TOPFAS

(Tool for Operational Planning, Force Activation and Simulation)

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Abstract

TOPFAS is the data and planning support system for the operational planning and force activation in accordance with the NATO Operational Planning Process. It will provide a common database and tools for the planning process as well as a common repository of the operational plans and the audit trail for the Force Generation Process. TOPFAS supports the planning process with graphical tools to the greatest possible extent; i.e. graphical lay-out of the operational design, phases and tasks, geographical mapping tools for the specification of operational planning factors and environmental conditions; and for the disposition of the forces. Troop-to-task rules, combined with military expertise, are the basis for the identification of force requirements. The present paper is a summary of the Symposium Presentation.

Operational Planning in NATO

In the first 40 years after the formation of NATO the military operational planning focused exclusively on a single overriding concern; – the potential need for the defense of NATO territory in Europe. The continuous refinement of the specific plans for this consumed the staff talents without the need for the development of explicit NATO versions of the general concepts and doctrine for the operational art and the procedures for the development of operational plans. NATO was a one-scenario alliance. With the end of the cold war and the emergence of the new European security environment and the expansion of the role of NATO to include force deployments and peace support operations outside NATO territories the need to establish NATO doctrine and planning procedures for such operations became a requirement.

Operational planning in NATO can be conducted under a wide range of conditions, from routine exercises to immediate reaction to an attack on NATO territory. The main categories of planning situations are; 1) The response to an emerging crisis situation that NATO might become involved in, - typically a peace support operation where NATO become involved as the result of

a UN resolution/mandate and request for intervention; and 2) Prudent military planning for potential future operations that are not linked to any expressed threat or an actual crisis situation, but which nevertheless require advance planning to ensure NATO's ability to respond should it be called upon to do so. The ultimate responsibility for initiating planning under any of these headings rests with NATO's political leadership – the North Atlantic Council (NAC); although military commanders are, of course, expected to conduct prudent military planning within their terms of reference. In either case, the planning procedures that NATO has adopted are the same; although the urgency and time pressure will of course differ. The basic steps of the planning process are also the same for the different command levels of planning; - the military strategic, the operational and the tactical/component levels. In NATO, the planning at all levels are typically conducted in parallel with close interactions throughout the command hierarchy.

The basic military concepts used in the NATO Operational Planning Process (OPP) are the same or similar to those found in national military doctrines. However, certain key aspects of the planning process will be different for the obvious reasons that NATO is an alliance of 19 sovereign nations and that military forces only become available to the NATO commanders through the contributions from the nations in the force generation and activation process. The basic planning stages and products of the OPP are illustrated in Figure 1. It can be seen that explicit directives from the political level are required at three critical junctures: 1) Initiation of the planning process through the Initiating Directive (ID); 2) Authorization to proceed to the force generation process with the nations through the Force Activation Directive (FAD); and 3) Authorization to commence the execution of the operation through the Execution Directive (ED). Planning may, of course, stop at any point in the process when the appropriate planning product for the situation at hand has been produced.

Figure 1

From the receipt of the Initiating Directive until approval of the Concept of Operation (CONOPS) the OPP is largely conducted within and among the NATO military headquarters with only ad hoc interaction with national military authorities. The key planning products from the strategic level military level are the CONOPS and the Statement of Requirements (SOR). The SOR is the detailed estimate of the forces and capabilities required to conduct the operation and perform the tasks spelled out in the Initiating Directive. The SOR is expressed in terms of generic units and/or equipment. (Note: Generic and real unit data in TOPFAS is described later.) Once the force generation process starts, the interactions between the NATO and national military headquarters expand greatly. These interactions continue throughout the force generation and the deployment planning process. At the end of the force generation process the generic requirements of the SOR have been replaced by the real and specific force contributions of the nations. For NATO-lead peace support, disaster relief or humanitarian aid operations the participation of Partnership-for-Peace nations and others will normally be invited.

The force contributing nations are ultimately responsible for the movement and transportation of their units, equipment and sustainment to the theatre destinations; although the national planning is, of course, subject to close co-ordination by the appropriate NATO functional area authorities.

The key steps and tasks of the NATO OPP are further described in Figure 2. The text also includes references to important military concepts in the planning process and should allow comparison to the concepts found in national doctrine.

OPERATIONAL PLANNING PROCESS (OPP)

Planning Stages	Steps	Tasks		Output
INITIATION	1. Receive or recognize task(s).	•Receive (or develop) Initiating Directive •Provide Strategic Military Assessment •Form the Planning Group and gather necessary information		Possible MROs
ORIENTATION	1. Conduct Mission Analysis 2. Deliver Mission Analysis Briefing 3. Develop Commander's Planning Guidance	•Review the Situation •Review Superior's Mission, Intent, Objectives & End-state •Identify/review Constraints & Restraints •Identify/determine Assumptions and Factors •Identify the Strengths and Weaknesses (OPFOR & Own) •Identify/Determine the Centre(s) of Gravity (Strategic & Operational) •Determine Decisive Points	•Identify/determine Tasks (Assigned and Implied) •Determine Own Objectives, Desired End-state and Criteria for Success •Develop Mission Statement •Conduct Initial Force Structure Analysis •Prepare/deliver the Mission Analysis Briefing •Develop the Commander's Planning Guidance	Commander's Planning Guidance (may serve as an Initiating Directive to subordinates)
CONCEPT DEVELOPMENT	1. Staff analysis 2. Develop COAs 3. Deliver Decision Brief 4. Develop a Concept of Operations	•Analyse Situation/Make Deductions (Theatre Situation, Opposing Forces, Time and Space, Assessment of Tasks, C2, CIS) •Develop COAs •Analyse COAs (Test, War Game, Compare)	•Prepare/Deliver Decision Brief •Select Preferred COA •Develop Concept of Operations and forward for approval •Develop Statement of Requirements	Concept of Operations; SOR
PLAN DEVELOPMENT	1. Develop 2. Co-ordinate 3. Seek approval 4. Issue plan	•Refine Commander's Intent and Concept of Operations •Complete synchronisation of the plan •Confirm and identify forces through Force Generation Process •Co-ordinate and write OPLAN	•Write SUPLANS •Write Branch Plans •Seek OPLAN Approval •Issue OPLANs and SUPLANs	Family of Plans; Allied Disposition List (ADL)
PLAN REVIEW	1. Plan Review 2. Plan Evaluation 3. Revised Decision Brief	•Conduct Progress Review for on-going operations •Conduct Periodic Review •Conduct exercises and/or war games	•Conduct Revised Decision Briefing as required •Update/issue amendments as required •Prepare and Issue plans as required	Updates and/or develop new plans

