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Integrating Multinational Organizations in Complex Operations – Dampening the Learning Curve

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Abstract

Leo Buscaglia stated “change is the end result of all true learning.” On a personal level learning manifests itself as formal and informal education. Learning and updating skills and expertise provides opportunity for the individual expand support to the organization at an individual level.

Organizations can learn as well. This is especially relevant with regard to change. When groups of individuals change their actions in support of organizational goals, the organization maintains or enhances its effectiveness [Edmondson, et al, 2006]. Essentially, effective and positive change requires learning and learning facilitates change. Organizational learning is a key requirement for success within a dynamic environment. However, as organizations are made up of individuals, their capability and willingness to learn is a major factor in the development of programs and concepts for organizational training.

The multinational organization has an even more difficult task. For these organizations, the development of training programs carry even more complex, especially when participants are characterized by multiple languages, cultures and levels of capability. This paper is about learning organizations, specifically multinational organizations that are thrust into complex operations with limited time and options for learning.

The paper will define organizational learning and the learning organization as an entity. This will be followed by a discussion of learning modes with special emphasis on the role of leadership as a critical component in the leadership and management of diverse organizations focusing on a defined set of objectives. The paper will conclude with a review and discussion of these concepts using a multinational military exercise as the model. For the purposes of this paper, the military organization used as the model will be exercise Bold Avenger/Trial Quest 2007 (BAR/TQ 2007) and its constituent national and coalition armed forces.

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By

John L Mahaffey

Leadership and learning are indispensable to each other.
John F. Kennedy

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Introduction

Leo Buscaglia stated "change is the end result of all true learning." In order to change; to improve our environment and enrich ourselves, our families and our associates, we must learn. On a personal level learning may manifest itself as formal and informal education. For example, a program manager may attend formal courses in the use of Microsoft Access in order to improve the efficiency of a project. As that program manager becomes more comfortable with the application, his or her efficiency increases and the amount of time managing their program is reduced. Essentially, the program manager has attained new knowledge that has improved the company's environment and likely prospects through both formal education through the course and through informal education through practice.

If the individual can learn and benefit, can the organization learn as well? There is ample evidence to say they can and do. When groups of individuals change their actions in support of organizational goals, the organization maintains or enhances its effectiveness [Edmondson, et al, 2006]. As noted earlier, change requires learning and learning facilitates change. The key question then, is how do organizations learn, and what factors may facilitate organizational learning?

This paper is about learning organizations, specifically multinational organizations that are thrust into complex operations with limited time and options for learning. This paper will first seek to define the organizational learning and the learning organization as an entity. This will be followed by a discussion of learning modes with special emphasis on the role of leadership as a critical component in the leadership and management of diverse organizations focusing on a defined set of objectives. The paper will conclude with a review and discussion of these concepts using a multinational military exercise as the model. For the purposes of this paper, the military organization used as the model will be exercise Bold Avenger/Trial Quest 2007 (BAR/TQ 2007) and its constituent national and coalition armed forces.

Learning Organizations and Organizational Learning

To be successful in a dynamic environment, organizations must acquire and interpret information before finally using or applying information to a problem or issue [Aron, 2000]. This requires learning at the organizational and individual level.

Learning organizations are characterized by a population that continually expands their capacity to create desired results and where new and expansive patterns of thinking are nurtured [Smith, 2001]. While organizations are often viewed as a larger entity, they are in fact made up of individuals. This requires organizations to address learning at both the group and the individual level. Focus on the individuals allows learning organizations to support the development of collective aspirations among their participants. This in turn supports individual participant's view of the organization as a

whole group or team. By focusing of collective support of the team, individuals "buy in" to organizational success at both the group and individual level. Because their participants are open to new and better methods, learning organizations provide the flexibility required to successfully address situations of rapid change. These types of organizations are often marked by high degrees of flexibility, adaptation and production [Smith, 2001].

Organizational learning is defined as the process of detection and correction of errors. Essentially, organizations learn through their individuals acting as agents. The individuals' learning activities, in turn provide the organization with a more current base of knowledge required to address rapid change with flexibility [Malhotra, 1996].

