difference affects participating practitioners (PEC) mindset when they are co-developing with military according to effect based approach operational planning procedure at operational level. It affects in developing elements in mission, objectives, effects, actions/activities, task and their orders. It affects them when they are to develop the sub-transformations needed in order to produce a comprehensive plan. To develop each of these transformations all four spaces needs to move concepts (FM 3-24/MCWP 3-33.5, 2006, page 4-2) gradually to be more and more specific as the develop their understanding in parallel or at least in cascade manner. This understanding is specifically directed towards the dynamics, interactions, and generative capabilities of the cause and effects in own, across and in others engagement space as well as in the nation. PECM engagement spaces are tasked to generate a course of action that can be directed, coordinated and synchronised at operational level into one operational scene.

The table in figure 1, below, is not intended to be a comprehensive comparison of all procedures and methods used to view enterprises methods in PECM. It is there just to illustrate what each engagement spaces works with and they have they're own tradition. This "own tradition" signifies inertia when they are to conform into a production of comparable planning elements and products to be use in one operational scene.

View	Political	Civilian	Economical	Military
Plan development	Political agendas, campaign planning	TQM, QFD, LFA	?	EBAO NATO GOP 2005
Rules on the enterprise	International and National laws Human rights	International and National laws Human rights	International and National laws Human rights	International and National laws Human rights FN
Process identification and cause and effect analysis	Elections, parliament ally Negotiations	TRIAD process identifications, System Dynamics	System Dynamics Gaming	FM , wargaming
Lexical elements, acronym's, symbols etc	Phrases	LFA, reporting	Specific	FM's Mil-std 2525B, etc

Figure 1, Enterprise view on engagement space

Military operational staffs have a large organization with many practitioners. Because of the vast amount of dynamics, interactions and the need to grasp generative capabilities implication of a military course of action the staff organized into branches with sequential and parallel work.

*"The basic types of planning in terms of time are sequential, parallel (or concurrent), and collaborative", {Milan, 2007, page 680}.*

Limitations in sequential, parallel or cascade planning process is that if the next procedure steps needs of predecessors output, and the assumptions of that products stability of the planning products when it is accessible for followers to work with. Sequential planning limits next decision level to plan their plan until former group is ready. Parallel planning demands that each procedure step is independent of each other, and its result are stabile and accessible; each planning element fits into the overall planning structure. Cascade planning allows some following processes to start and as predecessor procedure steps have results, followers access these with this conclude their work. It is assumed that cascade planning is more collaborate. This is to ensure within military the deeper span of control collaboration but does it work with a comprehensive approach even if one reaches a cooperative implementation planning concept we still have to evaluate all contributing actions or activities leading to orders tasks etc still in one operational scene. {MISP dec 2007, version 7.34}

At operational decision level commander own BLUE force units have internal dynamics, interaction in BLUE enterprise as well as dynamics and interactions with the area of operations environment, RED and GREEN actors (NATO STANAG 2019). A Joint Force Commanders receives missions, military objectives, effects and actions to accomplish. With this a commander with his staff is to state or represent his problem

using their normal notational system. Based on sense for the problem practitioners generate order list to be carried out to fulfil End-State. These sent out documents are usually in text, graphics, and maps. Natural language text with photos, graphics and maps is expressing what to be accomplished as well as how to accomplish. NATO GOP or NATO EBAO state;

”.. regressive or inverse (backward) planning process starts with the ultimate objective and follows with the determination of a number of intermediate objectives.”, {page 689, Milan,2007}.

Commander’s planning starts with initial sensemaking {Brehmer, 2007} ‘what to’ do and then followed by ‘how to’ do. This will therefore have a focus to organize his staff to define his operational end-state going backwards in time to his associated effects to be met. With his definitions of ‘what to’ he states the setting of a problem and sets the paradigm (FM 3-24/MCWP 3-33.5, 2006, page 4-2). This is a commander driven dialog. This will give the staff a sense of what to accomplish and a direction where his intensions is heading. The staffs are then proceeding to solve his stated problem, and by this generate all actions that is needed to accomplish defined effects. By following a procedure step by step, commanders staff is orchestrated to develop the products that produces an order-list that forms what to coordinate and synchronize in component commander’s execution. Operational staff develops a operational score with which the operation is conducted.

It is at Joint Force Command level that the military resources are visible. It is at this decision level, task’s is to be generated and sent out as orders to component commanders. Tasks that if rightly performed and measured during performance will give planned desired effects that consequently lead to a decided end-state. It is at this level the staffs’ sensemaking will point out ‘what to’ do and by developing ‘how to’ in means with which coordination and synchronization can be carried out on component command decision levels. It has of tradition bean at operational level the other engagements spaces sensemaking is to produce there design of what to’ do and its staff practitioners are to conduct planning by generating appropriate ‘how to’ do with their engagement means and their coordination and synchronization. To be sent out to their subordinates or component commanders.

The generic DOODA-loop {Brehmer, 2007} with the functions; data collection, sensemaking and planning is the ruling functions for C2-systems {Brehmer, 2006}. Data collection function is receiving human intelligence, HUMINT, and sensory-systems delivered data that is made retrievable for the staff. At an effect based approach operational level this is performed partly by the Knowledge Development {NATO EBAO version 4.2}. Plan construction is a backward process. Applying sensemaking function on understanding desired ends-state and list ‘*what to*’ do this is mostly expressed in normative natural language text. For our design purposes we compare this with the quality house defined in the method of Quality Functional Deployment, QFD. This method suggests a series of linked transformation matrixes each of them becomes decision matrixes, DM. The first transformation matrix called the quality house and hold all ‘what to’ do in leftmost column. At upper raw all ‘how to’ do is listed as they are

generated by the staff. The DM 1, figure 2 below, is our first sub-transformation when sensemaking is defining ‘what to’ do under each theme and planning function generates ‘how to’ associated to each engagement space. This comparison to sensemaking {Brehmer, 2007} gives the product of ‘what to’ do or effects to accomplish in a QFD terminology for the customer, which is the people in the nation (NATO EBAO). This list of ‘what to’ do needs to be compiled at operational level and the planning function {Brehmer, 2007} will develop appropriate actions for ‘how to’ meet this desired effects. This ‘how to’, is very alike the house of quality’s when developing industry service capabilities with QFD. They are listed at first upper row, to what the planning functions product according to DOODA-loop develops the actions. Figure 2 displays decision matrix DM 1, a comparable QFD quality house.