Figure 2

TOPFAS in support of NATO Operational Planning

TOPFAS is still under development and it is too early to say what the final product will look like in terms of data, functionality and user interface. The development up to now have progressed through a series of laboratory trials and user reviews. The early laboratory trials identified a number of challenges. Some of these spring from the fact that NATO planners come from diverse national backgrounds. Also, the operational planning process in itself is a highly creative process, including brainstorming techniques and the application of concepts that are not easily translated into bits and bytes. Other demands on the software functionality are driven by the quick response requirements in a real planning situation. Related to this, a further challenge arose from an early user requirement that TOPFAS should include all OPP computer support requirements. The reason being that, if planners were to invest the time and effort to make use of a dedicated planning tool in a time-critical crisis response situation, the value-added benefits of the tool would have to include support for the preparation of all planning products, thereby eliminating the distraction of having to learn and make use of further special-purpose tools. Operational planning is not a full-time occupation of any NATO staff officer. So when the need arises the tool that he turns to has to be simple and intuitive.

The tools used at the early stages in a Joint Operational Planning Group (JOPG) are typically simple, but at the same time very powerful. Figure 3 illustrates the usual situation map and a course of action butcher-board. Both illustrations are taken from the "Atlantis-scenario" used in the NATO Operational Planning Course (OPC).

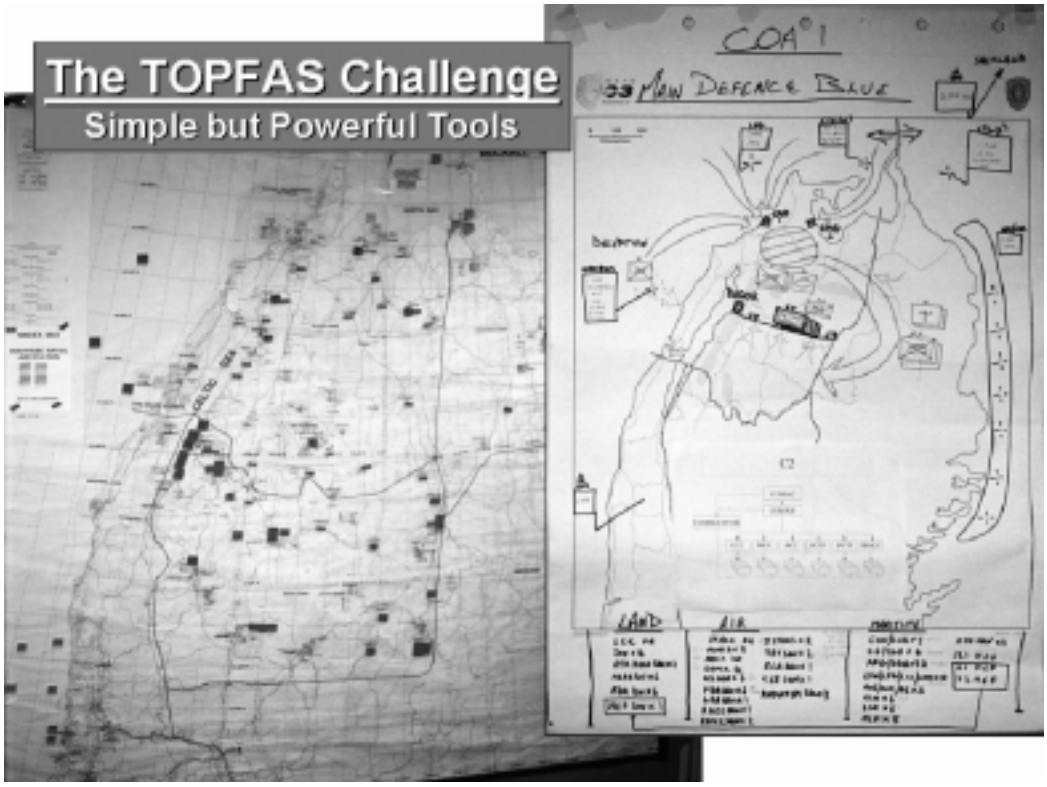

Figure 3

The tools in Figure 3 are so simple that we normally do not think of them as tools, but both are very powerful in focusing the JOPG and co-ordinating the creative process. At the same, both tools are very hard to emulate on a computer. The screen size, resolution and user interface technologies for practical and flexible fieldwork are not yet sufficiently advanced.

The scope and aim of the TOPFAS development is to provide software and data support for all stages and activities of the OPP. However, the sustainment and deployment planning are handled by other special-purpose logistics management systems. The TOPFAS functionality required for this is limited to the interfacing with these. For the rest, the stages and steps of the NATO OPP is build into the TOPFAS software in the form of a Planning Wizard (Figure 4) that guides the planner through the process and the associated TOPFAS functionality.

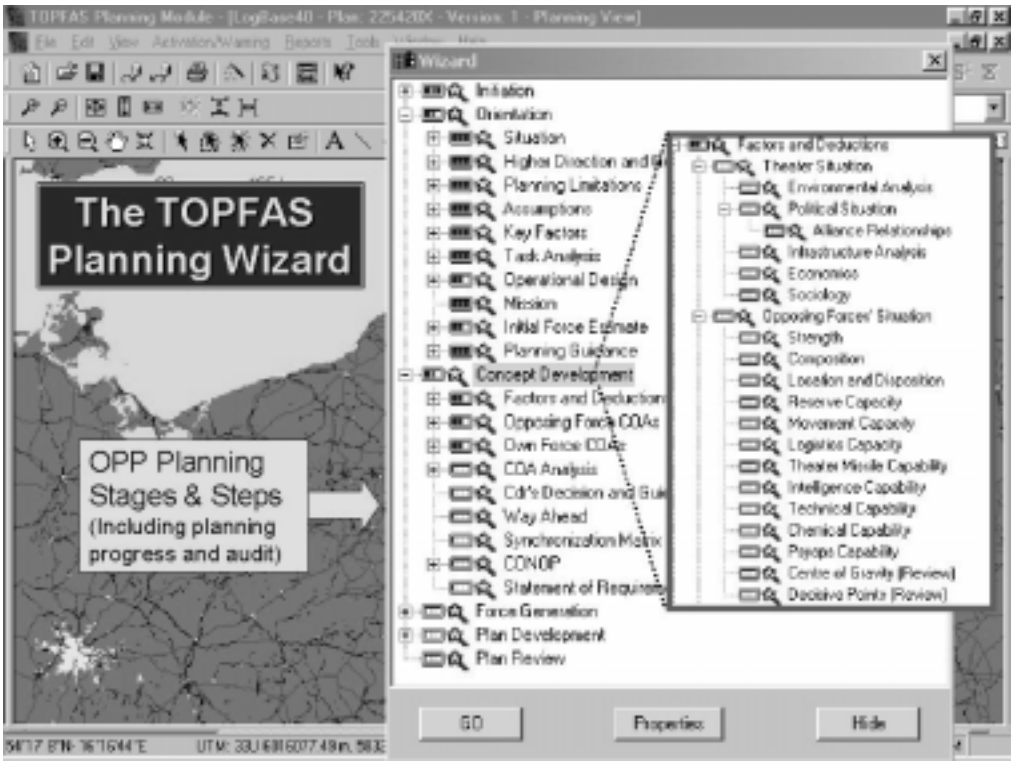

Figure 4

A further challenge in the system design, and especially the database, is that the OPP and hence TOPFAS is a joint planning tool. This means that the air, land, maritime and other service specific issues are all addressed within a common framework. A typical example of the issues that arise is the representation of military units. The way that unit data has is handled traditionally within the services are in many respects very different and the TOPFAS challenge is to merge these into common representation and processing functionality.

In addition to the basic functionality associated with the planning concepts and planning products there are extensive networking and interfacing requirements to support the collaborative

planning activities and the interfacing to other NATO military functional area systems. The systems architecture requirements associated with this are not discussed in this paper.

The primary users of TOPFAS will be the NATO Strategic Commands, Combined Joint Planning Staff, Regional Commands and other NATO military headquarters with designated operational planning tasks. It will provide a common database and tools for the NATO OPP as well as a common repository of the operational plans and the audit trail for the Force Generation Process. TOPFAS interfaces indirectly with the NATO Defence Planning Process through the planning situations and generic force definitions. In actual planning it will interface directly with Intelligence Information Systems for the preparation of the battlefield, and with the Logistics Management Systems for sustainment and deployment planning. OpsBase is the relational database for the family of TOPFAS applications. It is fully harmonized with LogBase, the relational database for the family of NATO Logistics Management Systems, and holds the relevant information about military tasks and planning factors as well as the generic and real forces and equipment that may be expected to participate in or impact on NATO-lead operations.

The planning functionality in TOPFAS requires that the database include extensive data on the military units that nations may contribute in a NATO-lead operation. Although the initial planning results are expressed in terms of requirements for generic units and capabilities, it is clear that the planning from the outset need to take into account the limitations of real capabilities. Once the planning has progressed to the force generation and balancing, the real-unit operational data requirements becomes obvious. By itself, the need for data management functionality within TOPFAS for the operational data on national units, their organisation and equipment makes the tool useful beyond the operational planning requirements.

TOPFAS Planning Functionality

The user software supports the activities and preparation of all planning products depicted in Figures 1, 2 and 3 through the planning stages:

- Initiation based on the initiating directive and including the receipt of planning inputs and preparation of the database.
- Orientation with focus on the mission analysis, operational design and the identification of assigned and implied tasks and planning factors.
- Concept Development with identification of the preferred course of action (COA) to be developed into the concept of operations (CONOPS) including force requirements.
- Plan Development with the refinement of the CONOPS and detailed planning based on the actual forces and capabilities provided by the nations.
- Plan Review for further assessment, large-scale war-gaming and exercising, including the adaptation of the force requirements to the changing operational environment.

TOPFAS support the planning process with graphical tools to the greatest possible extent; i.e. graphical layout of the operational design, phases and tasks, geographical mapping tools for the specification of operational and environmental factors. As an example, Figure 5 illustrates the Operational Design View for the development of the operational Objectives, Centers of Gravity,

Decisive Points, Lines of Operation, etc for each of the sides, factions or parties in the conflict or planning situation. All of these are concepts and their application to the different type of operations that NATO must plan for are continuously being discussed among the planners. The TOPFAS user interface for the operational design concepts will therefore, most likely, evolve as the refinement of the concepts and their application evolves.

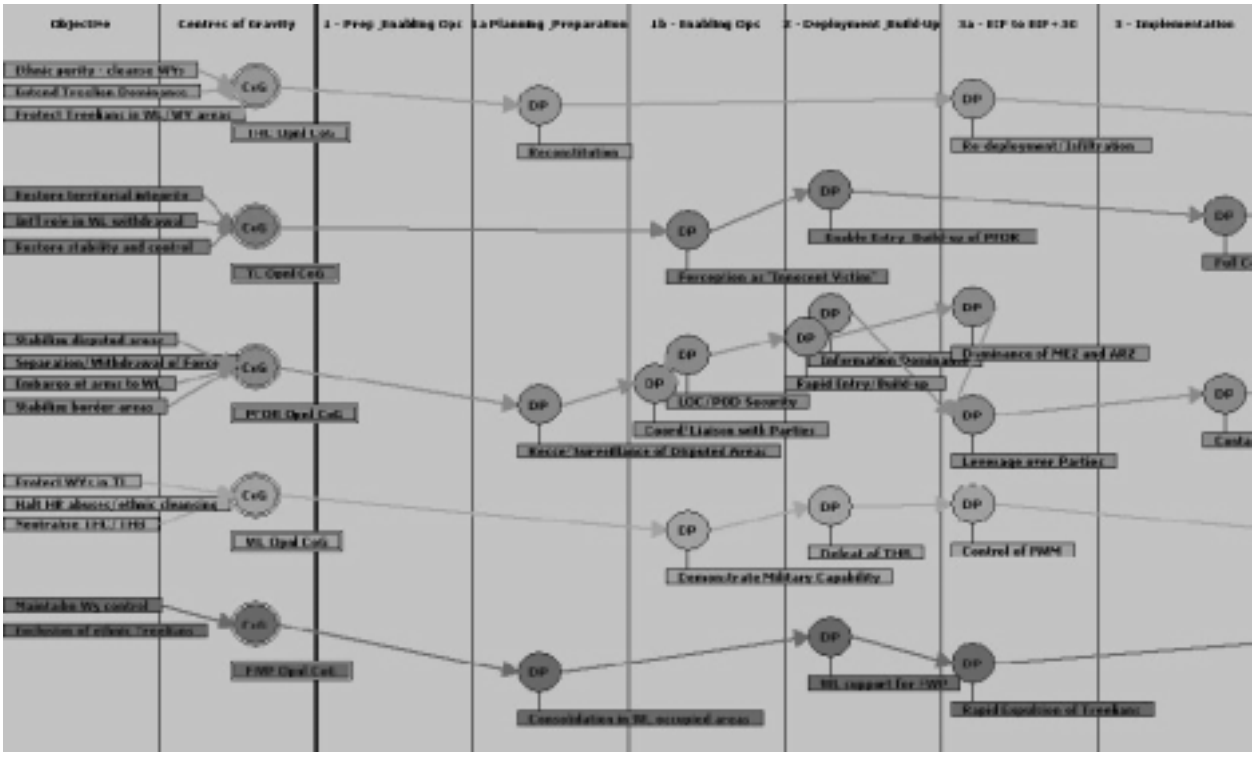

Figure 5. The TOPFAS Operational Design View

The work in the early stages of the NATO OPP (Initiation, Orientation and Concept Development) is aimed at the early and rough estimates of the force requirements and ultimately the refined Statement of Requirement (SOR) which is the strategic commanders feedback to the national/political level on what resources he needs to do the job. To the nations this represent the cost of the operation, both in terms of money and exposure. Needless to say, the SOR is therefore subject to careful scrutiny and it is necessary to be able to back up the entries (SOR Serials) with adequate operational justification before the nations can assign their soldiers and resources to the NATO commander.

The support of TOPFAS in this respect is to provide "an audit trail" from each SOR serial back through the planning process through the operational design to the Initiating Directive. The key to this audit trail is the tasks that the forces have to perform in order to execute the mission assigned to the forces. Each SOR Serial (unit, personnel and/or equipment) will have one or more functions to perform in the operation. The rationale or justification for the requirement will either be that the unit is required in support of other units as a consequence of deploying the

force, or as a requirement derived directly from the mission. The latter are tasks in either of two categories:

- *Assigned Tasks (AT)*, derived directly from the wording of the Initiating Directive, or
- *Implied Tasks (IT)*, derived by the JOPG in the course of the Mission Analysis.

The implied tasks are required for the mission, but are not necessarily spelled out in the Initiating Directive. Examples could be *Provide Force Protection*, *Secure Lines of Communication*, or *Establish Air Superiority*. In the planning at the operational level the assigned and implied tasks may be further assigned to subordinate commands once the planning has progressed to the point where the service/component commands required for the operation can be identified. In TOPFAS this leads to a third category of tasks:

- *Subordinate Tasks (ST)*, derived from the assigned or implied tasks at the operational level and passed on to component commands.

One assigned or implied task at the operational level may be passed on in different forms to several components. For example providing air defense protection to the forces may be an implied task derived on the operational level. In terms of implementing this requirement, further and more specific air defense tasks can be assigned to both the air component command (ACC), the land component command (LCC) and the maritime component command (MCC). Seen from the operational level planning, these become subordinate tasks. Both assigned, implied and subordinate tasks may be associated with the Intermediate Objectives of the Decisive Points in the operational design.

Both the ATs, ITs and STs are "free text" tasks in the sense that their wording is whatever the JOPG determined in their brainstorming or mission analysis. In order to bring the computer power to bear on the planning, the free text tasks need to be linked to the database and the supporting algorithms. The linking mechanism for this in TOPFAS is a fourth category of tasks:

- *Force-oriented Tasks (FT)*, a database library of all tasks that military units under NATO command can be asked to perform.

The next step in the TOPFAS way of operational planning is to assign (link) one or more FTs to each AT, IT or ST. This is done by "drag-and-drop" as illustrated in Figure 6. It is beyond the scope of this paper to describe how the TOPFAS list of force-oriented tasks has been developed. Needless to say, the list of potential FTs (FTL) is very long and several techniques are used to make the user interaction with it manageable. The FTL is first of all organised in a tree structure. At the top level are the types of operations that NATO can become involved in: Defence of NATO territory, Peace Enforcement, Peace Keeping, Humanitarian Aid, etc, etc. At the next level each type of operation is broken down into the typical phases of any operation: Preparation, Deployment, Execution, Transition, Re-deployment. The phases defined for an actual operation can of course differ from these, but the "standard phases" serves as a guideline for where the user might find the FT that he is looking for. At the third, fourth and fifth level, etc follow the actual tasks that might be relevant in that phase of that type of operation. Again organised in a logical hierarchical manner. Hence, the structure of the FTL also serves as a checklist of the tasks that