It should be noted that the act of learning itself may not be conscious or intentional nor does it always increase the participants' effectiveness [Malhotra, 1996]. For example, desktop access to the internet generally provides better access to research materials. Unfortunately, an employee learning to employ the internet may or may not use this capability responsibly, opting to surf internet web pages for news or shopping instead of using the capability for official or professional research. As a result, this behavior may become a detriment to the organization as opposed to an asset as the internet surfing employee does less work for the organization even though he or she may appear to be very busy.

Review of organizational learning is therefore a critical requirement for the effective management of an organization. Organizational Learning provides a process within the organization by which knowledge and its results are reviewed and applied as necessary [Malhotra, 1996].

The capability to learn is not standard across all organizations or among all individuals. While all people have the capacity to learn, the structures in which they have to function may not be conducive to reflection and engagement [Smith, 2001]. In order to facilitate learning, organizations must make a point of supporting it. In fact, organizations that successfully expand their capabilities in reaction to market requirements provide an environment that supports the accession and exploitation of knowledge through learning for their members [Smith, 2001].

For this reason, organizations that must rapidly learn and perform new tasks must plan for and execute rapid, accurate and applicable learning or training programs designed to provide the minimum required knowledge within a very short time. Once this information has been provided, the organization must then adapt quickly to changes brought about by previously un-planned for variables.

Case Study Bold Avenger/Trial Quest 2007 (BAR/TQ 2007)

On September 3rd, 2007 more than 1800 military personnel from twenty-one North Atlantic Treaty Organization's (NATO) nations began highly complex live air and

ground operations from three Norwegian locations as well as remote locations in the UK and USA.

BAR/TQ was in many ways, two exercises, Bold Avenger was primarily executed in support of tactical air operations, while Trial Quest was executed as a network enabled joint interoperable Intelligence Surveillance Target Acquisition and Reconnaissance (ISTAR) demonstration.

As a whole the BAR/TQ 2007 exercise provided training and validation for operational aircrew, command and control and their support teams from each of the participating NATO nations and multinational commands. The exercise also provided evaluation and validation of operational and technical processes and procedures related to the integration of network enabled ISTAR capabilities for operational commanders and war fighters. Operations performed during the exercise were executed in accordance with current tactics, techniques and procedures (TTPs) supporting air defence (AD), offensive counter air (OCA), tactical airlift, aerial refuelling (AAR), airborne and ground based command and control (C2) as well as airborne and ground based ISTAR systems. BAR/TQ 2007 was NATO's largest live flying exercise for 2007.

The BAR 2007 portion of the exercise replaced a long established air operations exercise known as the NATO Air Meet (NAM). From its inception, NAM provided an intense training environment in which operators from various NATO nations plan and execute their operations in a multinational environment. Traditionally, this was done by providing individual scenarios that force operators to leverage each participating nation's best aerospace capabilities in support of very specific missions. The TTPs and concepts of operation (CONOPS) developed from these exercises were then validated against current operational capabilities before being integrated into and published as NATO doctrine for use in future NATO operations.

This year however, BAR 2007 experienced a significant change in their normal operations; a separate but fully integrated exercise and demonstration took place during the exercise. The demonstration, known as Trial Quest 2007 (TQ 2007) integrated highly complex ISTAR systems and sensors from eleven NATO nations in support of air and land based mission requirements within the area of operations.

While ISTAR demonstrations have taken place in the past, TQ 2007 provided the first integration of systems and sensors providing multiple ISTAR products including pre-exploited and exploited ground moving target indicator (GMTI) and electronic support measures (ESM) data as well as synthetic aperture radar (SAR), electro-optical (EO), infrared (IR) imagery and streaming video from seven systems representing four nations. TQ 2007 provided these products to imagery and ISTAR data exploitation and C2 systems using wide and local area networks (W/LAN) located at military command and analysis facilities in Norway, UK and in the USA.