	Planning generates 'how to' do in each engagement space	<b>Political</b>	<b>Civil</b>	<b>Economic</b>	<b>Military</b>	<i>Measures of Effectiveness, MoE (PV)</i>
Sensemaking defines 'what to' do in each theme	What-Why-How					
<b>Political</b>		Why				
<b>Governance</b>		Why	Why	Why		
<b>Economy</b>				Why		
<b>Societal</b>			Why	Why		
<b>Quality of Life</b>			Why	Why		
<b>Environment</b>			Why		Why	
<i>Measures of Performance, MoP</i>						

Figure 2 – decision matrix DM 1, a QFD quality house

Figure 2 will be developed to a decision matrix, DM 1, that displays the linked effect in each theme existing in a country in leftmost column, with the staffs generated actions list emanating from the four different engagement spaces at the top. Each effect is linked with an action with a link called ‘why’. The more effect in each theme that is identified the more rows will expand the matrix downwards. The more action or activities that is generated the more column will be fused in the matrix expanding the matrix to the right. Fore each effect there will be an indicator listed far right under heading of measures, MoE, of effectiveness. For each action or activity that is listed there is a measures of performance, MoP, indicator listed at the bottom of the matrix. In planning each practitioner working in an engagement space will estimate the potential strength for each why-link. This give early in the staff work a relative indication of balance between each engagement space and the efforts put in to the operation. Compare figure 5 below. Based on a control theoretical rezoning one need to be able to observe a systems stat in order to

be able to control its outcome towards a desired system stat. DM 1 gives a overview of observability, choice of stat to control and controlling mechanism to control with.

### Second sub-transformation

Actions needs to be further developed to tasks and in this second QFD transformation from actions to task at Operational decision level the decision matrix is again developed. In this transformation previous defined ‘*how’s*’ becomes this sub-transformations ‘*what to*’ do. Again sensemaking functions product is defining all ‘*what to*’ do. This can result in additional actions that are identified and therefore listed at leftmost column. This results as well as a call back to update DM one developed at previous sub-transformation step. Planning function in this second sub-transformation step generates the entire appropriate task-list that is needed to meet its action-list. Again the links between actions and tasks is motivated by a ‘*why*’-link giving planned confidence for combined right task list. This task list can be compared to NATO mission essential components list, MEC-list, that is used for different types of scenarios conducted by NATO previous operations.

### Third sub-transformation

In a QFD sense we approaches a third transformation matrix. During this third sub-transformation sensemaking function lists all tasks as all ‘*what to*’ do and planning function generates or transforms this into ‘*how to*’ do in orders to assign each unit.

By summing up these three sub-transformations we link the military operational mission, objectives, effects, actions to tasks with orders and units. Compare figure 3 upper part.

### Wargaming

Based on this order with unit list the staffs are wargaming their plan according to a concept of operation for suggested procedure steps in the multinational exercise version 4. In this CONOPS in the second procedure step Action Development and Resource Matching, ADMA 2, a staff is wargaming their plans. The purpose of this step is

“To conduct an action/reaction/counteraction war gaming activity to determine the Cdr’s preferred option.” {CONOPS, 0.93, EBO}

The development plan is as well to be checked for robustness, reveal ambiguities and expose if the plan holds against known actions from other actors in the nation, as an operational plan should do. During this act of wargaming, the procedure is as following a turn taking and sequencing dialog between BLUE and RED/GREEN side when BLUE group and RED/Green groups in the staff is stepping through the plan, while the Joint Force Commander is listening and following the reasoning’s the staff is producing. Commanders interrupt this act to ask for clarification or correction on assumptions, or judgements. If commander decide this wargamed plan is sufficiently mature then it becomes the OPLAN. Orders are mediated to component commander for them to execute. At this stage a new DOODA-loop is initiated and now on component commanders level.

Mental simulation of the plan during wargaming is a step by step or sentence by sentence expressing BLUE orders that leads to dynamics, interaction and generative capabilities with RED's dynamic, interaction and generative capabilities as well as with GREEN's dynamics, interactions, and generative capabilities. Even if different people is dealing with different parts of the plans the mental simulation can identify a limited amount of ambiguities, shortfalls or out numberings. This mental simulation occurs in each person, while dynamics, interaction and generative capabilities is to be validated in the plan. Inconsistencies in the plan is difficult to see through, miscalculations or judgements and lack of detailed calculations down to relevant cause and effects results in errors. This process to wargame is a huge mental load for each person. This can be hidden in utterances like "We anticipate..that.", "We do the conclusion..that " etc. Wargaming is taking each order and unit for BLUE, RED, GREEN task, surrounding factions and other actors indication change and evaluate, judge outcome of this on own BLUE, RED, GREEN. By bookkeeping dynamics, status change caused by interaction and considered all generative capabilities in this as the time is stepped through the trail of events.

There is a need for an easy accessible computer hosted book keeping time based system, that book-keep movements of all actors units, take care of interactions by passing data between actors modeled resources, calculate possible outcomes, book keep people, petrol, ammo, damages, status change of factions lack of water, food, shelter, medicine, calculate Ethnic tension, violence, crime rates and economical changes. This system, should book-keep the outcome of generative capabilities or constraints of different leader skills to lead, and in this difference in performing is book-kept in a situated time-base.