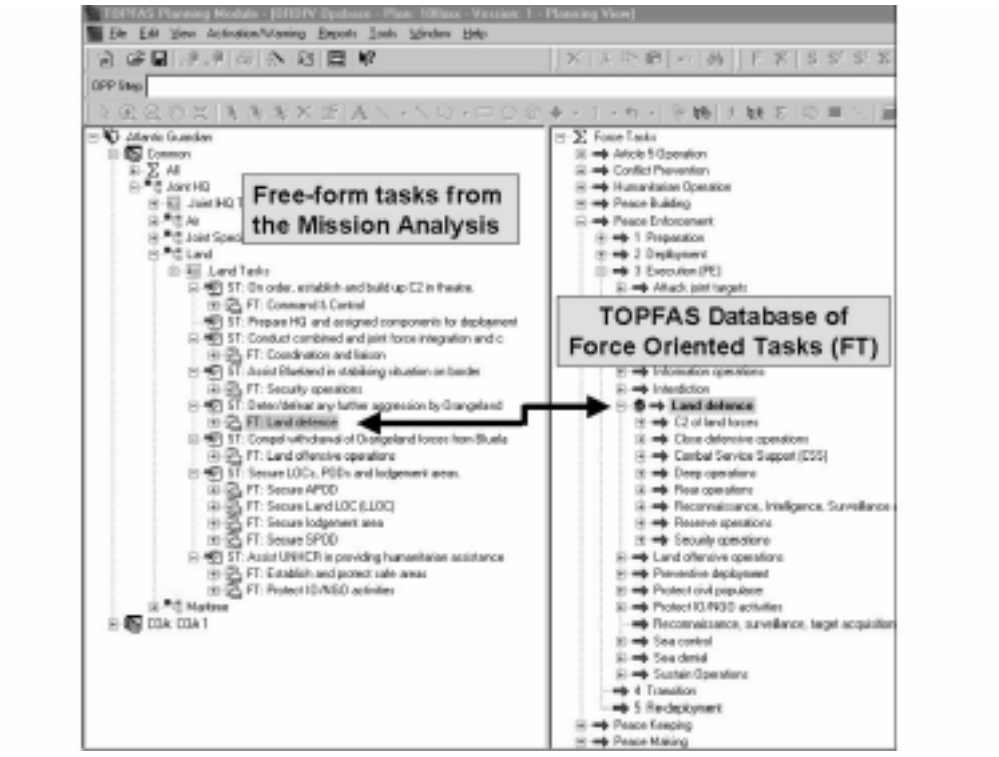

Figure 6. Linking Free Text Tasks to the Database of Force-oriented Tasks

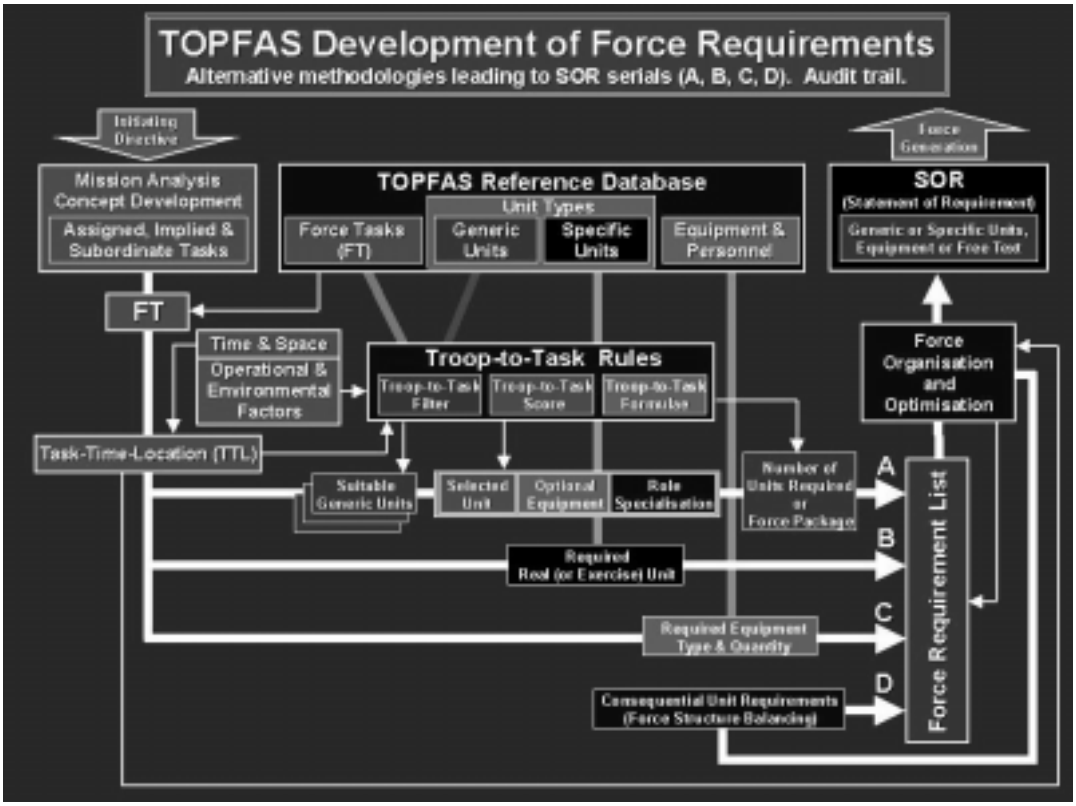

Figure 7

the planner should consider at the particular stage of the planning. As a further help in managing the list, each task has been labeled according to the level of planning (strategic, operational or tactical) where the task would typically be considered. The tasks are also labelled according to the service that might perform the task; and according to the role category of a unit performing the task (Command, Combat, Combat Support and Combat Service Support). The user may apply filters according to any of these categorisations to simplify his work. Search functions on keywords in the FTL is also included.

