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Meeting the Challenge of Providing Visibility of Force Readiness And Capabilities in a Multinational Environment

Mr. William M. Cryan
Joint Readiness and Analysis Division (SAIC Rep),
Operations/Plans Directorate, U. S. Joint Forces Command
1562 Mitscher Avenue, Suite 200, Norfolk, VA 23511
Tel (757) 836-7745, Fax (757) 836-7608, Email cryanw@saic.com

INTRODUCTION

This is a challenging time for the Alliance. What are the true warfighting capabilities of the Alliance? In assessing those capabilities, what metrics is required to assess a unit's joint readiness? With increasing demands being placed on NATO military forces, there is a growing need for Senior Decision-makers to receive more timely, analytical and flexible readiness assessments. Therefore, the Alliance must be able to assess and prioritize missions, essential tasks and operational requirements. This paper examines the challenges of developing and maintaining visibility of force readiness and capabilities within a multinational environment. Alliance and Member Nation/Service policies on force readiness and capability vary widely and often provide only a limited snapshot of a unit's ability to conduct its primary wartime mission and not the actual military operations they are undertaking. The challenge for the Alliance is to maintain readiness to support near-term force requirements as well as the long-term requirements of preparing for future security challenges. While technological advances occur rapidly, changes to readiness policies and reporting procedures move more slowly. This reality is more complex within a multinational environment due to the requirement to extract data from existing heterogeneous, legacy Alliance databases in order to present a coherent view of Alliance forces and their respective headquarters activities.

This paper outlines a technology strategy for visualization of readiness information and for developing a force readiness decision support system for use in a multinational environment to support the monitoring and assessment of Alliance forces with respect to:

- Unit reports (location, status, availability, etc.)
- Determining tactical and operational readiness (personnel, equipment, training and supplies, operations and interoperability)
- Availability of military/civilian airlift, sealift and land transportation assets
- Availability of pre-positioned equipment
- Mobilization capability
- Analyzing operations or contingencies from a force readiness perspective
- "What if" analyses of force capabilities

BACKGROUND

Maintaining a sufficient level of readiness in today's dynamic political, fiscal, and operational environments presents a significant challenge for the Alliance. NATO is currently in the process of restructuring their armed forces in an effort to create smaller, lighter, more mobile and more rapidly deployable forces. At the same time, however, the Alliance, is engaging in an ever-increasing number of large and small-scale operations. Accordingly, there is an even more urgent requirement for consistent and reconciled readiness data by Alliance commanders and staffs from a readiness visibility and information process and system that will provide:

- An ability to monitor, measure, analyze, and predict the readiness of assigned Alliance forces (e.g., Rapid and Immediate Reaction Forces, Main Defense Forces, Augmentation Forces).
- Access to a timely and accurate readiness visibility and information management system which provides an automated fusion of readiness information.
- An articulation of the cost of maintaining a high state of readiness within the context of small, European-based forces that are being asked to assume ever more increasing and broad requirements.

CURRENT READINESS CHALLENGES FOR THE ALLIANCE

- There are no standardized readiness metrics nor a readiness reporting mechanism within the Alliance that provides the status of each member nation's capability to provide required personnel, combat-capable hardware and technology, appropriate levels of maintenance and spare parts for that hardware, and training to ensure forces can actually conduct assigned operations.
- Readiness information is currently provided through a patchwork of manual and electronic links.
- The Alliance has not implemented an automated system and process to fuse tactical, operational and strategic readiness data.
- Manual readiness analysis is time-consuming and manpower intensive.
- Determining readiness depends on using an agreed to set of metrics against which the forces are measured. Applying varying metrics, therefore, yields varying results. In addition, readiness measurement is often based on subjective assessments.
- While NATO forces are expected to become smaller and more mobile organizations, there have also been major reductions in the number of forces held at high states of readiness. Remaining forces are a mix of both lower readiness units as well as core rapid reaction forces with the result that readiness is now measured in months and weeks, rather than hours and days.
- With smaller forces, a small degradation in readiness is more significant than before. Accordingly, the percentage of "ready" Alliance forces must be larger in an overall smaller total force. In addition, visibility of the readiness of "stay-behind" forces is critical since it is harder to monitor.
- Estimating operational readiness involves aggregating or "rolling up" readiness data from subordinate commands (tactical level) to higher commands (operational and strategic levels). The complexity in assessing operational readiness comes in trying to compare the aggregated data from one service with aggregated data of operational units from two or more other services.

- Developing and implementing an enhanced readiness visibility and information systems is of value only to the extent that it is accompanied by appropriate modifications to doctrine, concepts of operations, and policy and the willingness of the Alliance to integrate them into the operational environment. While the formation of a new NATO Standardization Organization is a good start, progress has been slow in changing doctrine, organization, and incorporating technology to ensure that NATO forces can serve as an effective crisis management tool.
- The gap in modernization and overall force reductions impairs NATO readiness. The Alliance can currently mobilize only a small percentage of its overall combat potential on short notice--a substantial decline since the end of the Cold War.
- Europe may be falling behind the United States in technological capabilities and must depend on the force capabilities of the United States, particularly in the areas of strategic lift, logistical sustainability, and the gathering, processing, and dissemination of intelligence.

DEFINING AND MEASURING ALLIANCE READINESS

Definition. Readiness is a fundamental aspect of an effective armed force and can be viewed as the ability to rapidly mobilize, deploy and sustain trained forces in an area of operations for an extended duration. Discussions of readiness components generally include the following six elements:

- Qualified people
- Combat-capable hardware and technology
- Appropriate levels of maintenance and spare parts for that hardware
- Appropriate tactics, techniques and procedures that support the capabilities represented by the qualified personnel and combat-capable hardware
- Training to ensure forces can actually conduct assigned operations
- The ability to deploy hardware and personnel to the fight

Measurement. In order to assess how ready the Alliance's military forces are, the following criteria can be applied and assessments made based on the results:

- For each measured unit, compare the required numbers of qualified personnel against the numbers actually on hand and available.
- For each measured unit, determine whether adequate supplies and spare parts are on hand.
- For each measured unit, determine and monitor the type and amount of training.
- Determine the ability of the sustaining base and infrastructure to support either major operations or smaller-scale contingencies for extended periods.
- Identify whether the Alliance has developed and promulgated the appropriate TTP for conducting military operations.
- Determine whether Alliance forces move quickly to wherever they might be needed.

- Determine the extent to which bases, hangars, maintenance depots, fuel farms, training ranges, etc. are in an "up" status.

SPAN OF ALLIANCE READINESS

Alliance readiness exists at the tactical, operational, and strategic levels. Readiness visibility and information systems must be able to support assessment requirements at each level.

- **Tactical** level. The level of preparedness of individual Alliance units to execute assigned missions with available weapon and support systems. Are the smallest elements of the Alliance ready to fight?
- **Operational** level. The level of preparedness of senior commands and joint task forces to integrate and synchronize ready combat and support units to execute assigned missions. Can the Alliance effectively form larger, operational-level fighting units from forces of the member nations? Can these organizations operate in coordinated ways with other operational-level units?
- **Strategic** level. The level of preparedness to support the Alliance military strategy. Strategic readiness is determined by senior Alliance military and political leadership by providing the means to put the right forces in the right place at the right time to fight the right conflict. Strategic readiness is based on the aggregation and synthesis of readiness data from the tactical and operational levels and combined with other data such as infrastructure analyses and industrial capabilities.

ALLIANCE READINESS VISIBILITY REQUIREMENTS

In order to assess the readiness of an integrated package of Alliance forces effectively, an ability to access, visualize and analyze the following information is required.

- Unit identification
- Unit capabilities
- Unit sustainability
- Unit's ability to re-deploy and reconstitute
- Hierarchical view of the unit within its component/force
- Unit status (current and projected)
- Mobilization of total force package
- View of major training exercises
- Task Force staff training
- Force interoperability during operations
- Deployment shortfalls
- Cost associated with operations and training

ENHANCING OPERATIONAL CAPABILITIES AND READINESS ASSESSMENTS THROUGH TECHNOLOGY INSERTION

The following proposed technology approach would provide Alliance military analysts and decision-makers with an automated decision support tool with a visualization capability into stove-piped, heterogeneous readiness and deployment databases. The approach must provide a consolidated picture of Alliance readiness data and leverage this information to improve the management of resources. It will also provide a single-point user-pull access to required data. The following are maturing technologies that are directly applicable to the technical challenge of developing and implementing an Alliance readiness visibility system.