### *Constructed system*

The developed system supports the activities during the operational planning process to find the instructions set, from defining operational End-State to orders for each Unit.

Our design form (Brehmer, 2007) contains procedures and software to support the C2 at operational level. This design use a control theory approach to command and control. The four enterprise view's, plan, rules, processes and terminology has although been treated differently. Planning uses effect based planning, EBP, products defined in concept of operations, CONOPS, version 0.93 planning procedure. This products was integrated (Christensson, 2006) in the quality functional deployment methodology, QFD, in producing each planning product. The DOODA-loops function cognitive sensemaking sorts 'what to' do in the QFD decision matrixes, DM, first column. The cognitive based planning work generates an appropriate 'how to' do list. This is listed in the DM at the upper row. All DM are part of developed software tool, Cupol™. The interfaced document management system, DMS, saves and traces planning products version and plan configuration for the distributed practitioner working in different staff-groups. When sufficient information is present in the system any practitioner in the staff can link Cupol™ with STRATMAS® software. In STRATMAS® the plan is war-gamed. In Figure 3 upper part, from End-State to Unit and order choice, is done with Cupol™. The lower part from point 7 to 16 is done with support from STRATMAS®. At step 7 wargaming is enabled.

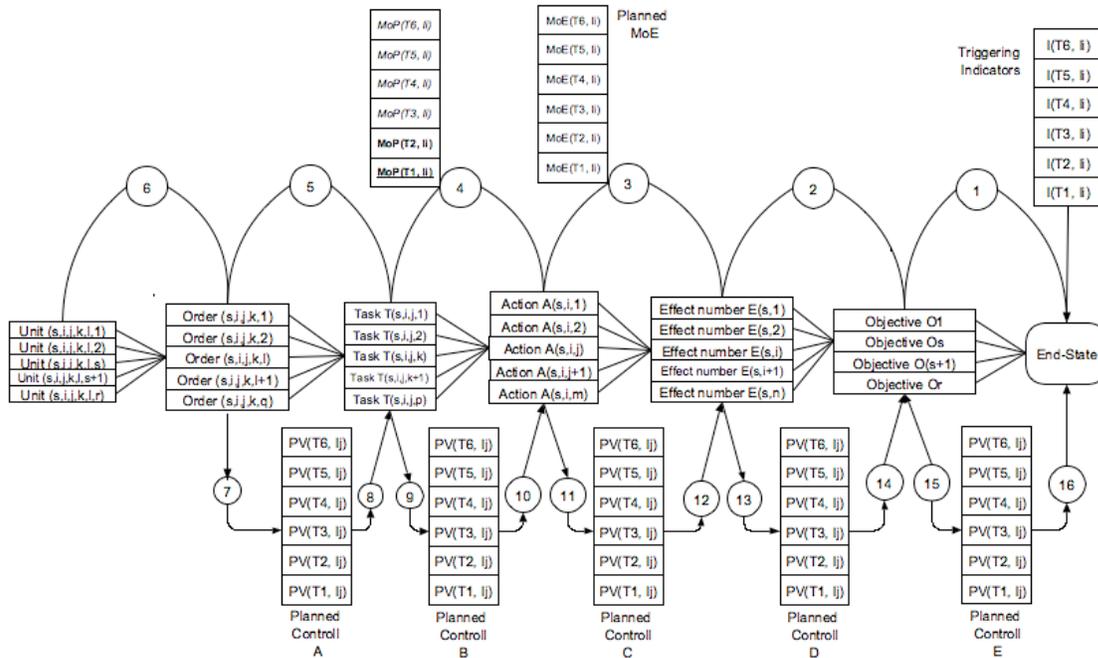


Figure 3 - Sub-transformation steps for order development, and links to spatial simulated indication of the theme-based process variables.

The simulation STRATMAS® executes book-keep’s stored data about dynamic, interaction and generative capabilities that the four different engagement spaces, compare figure 2 above, are effecting the artificial countries variables in the simulation. It’s response is displayed in the six themes, compare figures 6 and 10b below, and its indicators implemented as process variables. Cupol™ and DMS are designed to support each sub-transformation in sensemaking-planning function applied for each planning product. STRATMAS® is designed to mature plan through simulation.

At the operational level the staff have the triggering indicators historical development given from intelligence. Each engagement space define there operational end-state, lists objectives. To each objective, n effects can be identified. As effects are clarified appropriate planned measures of effectiveness, MoE, is identified. This as a guide that right actions is performed. Figure 3, above shows n listed effect linked to s-listed objectives that is linked to the end state. This resulted in m-listed Actions. Fore each Action (j), p-listed Task’s is identified. Implemented task in STRATMAS® where designed with guidance on the NATO Mission Essential Component definition of a task in mind. This requirement on a task to be performed is carried out by Unit (r) that has a Order (l) type out of q different orders. In STRATMAS® we have implemented 10 different orders. Fore each of the q=ten (10) different implemented Orders types, has the arguments; Longitude/latitude from and to destination, starting time and orders duration etc. Order types with their arguments needs to be specified by the practitioner. This is done in Cupol view displayed in figure 7 below.

As stated above, the staff is starting with End-state and do the sub-transformation 1-6 steps in Cupol™. Also described above at step 7 a practitioner can simulate. Looping through step 6-7-8-5 will increase insight of each tasks contribution on local, provincial and national process variables value. If other values are needed, displayed in each planned control panel A-E, practitioner can increase the loop-size to include more steps and adjust specified Actions by comparing Planned Control process variables assigned values with the refined values when looping from process 9 and 10 to 4 to 5, figure 3 above. Theoretically the staff can increase additional the loops size to include adjusting the effects and finally the End-state.