Having, linked all the free text tasks to the FTs of the database, the next step in the TOPFAS planning is to define the time and the locations where the tasks have to be performed. The time is typically a time widow, perhaps corresponding to a phase of the operation or events or time provisions in a peace treaty. The timing of the tasks can be either against real calendar dates or time relative to a reference date for the plan, M-Day, C-Day, D-Day, etc. The time management in TOPFAS is done with a Gantt-type interface. The location for the task will typically be an area within the general theatre of operation. The mapping tool in TOPFAS provide the functionality of defining areas or locations of various types on various map layers, either standard military functional area map layers or user-defined layers. The area defined by the user can either be an area of a pre-defined type (land defense area, sea control area, etc.) or any general area defined by a polygon drawn by the planner. The assignment (or linking) of tasks to areas is again by "drag-and-drop" on the map. The combination of task (FT), time window and location (area) is a key concept in TOPFAS and is referred to as a TTL (Task-Time-Location).

The last step in the TOPFAS planning sequence prior to generating a force estimate or an SOR is to assign the requisite type and number of units or equipment to each TTL. This can be done in either of three ways:

- Manual assignment of forces or equipment from the TOPFAS database of generic or real units and equipment to the TTL.
- Automatic calculation of the TTL requirement by applying the relevant TOPFAS Troop-to-Task Rule (TTR).
- A Combination of the above by first applying the TTR and subsequently modifying the TTR "recommendation" according to the planners preference.

The selection of real units for inclusion on the SOR is, of course, only meaningful only when the unit is a pre-assigned element of the operation and the owner nation is in agreement with this. In terms of the type of entries that can occur on the SOR the categories and general process is illustrated in Figure 7. Each SOR Serial can belong to either of 4 categories:

A. A generic unit manually selected or calculated from one of the Troop-to-Task Rules.

B. A named unit from the TOPFAS database manually assigned to one or more tasks.

C. A quantity of equipment from the TOPFAS database assigned to one or more tasks.

D. A consequential, supporting (generic) unit requirement derived indirectly from the primary force requirements (A, B, C); not directly associated with an operational task.

Note that the supporting unit entries need not necessarily be CSS units. In a humanitarian aid or disaster relief situation the support could include force protection by combat units.

Once the CONOPS and SOR have been approved, the next major stage in the NATO planning and preparation is the force generation. This is the process by which the strategic commander requests and the nations provide the forces for the operation. Needless to say, the forces provided do not necessarily match 100% with the forces requested. The evaluation of the impact of the differences and the further dialog with the nations to fill any critical shortfalls is the force balancing process. The end result in TOPFAS terms is the Allied Forces List (AFL) with the real named units or other contributions by the nations.

Once the forces that will participate in the operation are known, the Plan Development stage of the OPP refines the CONOPS into a fully developed plan. The key TOPFAS output at this stage is the Allied Disposition List (ADL) with further details as to the force composition, lines of communication, deployment timing. The ADL is the final result of the TOPFAS planning. It becomes the basis for the further logistical planning of sustainment and transportation by the NATO Logistics Management Systems:

- ACROSS (ACE Resource Optimization Software System) for the calculation and planning of the required sustainment packages. This together with the unit personnel and unit equipment becomes the total movement and transportation reqiurement.

- ADAMS (Allied Deployment and Movement System) for the planning and co-ordination of the deployment plans among the participating nations and the NATO movement co-ordination staffs.

In summary: Associated with the stages of the operational planning process are the TOPFAS database representations that provide the plan documentation and audit trail. Some of the key TOPFAS planning documents are:

- TTL (Task-Time-Location) providing the COA overview in terms of the assigned and implied mission tasks linked to the database of standard military force tasks with further specification of time and place (locations and operating areas).

- SOR (Statement of Requirement) expressed in terms the generic units, thereby defining the military capabilities required to accomplish the mission; serving as the basis for the force generating and balancing process with the nations.

- AFL (Allied Forces List) with the named units from the troop contributing nations matched against the capabilities and generic requirements of the SOR, including the force structure and command relationships.

- ADL (Allied Disposition List) providing the starting point for the deployment and logistical support planning in terms of further information and guidance on the operational disposition of the forces and recommended lines of communication.

Force Profiles, Formations, Units and Equipment in TOPFAS

A major concern of the NATO operational planners is to assemble and configure the right forces for the operation. The importance of this is reflected in the importance of the force data in the TOPFAS database. Forces and equipment in TOPFAS are represented on several levels of command hierarchy and with several levels of abstraction depending on the purpose of the force data. Forces from all services are represented within the same basic data structure. The categories of forces within the TOPFAS database are:

- *Real Units (Named Units)* as reported by the nations for NATO planning or other national forces that may participate in NATO operations. These are the units (or parts thereof) that may be nominated in the force generation process.

- *Exercise Units (Named Units)*. These are fictitious units owned by fictitious nations that are used in NATO staff exercises and training, but are otherwise represented in the same form and to the same level of detail as the real units.

- *Generic Units*. These are type units specifically designed for TOPFAS planning purposes. No two units of the same type from different NATO nations are alike. A different "common currency" is therefore required.

A *unit* in TOPFAS may be represented in either of two forms: As a "composite unit" or *formation* which has both subordinate/component units and equipment holdings, or as "basic building block" units which has equipment holdings but no further structural break down. A basic unit in TOPFAS may be at any echelon level. A basic unit may be a ship, a squadron, a battalion or a platoon depending on the appropriate level for the functional area.

The real units will typically have several representations in TOPFAS. The differences may be determined by planning horizon or operational configuration. For example the 11th NL Air-mobile Bde may have different configurations (both w r t constituent units and equipment) depending on whether the configuration is current standard, future improvement plans for the unit, its configuration for operations in the arctic or in the desert, etc. Different versions of the same unit or formation are organised in different force *profiles*. A profile may be any collection of units and formations, but would typically correspond to the units of a nation or a service or the forces in a particular plan, etc. The TOPFAS database of generic units is a special force profile.