As a demonstration, TQ 2007 provided a platform for the evaluation of multinational management, tasking and exploitation of ISTAR products within a network

enabled environment. The results of TQ 2007 will be used to validate current multinational ISTAR system CONEMP and TTPs and to chart the future of NATO Joint ISR (JISR) employment requirements and shortfalls. This placed heavy emphasis on the success of TQ 2007, not only as a demonstration of ISTAR system support to live operations, but also as the basis for billions of euros worth of investment for ISTAR systems procured by NATO and its member states.

In order to ensure that ISTAR assets were employed efficiently, NATO opted to direct planning and execution of BAR/TQ 2007 through a multinational command centre deployed from its home station in Germany. This unit, known as the Combined Air Operations Centre (CAOC), was deployed with a full compliment of operators and communications systems. CAOC provided systems included computers, networks and telecommunications. These operators, already fully trained in their own systems, were required to take on new roles and responsibilities while employing systems that heretofore had not been part of their arsenal of capabilities.

In other words, the change of NAM to BAR/TQ was significant at all levels from the individual pilot to the designated commander. Successful execution of this exercise required significant learning at the organizational and individual level and in a very short amount of time.

In essence, the old, well known NAM exercise had morphed significantly into a highly visible exercise integrating operational and technical capabilities from multiple nations, all trying to satisfy their own requirements for training and research and development. In order to address these changes, exercise planners and national representatives had to learn a new lexicon of systems and missions, and they had to do it in less than one year. As a result, exercise and demonstration planners needed to know what they had to do and what resources were going to be made available to them.

BAR/TQ Baseline

When BAR/TQ 2007 was proposed, representatives from each nation and operational community (i.e. Fighter, C2, ISTAR) reviewed their operational capabilities as well as their training and evaluation requirements. Each nation then offered up participating forces based on their system capabilities, their training requirements and funds available.

As a multinational organization, BAR 2007 became a training event, with each nation leveraging its own training requirements. For example, the Norwegian Air Force (NoAF) provided F-16 fighter aircraft equipped with targeting pods to support both strike and ISTAR missions. NoAF training requirements were forwarded to the BAR/TQ 2007 planning staff in order to guarantee applicable scenario events were provided to complete this training. Another BAR 2007 participant, the NATO Airborne Early Warning and Control (NAEW&C) E-3 component, provided E-3 Airborne Warning and Control System (AWACS) aircraft with the latest modifications with the goal of testing new systems while leveraging intense C2 and surveillance training for its on-board technicians

and operators. In order to effectively support all participants BAR/TQ 2007 planning staff were required to review and integrate the maximum number of training events required to complete national and NATO force training.

Effective participation in TQ 2007 was an altogether different but related problem. As a demonstration, TQ 2007 was required to complete certain tasks relating to the network enabled employment of ISTAR systems. However, because it was part of the BAR 2007 exercise, TQ 2007 assets and capabilities were required to provide immediate support to participants operating within their areas of operation. To support these requirements, BAR/TQ 2007 planners devised a scenario rich enough in training events, that all participants would be satisfied with operational training and where applicable, experimentation, evaluation and validation of technical and doctrinal concepts and capabilities.

Throughout a planning cycle that lasted from the initial planning conference in September 2006 to execution in September 2007, BAR/TQ 2007 planning staffs worked together to address every possible eventuality, using input from participating nations, multinational military staffs and developmental programs such as the Multi-sensor Aerospace – ground Joint ISR Interoperability Coalition (MAJIIC) and the NATO Joint ISR Capabilities Group (JISRCG).

BAR/TQ Training

Early in the BAR/TQ 2007 planning cycle, planners and participants noted the limited time available for training between initial deployment of forces and commencement of operations. The cost of deploying 81 aircraft, 1800 personnel and their logistical support precluded a long and highly detailed training program. In most cases, the amount of time available for training was less than three days from aircraft arrival to the first day of operational flying. Further, the high visibility of the exercise would require operators and aircrew to function efficiently and accurately from the very beginning leaving almost no room for trial and error.

The exercise itself would be no more than two weeks, with set up and integration taking place prior to the event. Set up and integration was largely the province of the technical staff, not the operators. