A Model for Peace Support Operations: an overview of the ICT and Interoperability Requirements

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Abstract: This paper is part of a long term research project conducted by the Council for Scientific and Industrial Research (CSIR) In South Africa. The objective of the project is to construct a model for the planning and execution of Peace Support Operations (PSOs). In this paper we describe the development methodology for a PSO planning model and we investigate the required interoperability information and communication technologies (ICT) requirements for PSOs.

Peace support operations, by their very nature, can be extremely complex endeavours. They are characterised by multiple stakeholders working together to solve ill-structured problems. In the case of the South African National Defence Force (SANDF), this means the deployment of different arms of service together with other potential stakeholders such as a coalition of multinational forces, government agencies, civilian agencies, local populations, warring factions, and media agencies.The diverse presence of multiple stakeholders requires a reciprocal interdependence among these various elements, and this necessitates complex coordination and a great demand for ongoing and accurate communication (Chisholm 1986). Higher technological complexity requires higher levels of communication (Gailbraith 1977).

The complexity is exacerbated by the fact that peace support missions are long in duration and success cannot be achieved by conducting a series of unrelated actions. The decision/action cycle is continuous and every action must contribute to the overall mission. Rapid decision making under conditions of volatility and uncertainty adds to the complexity. Forces, including commanders, are also rotated after serving a term, thus at hand-over loss of situation awareness may occur.

The Command and Control for these operations place additional burdens on the ICT that support it. In essence, required Information Warfare (IW) capabilities and technologies in Peace Support Operations (PSO) are the ICT that provides a Joint Command and Control capability.

In the first part of this paper, we describe a methodology to construct a planning model for PSO and we motivate the use of morphological analysis to develop a first phase of the model. In the second part, we identify the required ICT for PSOs, and investigate interoperability requirements for Joint Command and Control in PSOs. Our findings are based on interviews conducted with various individuals that are involved in PSOs, as well as a literature study. The Joint Command, Control and Consultation Information Exchange Data Model enjoys international acceptance as a basis for interoperability. Some countries have even accepted it as a national data model. This model will be used as a starting point of the interoperability standards investigation.

Keywords: peace support operations, command and control, situational awareness, morphological analysis, JC3IEDM.

1. Introduction

Deploying military forces in conflicting areas is without doubt a complex and multifaceted undertaking. The deployment process encompasses decisions at all levels of warfare. Peace Support Operations are multifunctional operations in which impartial military activities are designed to create a secure environment and to facilitate the efforts of the civilian elements of the mission to create a self-sustaining peace. The demands of individual PSOs are diverse and consequently require classification that reflects their essential nature. A PSO may include conflict prevention, peacekeeping, peace enforcement, peacemaking, peace building and humanitarian operations. The transformation of the security environment from classical peacekeeping operations into complex multidimensional conflict management activities with a diplomatic/political focus, has also meant an increase in number of role players, making military forces one of many role players. Other role players are international and regional organisations such as the United Nations (UN), African Union (AU), the Southern African Development Community (SADC); the International Civilian Police Component

(CIVPOL); civilian personnel, non-governmental organisations (NGOs); local communities, warring factions, and the international media.

These operations can be extremely complex endeavours. Success cannot be achieved by conducting a series of unrelated actions. The decision/action cycle is continuous and every action must contribute to the overall mission. Rapid decision making under conditions of volatility and uncertainty adds to the complexity. According to Peace Support Operations doctrine of the SANDF, the delivery of any peace mission requires the integration of five key functional areas; human resources, intelligence, logistics, infrastructure and finance (Joint Operations Division 2005). Analysis of previous peace support operations identified the following as operational tasks performed;

- Observation, monitoring and supervision;
- Preventative deployment;
- Enforcement of sanctions;
- Setting up and maintaining protected areas;
- Forced separation of parties;
- Guarantee or denial of freedom of movement;
- Demobilisation operations;
- Military aid;
- Non-combatant evacuation and
- Humanitarian operations.

These tasks are by no means exhaustive and do not cover all forms of military activity during a peace operation. Neither is the division absolute, as the tasks often overlap each other. Naturally, the military activities needed for one core task may also be performed for another.

