# TRAINING CHALLENGES FOR INTERNATIONAL INTEROPERABILITY

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## ABSTRACT

In the future, some of our most formidable threats will be those that are masters of exploiting and manipulating social and political foundations on an international level. MG John Robinson recently noted: "For international decisions to have lasting meaning in the world, they must be made in concert with the other nations of this earth. The U.S. has learned that there are limits to what it can do alone."[1] Future world stability will be dependent on the ability of nations to rapidly unite contingent multinational forces which can interact cohesively on the battlefield. Training will be a major factor in preparing for such joint international military operations. This paper will expand on the current interest and requirements for coordinated multinational training. Primary emphasis will be on the issues and challenges involved in achieving international interoperability including: technical requirements such as interface standards and correlated databases; philosophical issues such as differences in training ideologies; political implications such as national security; and management challenges.

## ABOUT THE AUTHORS

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## INTRODUCTION

In order to allow forces to be combined for a common goal, international forums are seeking to develop operational and technical agreements for military interoperability. One such forum is NATO, which supports working groups to produce Standardization Agreements (STANAGs). These agreements establish techniques and procedures to standardize the employment of forces. Participating nations will be subsequently responsible for implementing appropriate changes within their own forces.

The implementation of standardized techniques and procedures by multiple nations will "allow for" interoperability between their forces. Standardization, however, will not insure interoperability on the battlefield. The key to success in transitioning from manuals to practice is training. Just as the various elements of our own forces must train together, it will be necessary for multinational forces to train together. Also, just as our military is seeking interoperability of training assets, the multinational forces must seek training interoperability.

## ISSUES AND CHALLENGES

### TECHNICAL REQUIREMENTS

There are innumerable technical challenges involved in developing capabilities for interoperability between homogeneous and non-homogeneous simulators and simulations. Interoperability concepts and definitions (i.e., standards) are required to allow commonality in such areas as: physical interfaces and interface services; data exchange protocols for state data, emissions and tactical radio communications; environmental and geographic representations; sensor and visual databases; and system management and control. Methodologies are also required to allow the useful interaction of devices which may vary significantly in fidelity. These challenges are compounded even further as we expand the training potentials of our virtual simulators and simulations via seamless interoperability with constructive models (such as war games), with existing subsistent training resources (such as field ranges) and with actual weapons systems.

These technical challenges, however, are not unique to a particular military defense organization. They represent common interoperability requirements that must be addressed by any nation or group of nations that seek to enhance their military readiness through the employment of Distributed Interactive Simulation (DIS). The goal, therefore, should be to pursue international cooperation and coordination in seeking technical solutions, especially in the area of interoperability standards.

One forum for such cooperation is the DARPA/PMTRADE/IST sponsored Working Group for the Interoperability of Defense Simulations (often referred to as the DIS Working Group). More than 500 military, academic, and industry representatives have been supporting this group since 1989 in a cooperative effort to develop DIS standards. This working group is divided into numerous sub-groups and sub-sub-groups which are systematically seeking solutions to the myriad of technical challenges of interoperability.[2] The sub-groups are concurrently producing standards that reflect jointly developed interoperability methodologies. The first draft standard (Protocol Data Units for Entity Information and Entity Interaction in a Distributed Interactive Simulation) was released in 1991. There are plans in place to provide within two years, expanded capability updates to this standard

and to release three additional standards. The new standards will address: Fidelity, Exercises and Performance Feedback; Communications Architectures; and Environmental Correlation.

The DIS Working Group evolved from recommendations of the U.S. Defense Science Board (DSB) which were aimed at making more efficient use of DOD simulation technologies. Due to today's need for joint multi-national readiness, international interoperability is a natural extension of the original goals and is well within the spirit of the DSB recommendations. Accordingly, the DIS Working Group has openly encouraged international participation. In the past two years, the group has been benefiting through a steadily increasing participation by foreign representatives. Participants have been involved from Canada, France, Great Britain, and Germany.

Another relevant aspect of the DIS Working Group is its propensity towards the use of international standards. For example, the Communications Architecture subgroup is basing much of its work on ISO OSI standards. In addition, it should be noted that several of the basic operational concepts of DIS[3] are also conducive to allowing international interoperability. Of particular relevance are certain design goals such as: no central control computer for event scheduling; autonomous simulation nodes; and object oriented entity design including private and public components.

The U.S. Air Force-sponsored Project 2851 is another existing forum for interoperability. This group is seeking to develop standards for simulation visual and sensor databases. The activities of Project 2851 are being correlated with those of the DIS Working Group. Project 2851 also encourages international participation.