Triggering indicators are comparable to military defined MoE. Military engagement tasks performance is indicated in MoP. Our choice of indicators is implemented in the Process Variables PV for MoE and MoP, they are grouped into six themes. Each theme has one or several PV that is systems stat variables and interlinks the models in the simulation.

Units have organizational hierarchy, people, specific functions and subordinated commanders with attach and withdrawal skills. Assigning different orders to one specific Unit will produce different tasks. This is implemented in STRATMAS®

Screen layouts to support plan production

Each engagement space (PECM) is assumed to follow effect based planning procedure. Plan products for objectives, effects and actions to develop order for units. It uses a sensemaking-planning functions pair-wise transformation stating the products a like house of quality (effects linked actions) to order and unit list. Below is RED objective view in Cupol™ as an operations score view.

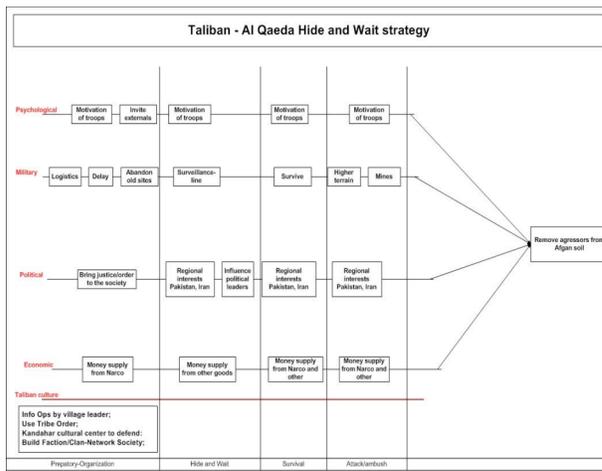


Figure 4 - Corce of action, CoA. The view of COA as an operational score. Defined End-stat has a headline inside the right-most box in figure 4. This box is linked to each line of operations, LoO. RED plan signifying Taliban/al Quada’s hide and wait strategy psychological, military, political and economical effects is to be counter act against with BLUE actions and actions. This screen layout is RED operational score that influences BLUE and BLUE therefore needs to plan for.

This view the operational score, figure 4, is constructed by dragging and dropping symbols and connect them in MS Vision™ drawing program. Attached to these symbol practitioners associates additional text, pictures or maps as the group is discussing. The focus is to define End-state, objectives, lines of operations, effect, actions, phasing. As the score is maturing the same content can be viewed later as a decision matrix, DM. First pratctitioner links effects with actions and give significance to this ‘why’-link.

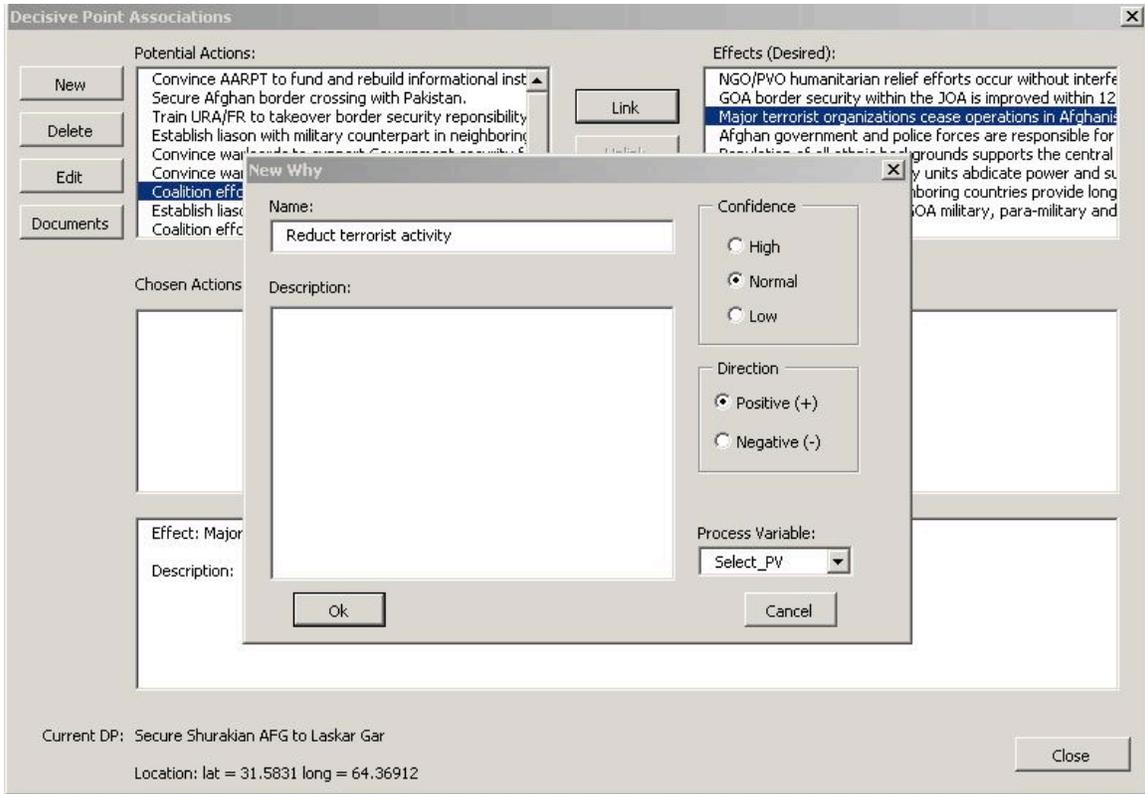


Figure 5 - Effect linked to Actions

In figure 5 military practitioners have chosen a potential Actions from the list on the left side that was generated in score view and a desired Effects from the list on the right upper side. By linking these two choices together the program prompts practitioner to name this link, in figure 5 practitioner names the link ‘Reduct terrorist activities’. In the description field a more thorough motivations can be edited. This ‘why’-link have a negative or positive impact on the plan as well as a confidence level of lo, normal or high. In this view it is also possible to linked an implemented indicator a process variable that is connected to a desired effect. Practitioner can now create the first decision matrix. Figure 6 left, is the decision matrix, DM, a staff has through sensemaking created. In first column the entities: Talibans and Al Qaeda and there effects practitioners envision these actors will impact on BLUE plan outcome.