A recent study conducted by CSIR identified problem areas faced by the SANDF during PSOs as:

a) Monitoring and Surveillance

Peace mission mandates (from the UN, AU, or SADC) instruct peacekeeping forces to observe whether parties stick to the conditions of peace agreements, to report on activities by belligerents, and to protect own forces. A major deficiency during PSOs is the lack of sufficient monitoring and surveillance equipment. Simple observation by the human eye has many limitations. The line-of-sight limits the range of vision in daytime, and observation becomes impossible during night-time. It becomes impossible to monitor vast territories, and to maintain a presence in distant locations. Early warning of armed conflict and the detection of arms smuggling cannot be accomplished without the ability to sensor activities. Modern monitoring technologies can increase the range, effectiveness and accuracy of observation.

b. Force Safety and Protection

The UN report by Dr. Dorn (Dorn 2007), ACCORD's report on the Burundi peace (ACCORD 2007), and recent events in Darfur clearly identify force protection and safety as a major concern for peace mission forces. More than 2 000 UN personnel have lost their lives during UN peacekeeping operations since 1948. The causes for these fatalities were accidents (40%), malicious acts (30%), illness (24%), and other causes (6%). Monitoring of belligerent forces and better threat assessment can prevent fatalities.

c. Situational Awareness

Commanders require contextual information at all levels of war to improve planning and decision-making. The different levels of war are national, strategic, operational and tactical. The commanders have to understand the local politics, and have knowledge about the conditions (roads, weather, etc.) at the location of deployment. They need precise information about the locations, unit structure and weaponry of belligerent forces, as well as factors like the level of support from the local population. The ability to track own forces is also essential. Situational awareness can be improved by better monitoring and improved intelligence gathering.

d. Decision Making

Due to the enormous quantities and varied sources of information that confront decision makers and commanders at all levels of the authorisation, planning and execution of PSOs, there is a need for decision support tools at all levels, as well as the integration of systems. "Raw" information from the field needs to be gathered, collated, synthesised, analysed, and disseminated. Technologies to assist with these tasks and to deal with "information overflow" are urgently needed. (Modise 2008)

In this paper it is asserted that the ability to perform adequate monitoring and surveillance enables situational awareness, while situational awareness enables force protection and safety, and it also supports decision making. The interdependency of the problem areas therefore, calls for an efficient planning model and requires interoperability of different systems, military divisions and role players, as well as efficient command and control (C2).

The goal of this paper is twofold. It describes a framework to develop methods and models required for the planning and execution of PSO and investigate interoperability requirements thereof. Such methods, when fully developed, give the military planner the ability to rapidly assess the requirements as circumstances change.

From interviews with SANDF staff (Ross 2007), we gathered that the SANDF planning process for PSOs involves an unstructured approach where a group of subject matter specialists gather around a table to develop planning requirements and scenarios. Individual divisions in the SANDF do have structured planning processes and we will incorporate these processes in our model.

An unstructured approach such as the one currently used may be useful or even effective in circumstances when: 1) planning for a small operation, 2) there is abundance of resources; 3) there are no time constraints. The approach however, fails to capture the complex interrelations of a joint force fulfilling multiple objectives such as PSOs. As mentioned earlier, the PSO environment is characterised by multiple stakeholders working together to solve ill-structured problems. There exist a scarcity of resources such as personnel, equipments, capabilities, and technologies needed required for such operations. The planning for PSO therefore exhibits characteristics of a *wicked problem*.

Wicked problems, according to Ritchey (Ritchey 2005-2008) are ill-defined, ambiguous and associated with strong moral, political and professional issues. Because of their strong stakeholder dependency, there is often little consensus about what the problem is, let alone how to resolve it. They consist of complex, interacting issues evolving in a dynamic social context. For this reason, we describe the development of a PSO planning model as a systematic approach designed to give the military planners a tool to rapidly assess the interoperable force requirements, and to develop efficient plans. The model aims to identify and capture missions to be carried out, match them to capabilities, ICT technologies and skills, threats and terrains. It should also include factors such as the readiness of the forces available, the location of the units, the rotations of the units, the status of equipment in terms of availability and usability, and necessary co-operation with other role players in the PSO environment.

The paper is organised as follows. Section 2 gives a framework for the development of a model for PSOs. Section 3 addresses interoperability requirements and related ICT requirements for PSOs, and we conclude in Section 4.

2. Developing a planning model for PSOs

Our aim is to develop a computer-based tool for military planners that can be used when the SANDF is instructed to deploy on a PSO. This tool will assist the SANDF to develop efficient operational plans where inputs from several arms of service and role players are required, and to relate the plans to force requirements.

The method we are using to develop the high-level phase is *Morphological Analysis (MA)*. MA is a non-quantified modelling method for structuring and analysing ill-structured problems that contain uncertainties and require a judgemental approach. This method builds an inference model that strives to represent the total problem space and a maximum number of possible solutions. A morphological analysis is carried out in a number of iterative steps, in which a subject specialist group goes through a number of analysis and synthesis cycles. During an analysis phase, the most important dimensions of the problem are identified and defined. Each dimension (or parameter) is given a number or range of values or conditions. An *n*-dimensional configuration space is constructed (called a morphological field) by setting these parameters against each other, each as the heading of a column, with its values in the rows. One state (or solution) of the problem is found by selecting one value from each column. A morphological field represents the total solution space and thus have many possible solutions.

In a synthesis cycle, we reduce the number of possible solutions by doing cross-consistency assessment (CCA): every pair of values in the morphological field is checked for consistency. The set of possible solutions is reduced to contain only internally consistent configurations. Note that the success of MA depends on the availability of a group of subject specialists. The output of MA is no better than the quality of its input. (Ritchie 2005-2008)

In the next few paragraphs we illustrate and describe how to apply MA to construct a PSO planning model. We describe the construction of a first phase morphological field. Note that example we produce is only an illustration of the process. The actual first phase morphological field will be constructed by facilitation with a group of SANDF members that have been involved in the planning and execution of a PSO. A completed PSO model will require several phases.

The first phase:
We assume the SANDF planners receive an instruction from the South African government to deploy on a PSO. This instruction will contain the mandate (i.e. type of PSO) and the geographical area of deployment. They now have to develop plans for the PSO.

The first question we pose to our selected specialist group is “What is the force requirement for this PSO?”. Our definition of “force requirement” is the size and composition of the deployment force. Our group has to identify the main functions they have to consider in the initial planning phase. These functions will be the parameters of the morphological field.

Suppose they identify the following parameters: type of mission; geographical area of deployment; expected threats; required capability of deployed force; tasks to be performed; and non-military stakeholders. A prototype morphological field is shown in Table 1.

The next step is to pair-wise check the consistency of different values in Table 1. This is shown in Figure 1. Note that the symbol “-“ indicates that the two values are consistent, while the symbol “X” indicates the two values are inconsistent. The symbol “K” indicates that the participants are not sure if the two values are consistent.

Tables 2 and 3 are examples of the resulting solution space after CCA was performed, i.e. inconsistencies have been removed. Note that CCA functions as a garbage detector: it detects vague concepts, concepts with different meanings for different participants, different terms meaning the same thing, etc. (Tom Ritchey 2005-2008).

In Tables 2 and 3, we show how any particular parameter can be selected as a driver, or several parameters as multiple drivers. One or more of the values of these drivers can be locked in as “input” – these values are indicated in red (light grey). The resultant outcome space is shown in blue (darker grey). Note that we used the MA/Casper software developed by the Swedish Morphological Society to produce these tables.

From Tables 2 and 3 and other solutions, it is apparent that there are some parameters and some values that are redundant / belong in a lower level phase / their interpretations have not been consistent. A few examples are:

- The parameter “Geographical area of operations” will only become important at a later phase of modelling. At this level of planning it does not yet influence plans.
- The value “IW” (Information Warfare) of the parameter “Capabilities” has to be considered at a lower level phase because it is consistent with every solution at this level.
- The solutions for “Peacekeeping” exclude some expected values: tasks such as “Setting up and maintaining protective areas” and the “Military Health Services” capability.

The next step is to go through additional synthesis-analysis cycles until you have a resulting MA analysis that makes sense and produces consistent results.

Table 1: An example of a high level prototype morphological field for PSO planning

Type of PSO mission	Tasks	Capabilities	Threat groups	Geographical area of operations	Non Military stakeholders
Preventative Diplomacy	Preventative Deployment	Navy	Terrorist group	Outside Africa	NGO's
Peace Keeping	Observation, monitoring and supervision	Army	Belligerent groups	Africa-wide	Media
Peace Enforcement	Enforcement of sanctions	Airforce	Political and ethnical extremist group	SADC	Other Gov Departments
Peace Building and Post conflict reconstruction	Forced separations of the parties	Military Health Services	Extreme Religious Group		
Humanitarian Support	Setting up and maintaining protective areas	Joint Ops	Dislocated population flowing into other African countries		
	Humaniatarian aid	IW	Hostile local communities		
	VIP Protection		No threats		
	Military aid/support to civil authorities				
	Gaurantee or denial of freedom of movement				
	Non combatant evacuation operations				
	Force Protection and Safety				