- Joint Readiness Automated Management System (JRAMS).** JRAMS is a user-friendly, readiness assessment tool that accesses, compiles, and displays information from disparate readiness and deployment databases. JRAMS allows military planners and readiness analysts to assess the current availability and preparedness of any combination of forces, supplies, and equipment. JRAMS permits the rapid display of multiple scenarios and allows the user to quickly change from viewing one potential course of action (COA) to another. Users can switch between a graphical (pipes) or text (spreadsheet) view of the data. Through the use of Composable Data Services (CDS), JRAMS is able to access readiness and deployment data which was previously retrieved and tabulated manually but now available from a single graphical user interface. JRAMS is currently transitioning to a three-tier Java architecture that takes advantage of proven technologies such as Java, XML, and HTTP. These technologies are easily applicable to Web browsers since they're the native protocol of the Internet and allow JRAMS to be more flexible and easily tailored to meet the requirements of multiple domains. JRAMS provides quick access to essential information on unit readiness and availability. It also allows planners to explore different options for identifying forces and/or force capabilities for various contingencies. In the past, planners and readiness analysts spent valuable time gathering information to support plan development. Now, less time is used looking for information and more time can be devoted to developing and assessing plans. The system uses "point and click" technology and intuitive interfaces to help users arrange and filter data, accessing unit resource, training and commitment data. The system also has an export capability to a number of commercial off-the-shelf office software for preparing graphic and text reports and briefings. JRAMS enhances the clarity of presenting unit readiness status information by color coding the displays.

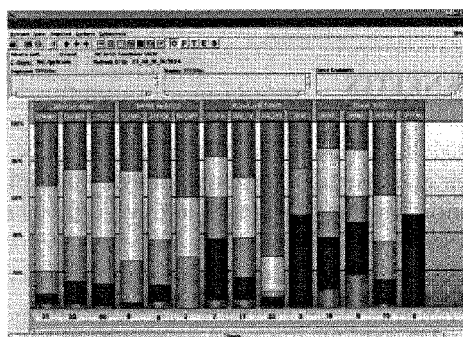


Figure 1 - Notional JRAMS View.

- TYCOM Readiness Management System (TRMS).** TRMS is a web-based readiness reporting and analysis program that provides a fully integrated environment for online analytical processing of readiness indicators to measure current Fleet readiness, analyze readiness trends, and to facilitate future readiness and resource planning. TRMS has been successful because it provides accurate and timely data, is user-friendly, integrates a variety of different readiness data, provides a common baseline for hardware and software, provides a common baseline for business rules, and eliminates burdensome reporting practices for the Fleet.

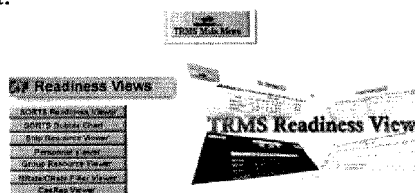


Figure 2 – Notional TRMS Readiness GUI

- Electronic Watch Board (EWB).** An innovative information visualization capability called an Electronic Watch Board enables multiple concurrent views of up to 16 different individual or combined data sources in a web-based environment. Each of the 16 cells can be tailored to display a variety of analytical graphics to facilitate user review and decision-making; each of the cells is connected to live data and supports a capability to display more detailed data to permit further analysis of the information displayed. The technologies and languages that can be leveraged in the Readiness Watch Board include object-oriented analysis and design, Java, CORBA, XML, RMI and UML. Users can select data elements for display and customize the graphical views in individual cells in the Watch Board. The user can create pie charts, bar charts, and three-dimensional views to compare and analyze selected data sets.