In summary, the technical challenges of simulation interoperability are to a large extent universal. The Working Group for the Interoperability of Defense Simulations and Project 2851 are two existing forums through which these challenges are being addressed. International participation has been welcomed and additional foreign representation should be encouraged. These participants will provide an enhanced technical base for DIS solutions and can provide guidance in avoiding decisions which could hamper interoperability at the international level.

## PHILOSOPHICAL ISSUES

Potentially, the most difficult challenge in seeking international interoperability for training will be the task of soliciting full acceptance of the DIS concepts on a world-wide scale. Throughout the world today, there is a commonly accepted training philosophy that simulators are beneficial resources for supporting the development of individual and crew skills. Before international interoperability can become a reality, there must be a multi-national agreement upon a philosophy that through DIS, simulators and simulations are beneficial resources for team and combined-arms training as well as for other non-training applications such as combat development, systems acquisition, systems testing, and force structure effectiveness analysis. The responsibility for gaining philosophical acceptance of DIS in each nation will most likely fall on the shoulders of the nations' military leaders and their training advisory organizations. These individuals will need to acquire a comprehensive understanding of the concepts and benefits of DIS. They will subsequently need to assess how national and international applications of DIS can be best integrated into their respective training programs. These same individuals will then need to interface with their leaders to solicit an acceptance of the DIS concepts and of the programs they have formulated to take advantage of DIS capabilities. The total process, unfortunately, is very time consuming. The development of DIS in the US has been evolving for approximately ten years. Hopefully, the U.S. experience will help expedite the process in other nations.

One forum that should help speed up the multi-national acceptability of DIS concepts is the NATO-sponsored symposium on Training Strategies Using Networked Simulations being held in November 1992. Another contributing factor will be the numerous government, academic, and industry briefings being presented at conferences in the US and abroad. It would also be beneficial to provide DIS briefings for key training advisory groups such as simulation technology subgroup of the European Community Initiative Difference organization (EUCLID).

## POLITICAL IMPLICATIONS

The political implications of conducting international training exercises is another area that must be addressed. An obvious example is the need to create an interoperability environment in which joint simulated operations may be conducted without compromising national security interests. Meeting this challenge will involve the creation of operational and procedural guidelines as well as the implementation of protection capabilities within the network systems architecture.

There are numerous conceptual avenues which may be explored in seeking methods to protect sensitive national capabilities during international training sessions. A logical way to approach the problem may be to consider the various levels of security concerns involved. For example, at one level it may be desirable to protect information about the internal operation and capabilities of certain weapon subsystems. Another level of concern might be the performance achievable with a specific weapon system (i.e., with its suite of sensors, fire control, and weapons an aircraft (A) can successfully acquire and engage target type (T) at a range (R), under environmental conditions (E)). Still another level of concern might be associated with the tactics a unit or force might employ in specific military situations.

In a DIS training environment, there is generally no need to distribute information about the internal operation of weapon subsystems. The primary security concern at this level is to prevent potential intruders from using the network to access localized data. Addressing this concern requires physical protection implementations at the respective local facilities. In addition, a multi-national, multi-level security system will most likely be required for the long-haul network which interconnects the facilities. The desire to protect information about the performance of individual weapon systems is a more difficult problem. Many joint non-combat operations could be trained in a DIS environment without exposing any sensitive vehicle performance characteristics. Such operations might include movement to the battle area and resupply. When the operations transition to combat engagements however, there will most likely be a strong desire for the individual participants to exploit the full potentials of their vehicles.

The methods available to limit observation of combat performance capabilities are related to how closely the multi-national forces interoperate. There are numerous conceptual options in the case where different forces are assigned different battle objectives. That is, although a multi-national task team has a joint high level goal, the forces of the individual nations are assigned separate missions in separate physical locations. The options available in general will employ multiple levels of DIS networks in which individual national forces will have high detail networks which would be interconnected by separate networks which would provide low detail or aggregate data as well as interface communication links. A methodology would also be required for direct communications between commanders. (Figure 1)