		Type of PSO mis					Tasks											Capabilities							Threat groups							Geograph		
		Diplomacy	ce Keeping	nforcement	onstruction	an Support	eployment	supervision	f sanctions	the parties	ctive areas	iatarian aid	Protection	authorities	movement	operations	and Safety	Navy	Army	Airforce	h Services	Joint Ops	IW	y capability	orist group	ent groups	emist group	ious Group	n countries	ommunities	No threats	tside Africa	Africa-wide	SADC
Tasks	Preventative	-	X	X	X	X																												
	Observation,	-	-	-	-	K																												
	Enforcement of	-	X	X	X	X																												
	Forced separations	X	-	-	X	X																												
	Setting up and	X	-	-	K	X																												
	Humaniatarian aid	-	-	-	-	-																												
	VIP Protection	X	-	-	K	X																												
	Military aid/support	X	-	-	-	-																												
	Gaurantee or denial	X	-	-	K	X																												
	Non combatant	X	X	X	X	-																												
	Force Protection	-	-	-	-	K																												
Capabilities	Navy	X	-	-	X	-	X	-	X	K	K	-	K	-	-	-	K																	
	Army	-	-	-	-	-	K	-	X	-	-	-	-	-	-	-	-																	
	Airforce	X	-	-	K	-	K	-	X	K	K	-	K	-	K	-	K																	
	Military Health	X	-	-	-	-	X	X	X	X	X	-	X	K	X	-	X																	
	Joint Ops	K	-	-	-	-	K	-	X	-	-	-	-	-	-	-	-																	
	IW	K	-	-	-	K	K	-	X	-	-	K	-	K	-	-	-																	
	Non military	-	X	X	-	-	-	X	-	X	X	-	K	-	X	-	X																	
Threat groups	Terrorist group	X	K	K	K	X	X	-		K	K	X	-	X	-	X	-	-	-	-	-	-	-	X										
	Belligerent groups	-	-	-	-	X	-	-		-	-	X	-	X	-	X	-	-	-	-	-	-	-	X										
	Political and ethnical	-	-	-	-	X	-	-		-	-	X	-	X	-	X	-	-	-	-	-	-	-	X										
	Extreme Religious	-	-	-	-	X	-	-		-	-	X	-	X	-	X	-	-	-	-	-	-	-	X										
	Dislocated	K	X	K	X	X	X	K		K	K	X	X	X	K	X	K	-	K	K	-	-	-	X										
	Hostile local	K	-	-	-	X	-	-		-	-	X	-	X	-	X	-	K	-	K	-	-	-	X										
	No threats	X	X	X	X	-	X	X		X	X	-	X	-	X	-	X	X	X	X	X	X	X	-										
Geographical area of operations	Outside Africa	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	K	-	-	-	-	-	-	X			
	Africa-wide	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	K	-	-	-	-	-	-	X			
	SADC	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	K	-	-	-	-	-	-	X			
Non Military stakeholders	NGO's	-	-	-	-	-	-	K		-	-	-	X	-	-	-	X	X	X	X	X	X	X	K	K	-	-	K	X	X	-	K	K	K
	Media	-	-	-	-	-	-	K		-	-	-	K	-	-	-	X	X	X	X	X	X	X	K	K	-	K	K	X	X	-	K	K	K
	Other Gov	-	-	K	-	-	-	K		X	X	-	K	-	-	-	K	K	K	K	-	-	K	-	K	K	K	K	X	X	-	-	-	-

Figure 1: The cross-consistency assessment values

Table 2: An example of a solution. Input value: "Preventative Diplomacy"

Type of PSO mission	Tasks	Capabilities	Threat groups	Geographical area of operations	Non Military stakeholders
Preventative Diplomacy	Preventative Deployment	Navy	Terrorist group	Outside Africa	NGO's
Peace Keeping	Observation, monitoring and supervision	Army	Belligerent groups	Africa-wide	Media
Peace Enforcement	Enforcement of sanctions	Airforce	Political and ethnical extremist group	SADC	Other Gov Departments
Peace Building and Post conflict reconstruction	Forced separations of the parties	Military Health Services	Extreme Religious Group		
Humanitarian Support	Setting up and maintaining protective areas	Joint Ops	Dislocated population flowing into other African countries		
	Humaniatarian aid	IW	Hostile local communities		
	VIP Protection	Non military capability	No threats		
	Military aid/support to civil authorities				
	Gaurantee or denial of freedom of movement				
	Non combatant evacuation operations				
	Force Protection and Safety				

Table 3: An example of a solution. Input value: "Peacekeeping"

Type of PSO mission	Tasks	Capabilities	Threat groups	Geographical area of operations	Non Military stakeholders
Preventative Diplomacy	Preventative Deployment	Navy	Terrorist group	Outside Africa	NGO's
Peace Keeping	Observation, monitoring and supervision	Army	Belligerent groups	Africa-wide	Media
Peace Enforcement	Enforcement of sanctions	Airforce	Political and ethnical extremist group	SADC	Other Gov Departments
Peace Building and Post conflict reconstruction	Forced separations of the parties	Military Health Services	Extreme Religious Group		
Humanitarian Support	Setting up and maintaining protective areas	Joint Ops	Dislocated population flowing into other African countries		
	Humaniatarian aid	IW	Hostile local communities		
	VIP Protection	Non military capability	No threats		
	Military aid/support to civil authorities				
	Gaurantee or denial of freedom of movement				
	Non combatant evacuation operations				
	Force Protection and Safety				

The planners can now select the type of mission and geographical area of deployment as input values in the matrix, and the matrix will identify values of the remaining parameters that have to be considered.

This high level phase of our planned PSO model will then be extended by modelling lower-level intermediate steps in a solution, using appropriate modelling techniques. Depending on the nature of the problem represented by an intermediate step, we may use other modelling techniques such as Bayesian Nets, Systems Dynamics, Operations Research techniques, etc.

The development and execution of operational plans for PSOs rely on an interoperability capability of a military force. The next section addresses the requirements in this regard.

3. Interoperability Requirements and ICT Support

PSOs on the African continent have a somewhat different flavour to that of the rest of the world. These operations may be conducted by a single nation, such as South Africa, in a different African country, with no or very little ICT infrastructure. Typically, the ICT infrastructure will not be to support advanced equipment, but rather for operational communications (voice and maybe data). The term interoperability conjures up visions of complex and sophisticated interconnected equipment, possibly in conjunction with coalition forces. Tolk et al. (Tolk 2006) defined the levels of conceptual interoperability (LCIM), which starts at the lowest level with technical interoperability (just after no interoperability)), which is implied to be already within the ICT infrastructure domain – meaning that it is an ICT-based interoperability. To accommodate PSOs in the African context, this model needs to be extended to include non-ICT based interoperability as well. The latter is an attempt to bridge the ICT divide, but still to facilitate interoperability, and should proper ICT systems be available employ those as well.

In the ICT realm, data models are used to facilitate interoperability, such as the Joint Command, Control and Consultation Information Exchange Data Model (JC3IEDM). This model is widely used within NATO, especially where information has to be exchanged between coalition or combined forces. It is from experiences with different nations (different languages) that the need for a data model arose. Orders defined in one language did not get interpreted correctly by forces using a different language. The data model aims to standardise all information that need to be exchanged, by using internet-related technologies such as the Extensible Markup Language (XML).

3.1 Extending the LCIM

The LCIM, depicted in Figure 2, should be extended to accommodate non-ICT related interoperability aspects.

Level 6 Conceptual
Level 5 Dynamic
Level 4 Pragmatic
Level 3 Semantic
Level 2 Syntactic
Level 1 Technical
Level 0 None

Figure 2: Levels of Conceptual Interoperability (Adapted from Tolk 2006)

It is proposed that the model is kept in the same format, but that the level definitions are adapted for non-ICT use. The modified model will not be “below” or “above” the original; it would rather stand next to it, so that a dualistic approach is supported where ICT infrastructure is sufficient. It is also important to consider the levels and types of information to be exchanged during PSOs – this could be intra-force or inter-force – before modifying the interoperability level definitions. The levels of information are linked to the levels of operations and are shown in Table 4.

Table 4: Levels of Information in Military Operations

Level	Description of Information Exchange	Typical Duration
Strategic (Highest)	Relates to a higher purpose or outcome.	Weeks and longer
Operational	Specific operation, deployment or concerted series of activities. Relates to a purpose.	Hours to Days
Tactical	Specific encounter involving multiple systems or multiple entities. Relates to an objective.	Minutes
System (Lowest)	Specific systems, such as the tracks from a search radar	Seconds

For each level, as defined in Table 4, three related activities are applicable: planning, tasking and control. Situation awareness is required to perform these activities, and ranges from immediate perception – i.e. observing an aircraft with a pair of binoculars – to indirect reports, such as a commander receiving a intelligence reports that has been prepared and reviewed by several rungs below her. With the levels of operations, activities and situation awareness in mind, Table 5 proposes non-ICT definitions for the LCIM.