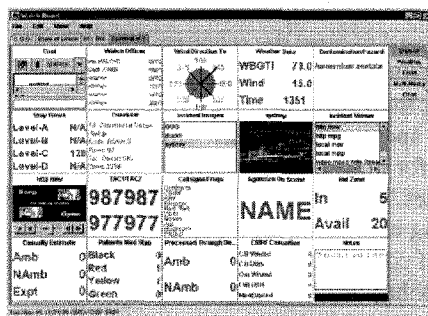


Figure 3 – Notional EWB GUI

GENERAL APPROACH AND BENEFITS

- Employ Composable Data Services (CDS).** CDS creates the data access and communication infrastructure necessary to gather and assemble information from multiple dispersed data sources residing within legacy systems. CDS uses advanced object technology to stay ahead of evolving technology. CDS transforms individual data storage repositories into an information resource. The transformation is accomplished without the need to create large data warehouses or data marts to accumulate the information. Existing data sources and new evolving data sources are accessed through the same common information interface. CDS exploits the rapid development and cost-savings benefits of CDS. CDS will allow the readiness developers to standardize interfaces and specifications so that software built to international standards can be used, evaluated and adapted in ways that make sense to the operational planners and analysts. CDS uses commercial-off-the-shelf tools such as Rational Rose to define user capabilities, data requirements, and create an object model that represents the business applications and data flow within the system. The Schema Server would provide the data dictionaries and locations of the data elements required by the business applications. The Model Editor would enable the system designer to map data to the services/business applications, and the Code-Generator would automatically generate the underlying services (e.g., query, proxy, naming, and persistence), as well as the client objects of the business applications and graphical displays.
- Capitalize on the maturity and utility of XML.** The NATO Consultation, Command and Control Agency (NC3A) is examining whether NATO's use of XML could help improve interoperability between heterogeneous (national and NATO) C3I systems. NATO has an ongoing data modeling effort by a data administration organization. It also has an emerging high level technical architecture in which the place and role of XML could be clearly identified. XML is platform independent and allows different computer hardware, software, databases and communications protocols to exchange information. Data content is separated from its presentation format, allowing customized views of data tailored to support specific user requirements. The use of XML will drastically improve the user's ability to find, retrieve, and process and exchange tremendous amounts of information easily across system, organizational and format boundaries.

- **BENEFITS.** The benefits of employing CDS and incorporating proven readiness assessment and visualization tools in this technical approach are:
 - The technology increases the productivity and performance of the developers by providing tools for rapidly integrating large amounts of information from otherwise incompatible systems into a common framework.
 - The developers can focus on application logic and not on data access, plus a reduced amount of time and expertise is required to implement robust services and business applications.
 - The time and cost of development and enhancements are reduced because of the rapidity by which new data sources may be integrated into the common information framework, the elimination of custom coding, and the avoidance of multiple point solutions in complex architectures.
 - CDS promotes a consistent handling of security issues; standard coding requirements, policies, and practices can be embedded within the code-generation process based on defined rules, algorithms, constraints, etc.

PROPOSED TECHNICAL APPROACH

- **STEP 1. Requirements modeling and analysis.** Alliance readiness analysts in the field and at headquarters capture and iterate requirements. Modern COTS tools such as Gensym's G2 tool kit could be used to capture the requirements, processes and relationships; model and assess them within a comprehensive modeling and simulation framework; and engage operational end-users directly in the knowledge capture process because of its simple and intuitive user interface.
- **STEP 2. What-If Analyses.** Once requirements are captured in the tool kit, "what-if" analyses can be rapidly conducted to optimize the desired performance and/or test new concepts conceived by the end-user prior to system implementation.
- **STEP 3. Proof-of-Concept system requirements definition.** This phase would involve identification and description of a core set of requirements and appropriate databases to be accessed, including location, format/content, access methods, specific Information Exchange Requirements (IER), and security requirements.
- **STEP 4. No Re-engineering.** A key aspect of the technical approach is that there is no requirement to re-engineer the databases or consolidate all readiness-related data in a data warehouse because the application of CDS technology would enable the readiness to have direct access to existing databases.
- **STEP 5. Rapid code generation.** The principal value of CDS is that it promotes the rapid code-generation of many object servers (i.e. Java RMI, EJB, CORBA) that can access multiple heterogeneous databases/data sources.
- **STEP 6. Proof-of-Concept system design and development.** Once the core requirements have been defined and agreed to among the Alliance Readiness IPT, the design and development phase would commence. The design and development approach is illustrated in Figure 2 and summarized in the following paragraphs:
- **STEP 7. Iterative definition of future builds/extensions to the core system.** Readiness support applications and data requirements can be rapidly incorporated in the object model within Rational Rose