The generic units in TOPFAS serves two purposes: On the SOR the typical SOR Serial is a generic unit; for example "*Mechanised Infantry Battalion*". The TOPFAS database entry for the unit describes further what the planner had in mind when he placed this requirement on the SOR. The generic units are also used as type designators for the real and exercise units. This serves as a general indication of the expected unit capabilities. The challenge in defining the TOPFAS generic units has been to balance between useless generalities and counterproductive level of detail. The hierarchical breakdown of the generic units is illustrated in Figure 8. It is somewhat different from that of the real and exercise units. To simplify the user interaction with the data, the generic units are organised in a tree structure according to military functional family and unit type. Below that are the relevant echelons for the unit type which are broken down in the same

way as for the real and exercise units. Also note that the equipment holdings for the generic unit are limited key equipment items that indicate the type of capability expected from this type of unit. The equipment listing for a corresponding real unit would be much more extensive and include all equipment holdings for the unit.

The military *equipment* representation in TOPFAS is organised in a six-character hierarchical system of Reportable Item Codes (RICs). The RIC structure is a tree-structure based on military functionality. All NATO military equipment has a corresponding RIC code which allow the categorisation of similar equipment across the nations according to functionality and basic characteristics. The hierarchical breakdown is from the generic to the specific; e.g. the interpretation of RIC 'AA14A2' is: Armor – Tank – MBT – 120 mm main gun – Leopard II – Leopard II, Model x. This would be the RIC designation in the inventory of real units that have this type of main battle tank. However, this would be too specific for the equipment description in a generic unit. A generic tank battalion would typically be described as having a number of main battle tanks, perhaps with an indication of main gun caliber; e.g. RIC 'AA14' (Armor – Tank – MBT – 120 mm main gun) without any further reference to make or model. Note from the example in Figure 8 that the equipment descriptions are typically limited to "four-character" RICs, while a real unit inventory would be described by the full "six-character" RICs.

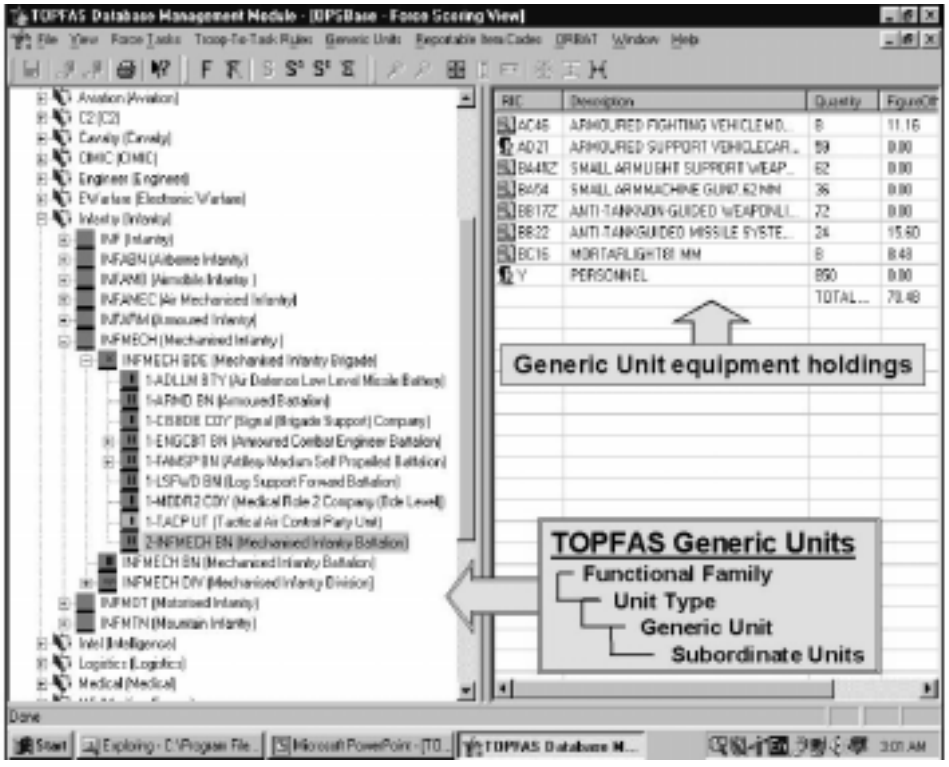

Figure 8

Notice also in the example that some equipment have a Figure of Merit (FoM). This is a static scoring system to allow a measure of the quality as well as the quantity of the equipment held by the unit. When multiplied and added up it gives a measure of the strength of the unit and allows

for force ratio calculations in the mission analysis as well as in the Troop-to-Task Rules. It also provides a quantitative measure for the comparison of force contributions in the force balancing process. The current TOPFAS FoMs are based on the well-known EPOCC (Equipment Potential Capability Comparisons) system. FoM for generic TOPFAS equipment; i.e. 'four-character RICs' etc. are calculated from the EPOCC scores of the real equipment of the same type.

Troop-to-Task Rules

A key output of the TOPFAS planning is the Statement of Requirement expressing the force requirements for the operation. The requirements can be generated by the planner selecting generic units for the tasks based on his military judgement or by invoking the power of the computer by applying the Troop-to-Task Rules (TTRs) residing within the TOPFAS database. The latter is the standard way of TOPFAS planning, however much work remains to be done before we can claim that the TOPFAS database of TTRs are anywhere near the required level of completion or quality. The development of the TTRs is very much an evolutionary process involving numerous NATO military headquarters that have been designated as custodians and the source of the expertise required for the TTR. In addition to providing the planning support within TOPFAS the TTRs also function as a repository of the corporate knowledge and doctrine for the particular type activity represented by the TTR. A key feature here is that while all other TOPFAS software is coded in C++, the TTRs reside as readable Visual Basic text code in the relational database and is directly accessible to the user. This provides for greater user visibility of the TTR algorithms and eventually greater confidence in the TTR results. Figure 9 illustrates