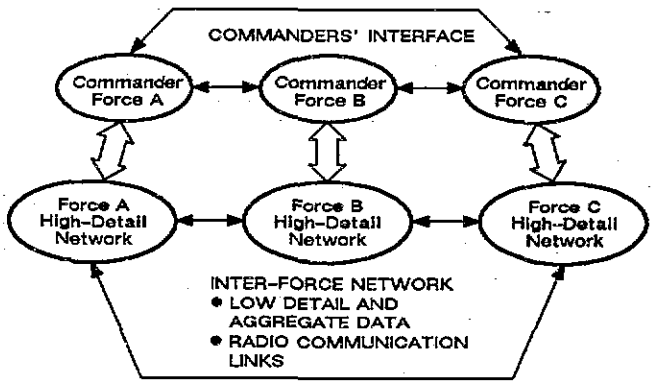


**Figure 1 Inter-Force Network**

Various techniques could be employed at the inter-force network level to limit data flow between the individual force networks. One technique would be to implement only the inter-force communications links. Forces would report to each other information concerning their locations and the results of their engagements through normal communications procedures. In this case, the specific DIS data of one force would not be made available to other forces, thus isolating detailed information on the performance of individual vehicles. This technique, however, limits the ability to provide an overall battle situation presentation. This might not be a significant drawback if the joint training assessments were conducted using the commanders' facilities.

A technique that could be implemented to provide more overview data would be to interface aggregate level information on the inter-force network. Various options exist for aggregation level definition (i.e., troop, company, etc.). The aggregation data would include such information as the centralized position of the aggregate entities, the numbers and types of participants within each aggregation, and the status of those participants (i.e., active, disabled, etc.). Data related to the threat forces could be interfaced either as individual or aggregate entities.

Another inter-force network technique which could be explored would be to send selected DIS data on a time-stepped (non-real-time) basis. Updates of entity positions and status (friendly and threat) would be passed at preselected rates (possibly one, five, or ten seconds). Other DIS information would not be passed. (such as what weapons were fired, by whom, or at what time). This technique may be plausible to provide an acceptable level of performance dissemination protection for training scenarios with relatively large numbers of moving vehicles. The approach may, however, be inadequate for training

with small forces or in training employing fixed (i.e., defensive) positions.

There also may be cases where training is required for combat missions in which multi-national forces must closely interact, thus making it difficult to isolate the performance capabilities of the various participants. This is a more complex issue which apparently will require joint security agreements between the national forces involved.

Political implications may provide obstacles for international interoperability, but they are not a barrier. Political and military leaders should work together to fully identify the political issues involved in implementing international DIS networks. Subsequently, they should seek concurrence on methodologies to address each issue.

## MANAGEMENT CHALLENGES

The primary management issues associated with international interoperability are the requirements to create policies, procedures, and organizational structures to: support the coordinated development and validation of interoperable system environments; to control training operation employing these environments; and to provide coordinated environment configuration control functions. The management of specific development programs is not a primary issue. There are many organizations which are qualified to manage international development programs either as a stand-alone company or as part of a development team. Management challenges exist at this level but they controllable by the developer.[4]

The management issues that need to be addressed are those at a higher level which affect the coordination and control of activities for numerous programs. For example: what organization will regulate and control the use of an international network; how will individual nations and projects be allowed to provide inputs (or a vote) on how the international networks are controlled; who will be responsible to validate that a new system is compatible with the internet; what organization or organizations will validate security provisioning; how will the internet be funded; who will be responsible for updating common databases; etc. These are the types of management questions that international forums of political and military leaders must address. The NATO training symposium previously mentioned may provide a convenient forum to start addressing management issues.

## CONCLUSIONS

The need to develop doctrine and methodologies for international military interoperability is recognized and being acted upon. A key factor, however, in military preparedness is training and that factor needs to be addressed relative to supporting readiness for multi-national military operations. Significant efforts are underway in the U.S. to develop Distributed Interactive Simulation capabilities for the DOD. Now is the time to raise our sights a little higher and to begin to comprehensively address the issues involved in applying DIS at an international level.

The research for this paper was originally aimed at finding new internationally-oriented technical challenges that could affect the decisions of the Working Group for the Interoperability of Defense Simulations. The research, to date, has not revealed any significant new technical challenges. To insure that international technical aspects continue to be considered, we should continue to encourage foreign participation in this working group as well as other interoperability groups such as Project 2851.

A more significant challenge to international interoperability is the need to take the vision of DIS to the decision makers of foreign nations. Foreign training advisors and military leaders should champion DIS concepts and the force readiness enhancements that can be derived by employing DIS. Political and military leaders should also ensure that training capabilities are a priority topic in their preparation of multi-national military strategies. These leaders also need to promote international forums to begin addressing mechanization issues such as security provisioning and internet management responsibilities. Representatives of industry and academia and the U.S. military can also help by being diplomats of DIS when the opportunity arises.

## REFERENCES

[1]Robinson, MG J.D., "International Focus on Interoperability," Army Aviation, Dec. 31, 1991

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[4]Engle, H.P, Swick G., "The Challenge of Developing a Complex Training System with an International Team," I/ITSC, 1991