and the Schema Server, and the new system containing both the old and newly designed services and business applications can be quickly code-generated. In addition, legacy databases don't have to be changed and CDS developed applications can rapidly adapt to changes in data format and structure in order to accommodate changes in data requirements.

SUMMARY. From a readiness analysis perspective, the Alliance is grappling with issues that are significantly more complex than the "jointness" and "joint readiness assessment" issues that the U. S. Military has been trying to address for several years. It will be a major challenge to get 19 member nations to agree on standards for readiness reporting or whether to allow Alliance systems to access, aggregate and display national data. Those issues must be addressed; however, in order to provide Alliance commanders and their staffs with consistent and reconciled readiness information to be used in support of current and emerging Alliance military force requirements.

As noted in the beginning of the paper, this is a challenging time for the Alliance. Demands are increasing for use of NATO military forces and Alliance commanders and their staffs must be able to assess and prioritize missions, determine essential tasks and evaluate operational requirements.

- Maintaining a necessary level of readiness in today's ever changing political, fiscal, and operational environments will continue to present a significant challenge for the Alliance. The situation is complicated by the fact that while NATO is in the midst of restructuring their armed forces to create smaller, lighter, more mobile and more rapidly deployable forces, the Alliance is engaging in an ever-increasing number of large and small-scale operations.
- An Alliance readiness visibility and information system should allow for continuous, real-time readiness reporting and analysis throughout the full range of Alliance operating environments from austere deployed areas of operation using commercial telephone lines to standing headquarters locations. The fundamental requirement is for readiness visibility to support operational planning, deployments and exercises.
- To meet this requirement, readiness and readiness related data must be identified, accessed, aggregated, analyzed, comprehended, transformed and delivered. Additionally, the Alliance must place greater emphasis on defining required readiness levels with the appropriate level of resources applied against it. There is a significant difference between the required readiness of a Main Defense Force unit versus more deployable units like the Immediate Reaction and Rapid Reaction Forces.
- The Alliance must be able to strike the right balance between maintaining readiness to support near-term requirements of responding to theater crises and the long-term requirements of preparing for future European security challenges. Accordingly, Alliance members contributing forces must meet NATO requirements for enhanced readiness, mobility, sustainability, survivability and interoperability.

RECOMMENDATIONS

1. Develop and implement a readiness visibility system to allow Alliance readiness analysts and decision-makers to:
 - Extract, evaluate and display data from Alliance readiness and deployment databases.
 - Embed C3I business rules for navigating, viewing and fusing readiness and readiness-related data.

- Develop metrics to support the requirement to integrate and synchronize ready combat and combat support forces to execute assigned missions.
 - Enable rapid presentation and analysis of readiness and force capability data and reduce force readiness assessments from days to hours.
 - Enable military planners and readiness analysts to perform "what if" analyses and rapidly view the impact of executing one or more force deployment plans.
 - Leverage emerging data services technology to provide heterogeneous database functionality and allow the retrieval and display of readiness information from multiple data sources.
2. Establishing an Alliance readiness and force capability assessment system will, of necessity, require changes to existing:
- Policy (to implement a more robust and detailed reporting requirement),
 - Technology (to develop a means to access the likely stove-piped data sources of 19 member nations)
 - Political will (to allow the Alliance to create a data collection capability that some Member nations may feel is intrusive).
 - Determination of standardized readiness metrics for tactical, operational and strategic levels of readiness
 - Determination of assessment metrics
3. The Alliance should also consider developing a tool to input data from existing Alliance and member nation/service organizations in order to provide a more consistent view of forces and headquarters activities. The retrieved data presentation should include time, unit, requirement, type of activity and other pertinent categories.