Line Of Operation		Psychological				
		Preparatory-Organization	Hide and Wait	Survival	Attack/ambush	
Phase	Decisive Point	Motivation of troops	Invite externals	Motivation of troops	Motivation of troops	Motivation of troops
		Actions	Effects	Distribute experienced capabilities among troops (Set wars field event)	Invite journalists to write the truth of Taliban and control what will be said	Distribute experienced capabilities among troops (Set wars field event)
Entities	Strategic Effects					
Taliban	E7: Taliban is able to oppose coalition efforts to install a western version of "stability" throughout while presenting a viable alternative to the Afghan population and other political/military actors and competitors		High			
	E8: Blue is unable to affect Taliban's influence across the PMESII spectrum in the Kandahar region.	Low		Low	Low	Low
Al Qaeda	E1: Anti-coalition militias are quantitatively and qualitatively enabled (money, weapons, fighters) to sustain a long term fight against Coalition forces and Afghan security forces.					
	E2: Afghan Government unable to demonstrate, internally and internationally, effective control over the Diplomatic, Information, Military and Economic elements of national power.		High			
	E3: Coalition and non-military stability, reconstruction, and humanitarian activities are reduced, delayed or terminated due to increased insecurity.					
	E4: Coalition partners are unable to sustain national support for a costly, long term security presence in both Afghanistan and Iraq and are ultimately forced to withdraw	High		High	High	Low

Figure 6 - Course of Action in DM view.

Practitioner is now moving to point 4 in figure 3 above in which potential actions will be assigned the appropriate orders and units. Unit or resource list is imported to Cupol. This

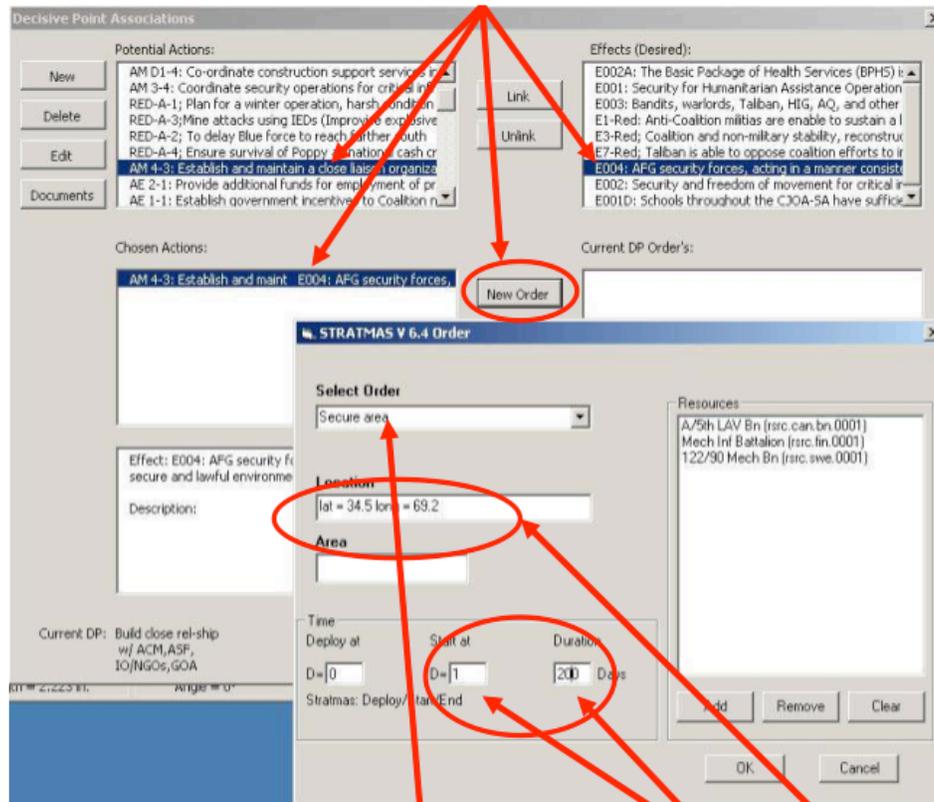


Figure 7 – link control panel for order type and arguments

file is created before point 5 in figure 3. As desired effect named E004 is linked to potential actions AM4-3 and to this action practitioner selects 'New Order' button a STRATMAS® Order list is popped. Practitioner have the imported resources at right in this popped window. Out of ten different orders practitioner chooses 'Secure Area' from the popped window list at the left. This orders arguments is easily filled into appropriate fields. Step 6 is now completed and practitioner starts the simulation by using the Cupol



Figure 8 – Run simulation

file menu 'Run Simulation' entering step 7 in figure 3 above. This starts the client, and its content in spatial visualized on the screen. Practitioners interact with the map; scenario events and practitioner can call up local, province or county-based indicators for each of the engagement space (themes) he needs to monitor during simulation.

Run Simulation command starts an active STRATMAS® client window. In this window practitioner can inspect all necessary parameters that has up till now been created and imported in advance and during planning steps from End-State to step 7 in figure 3 been entered.