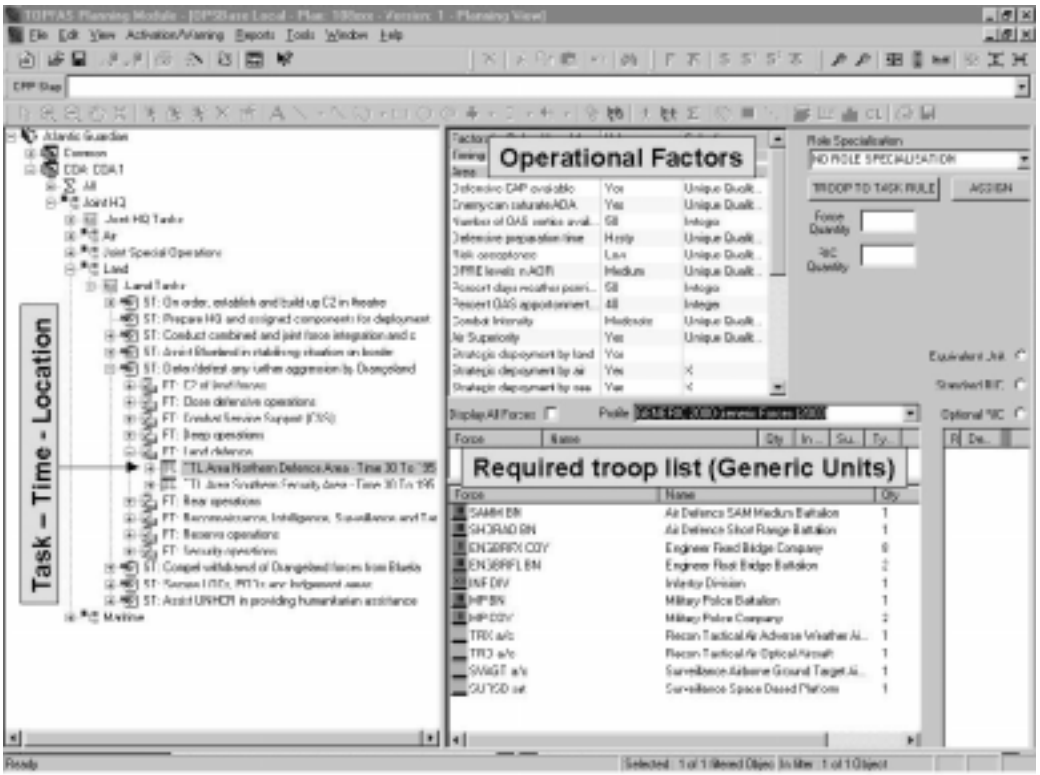

Figure 9. TOPFAS Troop-to-Task Worksheet

the TTR Worksheet. A TTR is applied to a TTL, which define the force-oriented task and the time and the location for it. Depending on the TTR, most of the environmental and operational factors have already been defined in the mapping tool for the relevant drawing objects when they where created in the earlier stages of the planning. The values for the additional factors required by the particular TTR are entered or modified on the Worksheet. The results in the form of a recommended force package are seen immediately on the same Worksheet. Of course, in a typical situation the planner would not simply accept the TTR results. The TTR also indicate alternative solutions and measures of their suitability. Also the user may wish to change the value of certain factors to explore the sensitivity of the 'solution' in which case the TTR will highlight the impact of the changes. Alternatively, the planner may accept part of the solution or modify the results in terms of unit types or quantities according to his judgement.

Additional TOPFAS Tools and Functionality

The description of the TOPFAS planning functionality in this paper has concentrated on the main line of planning from the Initiating Directive to the SOR and the final ADL. However, in the course of the planning several additional steps and supporting activities will have to be covered. For example, tools are required to support the synchronisation of the joint operations and the evaluation of alternative courses of action. Both manual and automatic war-gaming tools as well as deployment feasibility assessment tools are under development and will be included in TOPFAS. Figure 10 is an illustration from the joint operations simulation model Gamma which is under development and will be included in TOPFAS. Numerous other statistical and analytical tools are included for the evaluation of the quality and completeness of the plan.

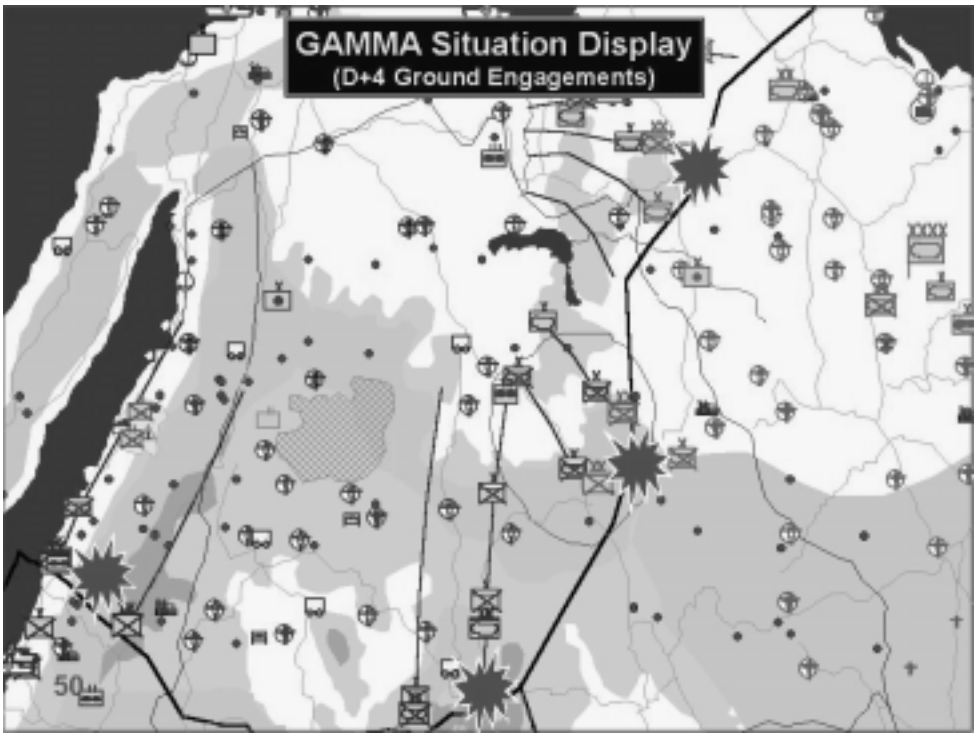

Figure 10