Table 5: Modified LCIM for non-ICT use

Level Index	Level Descriptor	ICT-based Interoperability (Original LCIM)	Modification for Non-ICT case
0	None	No Interoperability	No exchange of tactical, operational or strategic information. No coalition or combined forces defined.
1	Technical	Protocol interoperability, such as TCP or UDP	The best fit for this level is where the different parties have a common means of exchanging information, either verbally or in written form. The language barrier is crossed via translators or second or third language adoption.
2	Syntactic	Message exchange via higher level frameworks such as CORBA, SOAP or DCOM	Still with verbal or written information exchange mechanisms, the format of information is common between parties, i.e. templates of forms are available. Interpretation errors still possible, since the reasoning behind a template's format have not been communicated.
3	Semantic	Common data model, standards or templates	Although common templates and formats may be used, the true meaning and shared understanding of information is only possible if all parties have negotiated and resolved differences in perception and interpretation.
4	Pragmatic	Use of standards, data models or templates coupled with high-level frameworks such as the High Level Architecture or CORBA.	This level can only be achieved if shared responsibility and co-ownership of all aspects relating to common templates and forms are fully accepted by all parties.
5	Dynamic	Accommodates changes in standards.	Proper processes are in place to address alterations to templates and formats, and to detect obsoleteness, etc.
6	Conceptual	Ultimate interoperability – The exact intention and meaning of information is perfectly exchanged.	Parties can operate interchangeably without an effect on performance or efficiency.

From the levels of information, activities, situation awareness and modified levels of interoperability, a range of ICT interoperability requirements may be identified. These are addressed after the functions that need to be considered in the C2 domain are presented in Table 6. PSOs are sometimes conducted as a single service, i.e. only the Army or Navy is involved, but mostly as a joint effort. Although Function J6 is dedicated towards ICT, all of them have ICT requirements, such as J1 (Personnel) – Enterprise systems are necessary to manage the force members (training, salaries, health, etc).

Table 6: Joint C2 Functions

Index	Function
J1	Personnel
J2	Intelligence
J3	Current Operations
J4	Logistic Support
J5	Future Operations
J6	Communications and Information Systems
J7	Training and Exercises
J8	Civil Military Cooperation
J9	Host Nation Support

3.2 ICT Interoperability Requirements

In order to facilitate interoperability in the C2 domain for PSOs, a common data model is the most prominent. The data model serves as basis for all information exchanges at all the levels, types and function elaborated on in the previous subsection. The common data model needs to be available in the relevant formats, as required by specific aspects. It is not necessary to know the salary of a soldier that performs the duties of a gunner during a tactical engagement, but it may be necessary to know her rank or level of training. To the same extent, it is necessary to know the salary of the soldier during a planning phase for month-long exercise off-site, since it will influence the soldier's subsistence and transport rate. Similarly, a commander needs to have a consolidated view of the serviceability of equipment when planning a PSO in a remote theatre during his force projection planning. The examples provided up to now support the requirement for a common data model, since various systems have to access different information sources. However, it also emphasizes the requirement for enterprise systems in terms of workflow and information systems. This is not different from that required by the business world, and is even similar in activities such as force projection. The latter is a strong PSO requirement. This implies that the ICT infrastructure should support remote access, or at least replication and consolidation when returning. All of these have implication in terms of the communication infrastructure. Whereas a common data model, such as JC3IEDM, facilitates interoperability, the flexibility of the communications infrastructure enables it. This is depicted in Figure 3.

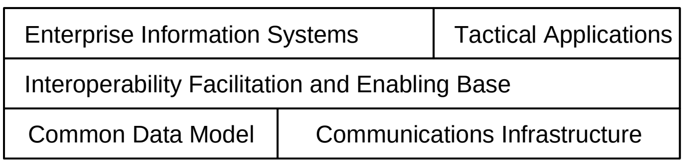

Figure 3: Facilitating and Enabling Interoperability

6. Conclusion

In this paper we describe a framework for developing a PSO planning model that can be used to assist military planners of PSOs. The complex, multifaceted nature of PSOs requires a capability to rapidly develop operational plans within an environment that is uncertain and unique. We motivated the use of the Morpological Analysis modelling technique for the high level modelling phase, because it is well-suited to model ill-structured, messy problems where human judgment is required.

The succesful use of the PSO planning model, as well as the execution of the operational plans rely on the capability of the military force to interoperate between its own divisions and other role players. These interoperability requirements are described in the second part of the paper.

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