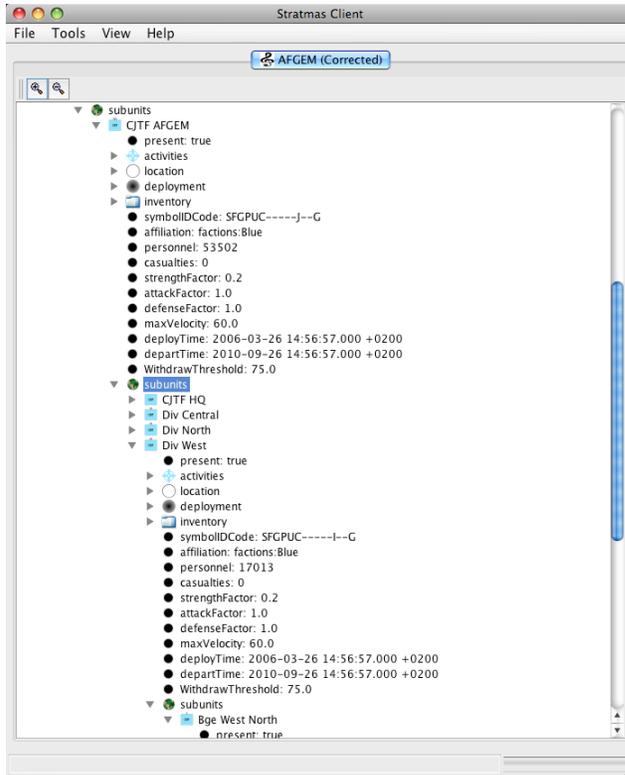


Figure 9 – A loaded active STRATMAS client

Most lightly planned measures of effectiveness may fit chosen process variable selected from this list beside. A choice from these seven themes (although forces are in environment but can be considered as Measures of Performance process variables) and with its process variables practitioner can follow the dynamics during simulation. “Planned Control”- panel A through E, figure 3 above will alter as new insights are gained as planning is proceeding. Process variables are displayed for all factions. In the Afghanistan case we have defined three different factions, Pushtuns, Northern and Others since they live spatially distributed with different densities locally, provisionally.

Figure 9 – is the active STRATMAS client window displaying all parameters and values added so far into an input to the simulation. In Figure 9, STRATMAS-Client window practitioners can fine tune Cupol entered data to better reflect the details if necessary. Accompanying this client window three additional windows opens up, ‘STRATMAS Map 1’ window. This window is controlled by ‘STRATMAS Map Control for STRATMAS Map No 1’- window and a ‘STRATMAS time control’ window (not shown). Practitioner connects to a server of choice by pushing ‘Connect’ button. In ‘STRATMAS MAP1’ window practitioner pushes a cell-, province- or country-view causing all process variables to pop, figure 10 below.

PV	Category	All	Pushtun	Northern	Other
Blue	Forces	0,00			
Blue casualties	Forces	0,00			
Casualty sum	Forces	0,00			
Green	Forces	0,00			
Green casual...	Forces	0,00			
Northern	Forces	0,00			
Northern cas...	Forces	0,00			
Other	Forces	0,00			
Other casual...	Forces	0,00			
Pushtun	Forces	0,00			
Pushtun casu...	Forces	0,00			
Red	Forces	0,00			
Red casualties	Forces	0,00			
Daily Dead	Environmental	0,00			
Fraction No F...	Environmental	0,00			
Fraction No ...	Environmental	0,00			
Insurgents	Environmental	0,00	0,00	0,00	0,00
Insurgents ca...	Environmental	0,00			
Population	Environmental	7,7E5	3,7E5	2,7E5	1,3E5
Sheltered	Environmental	0,00	0,00	0,00	0,00
Total Dead	Environmental	0,00			
Fraction No ...	Quality of Life	0,29			
Perceived Th...	Quality of Life	100,00	0,00	0,00	0,00
Displaced	Social	0,00	0,00	0,00	0,00
Ethnic Tension	Social	8,3E-2			
Fraction Crim...	Social	0,00			
Fraction Infe...	Social	0,00			
Fraction Reco...	Social	0,00			
Protected	Social	0,00	0,00	0,00	0,00
Violence	Social	100,00	0,00	0,00	0,00
Water Days	Social	2,99			
Food Days	Economical	6,21			
Fraction No ...	Economical	0,25			
Supplied Water	Economical	0,00			
Infrastructure	Governance	0,25			
Disaffection	Political	11,90	11,52	11,79	13,17
Polarization	Political	7,0E-8			

Figure 10 – sorted theme based indicators

For the order “Secure area” order practitioner assigned three listed resources in figure 7 above and automatically links this file to the STRATMAS-client. The connected the client to the server and selected anticipated process variables and started the simulation.

## Simulation

Since STRATMAS server hold the three views, rules, processes, lexical elements, and practitioner now have injects the plan into this server, the enterprise to make difference in Afghanistan can be followed.

Practitioner monitors selected indicators during simulation. Their change is a consequence of selected unit+order(argument) choice, figure 3. New choices at step 5 figure 3, can easily be entered and this will give a new indicators plot that can be compared to previous runs. STRATMAS® software is accommodating political, civilian and economical engagement spaces and to these linked societal-economical models and their lexical library. This gives the opportunity for other organizations at Joint Force Command to generate their plan, to experience other engagement spaces task or orders effects on the system. Figure 11 and 12 displays different plots without or with Green part participation in the operational plan.

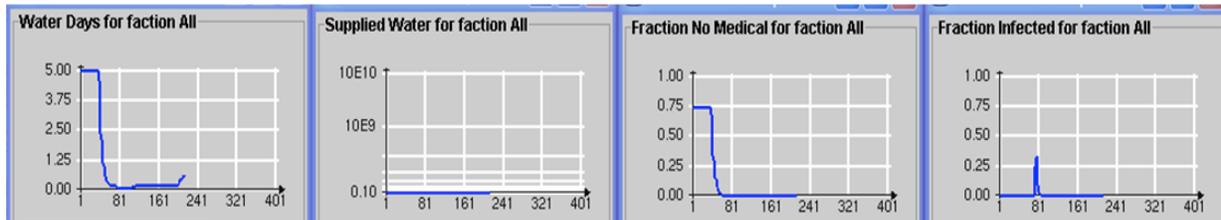


Figure 11, Blue E008 Plan simulated *without* Green Impact

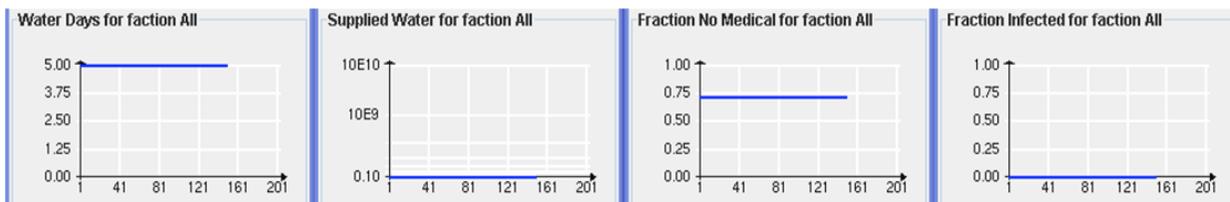


Figure 10b - Blue E008 Plan simulated *with* Green Impact

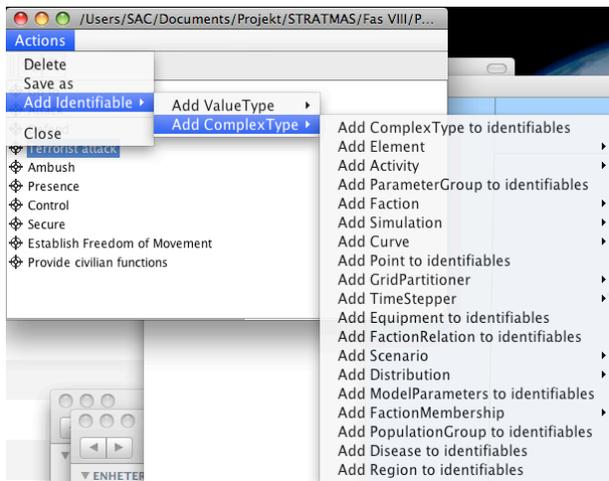
The four different process variables Water days , Supplied Water , Fraction No Medical and Fraction Infected is for all factions. I MNE 4 four process variables was sufficient to use. Comparing two different simulation outputs without or with GREEN impact on BLUE plan gave differences in the amount of water days and access to medical means. Also is the peak of infections reduced. By looping through 6-7-8-5, figure 3 above for combinations of BLUE, RED and GREEN present in the simulation and do adjustments on order choice or in the arguments to the orders, or reduce/increase unit strengths different outputs was obtained. A large set of combination of these can give a variety of desired patterns of process variables. Choice of ‘Planned MoE’ and selected process variables in ‘Planned Control A-E’ panels, figure 3 above, will very as insights are gained. More about this variation is presented under discussions.

## Units and Orders

As mentioned above Units and Orders are visible at operational level. We do the last transformation according to figure 3, above, in step 5 and 6. This task to Units and Orders assumes that Units are configured and Orders can be imported into Cupol. In this last step

practitioners in the staff needs to use a pre-assigned lexical<sup>1</sup> library. Lexical library for nouns or units are imported from IconEditor2 to the STRATMAS Client, figure 7 above. Practitioner assigns affiliations, personnel numbers, strengthFactors, attackFactors, defenseFactors, maxVelocities in advance but as well in the client, figure 9. Units with MIL-STD 2525B symbols, that military staff members knows and have practiced with during their military carrier is then visible in the Client window and is moving on the map as simulation is executing orders and interactions occurs with other actors in each location. Because organization leafs have different capabilities and skills one identical symbol with an other can have different outcomes as the simulation book-keeps the generative capability differences.

Orders or the verbs to assign to each unit are imported into Cupol. Ten different order types are presently available but more are needed. They work in large from a point to a point or a point to an area. They have deployment, employment and duration time numbers. If the simulation step is one day at the time then one-use day works as for time units. It is up to practitioner to define the time steps.



In Figure 11 left, some of the menu branches is displayed. In order to make it quick and accessible practitioner easily moves his cursor through the sub-menus and in doing this branches sub menu pops up automatically. Upon mouse right click confirming his argument for each order. Cupol do not have all menus accessible like this. By looping from 7, perceiving outcome in step 8 and back to step 6 and here adjust the arguments in the orders, practitioners tone the effects to get outcome right.

Figure 11- Terrorist attack order is complex

Cooperation of generating different engagements task list together with the RED and GREEN teams task list was tried out at MNE – 4 exercises held at Joint Force Command, Norfolk, Virginia, USA in January-February 2006. In the experimentation set up, gaming parties was confronted with injects that triggered a re-planning process. Existing effect based plan, EBPlan 1, was executed and during this, assessed measures of effectiveness was stating need to initialize a re-planning process, else would the operation fail, this was day two in the exercise.

<sup>1</sup> This lexical library is built with IcaonFactory2. A developed editor that practitioner build organisations according to Mil-Std 2525B symbols at each branch

## *Results*

During four different explorative exercises incremental developments between and before each exercise has improved designed system. Results from these exercises has mostly been published in the Cornwallis or in NATO RTO proceedings. Some highlights is emphasized.

### Afghanistan 2003 and Iraq Future 2005

The exploratory exercise Afghanistan 2003 aimed to explore if simulation generated data output could give a small operational staff of top chief executives and experts relevant dynamic response. This stimulated them to produce two different OPLAN's. By using 55.000 troops in a peace enforcement operation violence could diminish to a value acceptable to make a transiting towards the first phases of a peace building operation. In the Iraq Future 2005 explorative exercise the Afghanistan result was used together with first version of Cupol™. In this exercise 9 different syndicates planed and documented their plan using Cupol. Five J5 syndicates developed different BLUE plans and four J2 oriented syndicates (Christensson, 2005) developed different RED plans. This lead to define general process steps (Woodcock et al, 2007).

### MultiNational Experiment version 4, MNE 4

Joint Futures Lab; U.S. Joint Force Command has been helpful to release defined files that Cupol generated during multi national experimentation version 4, MNE-4. The exercise was held at multiple geographical locations and had the US Department of Defence exercise hub at Suffolk, Virginia. NATO response Force Headquarters was situated in Europe. Sweden and Finland resided in upper floor in main building. The other NATO and Partnership for Peace, PfP, partners were spread over the globe. By a compromise of daily timing the battle rhythm had a small time window in which the global interactions was executed. All used software were installed in Joint Futures Lab different servers and echoed to designated stations. It has still been difficult to restore the MNE-4 resulted process flow as it was performed during the event. These difficulties are there because of the nature of distributed execution as well as the mix of many interacting software tools. Many of the software's were scheduled to be re-booted 5 to 7 times a fortnight. Therefore the tutorial for MNE-4 practitioners, resulting Powerpoint slides generated and used for briefings during the exercise has been used to restore the events and to illustrate the workflow that appeared in the exercise, Figure 2, above.

In MNE – 4, Joint Intelligence branch, J2, RED and GREEN teams' operators used Cupol™. Practitioner in the RED and Green-planning cell at US Combined Joint Task Force, CJTF, used at operators level as well the link from Cupol™ to STRATMAS Client and the STRATMAS server simulation software. It was a decision at the US Joint Futures Lab administration not to use Cupol™ and STRATMAS® for the whole US Department of Defense Combined Joint Task Force in their designated operational space. NATO Response Force headquarters, NRF HQ, used NATO developed own Effect Based

TOPFAS<sup>2</sup> or EB-TOPFAS<sup>3</sup> to plan with. Other simulation tools used during the exercise was Joint Air Force , Navy and Army or JOANA from Germany, NATO developed GAMMA and SEAS from USA. STRATMAS delivered data to J2 branch RED and GREEN teams as planned. According a report (FMV VO Led 09700:5597/06, point 1.6.4 Simulation, page 15) other simulation systems did not deliver data in time or not at all, a broader insight of what simulation could give to operational planning level was therefore not won.

We are convinced of that if the whole staff with is J5 BLUE and J2 branch RED and J2 GREEN had used Cupol and STRATMAS, this would have given a more comprehensive insight of simulations benefits in plan development. This could have as well been submitted for stepwise gaming as a support for J3 branch in a NATO operational level. BLUE with the impact from RED and GREEN simulation results would make a significant difference across all process variables. Plan verification of all plans could have been visualized in alternative views, compare figure 4 and 5 above. In these views different analytical calculations could have applied.

In MNE – 4 military Course of Action, CoA, for RED and GREEN, was validated through mental based wargaming, not through simulation using STRATMAS®. It would have been a to large effort to set up data collection from both the mental based wargaming and the simulated wargaming. How ever future experiments will compare the two different forms. The purpose is of coerce to gain quantifiable evidence if simulation based support in wargaming leads to better plans. We anticipate this since amounts, in consumables, times and places are also linked to qualitative variables. Details and quantities in the dynamics, interactions and generative capabilities is anticipated to increase precision to more right addressed effects, and performance and have less of ambiguities, missing parts or flaws and this conducted faster.

Project Albert's International Workshop annual XII event, PAIW XII.

This event was partly sponsored by US Marine Corp and Swedish National Armed Forces project Röde Orm. Core of PAIW XII activities is to compare different agent-based implementation and use them during a concentrated workshop time of three days.

STRATMAS participation was to expose Cupol and STRATMAS for other users to gain insight of what other users outside development team, military practitioners had to comment on its use. A common objective was to mimic the workshop like an EBO (Effects Based Operations) process; where the users selected Effects, linked the Effects to Actions, and assigned Resources for combined Tasking Orders. The users did not create new Effects, Actions or Resources just altered the Force Composition and reviewed different simulation results. Our syndicate 10 consisted of six persons from four different

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<sup>2</sup> Tool for Operational Planning, Force Activation and Simulation

<sup>3</sup> Effect Based Tool for Operational Planning, Force Activation and Simulation

organizations. They obtained that the work in the group resembled an EBO planning process and Cupol and STRATMAS provided helpful means of supporting this process. However, the main result was that the MOEs, compared to the MOPs, did not seem to add any better understanding of how force composition affects the outcome of the plan. Because of the limited time, we used a rather uncomplicated plan and perhaps the results would have been different if the plan that was tested would have been more complex.

We also discovered some things to improve in STRATMAS that are likely to result in more accurate and realistic values on some of the MOEs/MOPs. Thus, the results from this workshop should be useful in the forthcoming development process of STRATMAS.

### *Discussion*

Practitioners have in qualitative terms expressed their experiences of its use through out planning in four different exploratory exercises. Afghanistan, Iraq Future 2005, MNE-4 and Boppar. Their experiences are that they are supported by Cupol and STRATMAS and can transform initial state for a failing state, through a stepwise support in each sub-transformation procedure. Each sub-transformation step has focus around the effect based approach operational procedures planning products; effects, actions, tasks and this supports orders that was simulated.

Cupol as a plan generating transformation support has shoed it self to work. Existing half duplex link between Cupol and STRATMAS from Cupol to STRATMAS has not bean complained on when used by practitioners. It is although obvious that if MoE and MoP from STRATMAS to Cupols DM 3 matrix was streamed as feedback, could increase practitioner's overview during planning.

Observed questions stated by practitioners during simulated stimulated planning in Afghanistan exercise advised us that quantitative answers would increase planning precision. With this in mind practitioner have answers in the wargaming to how much, "when" to synchronize event at day granularity. This is also the last sub-transformation step practitioner performs in the staff. This last sub-transformation step, from tasks to units and orders, is bounded to use pre-assigned lexical elements and there arguments.

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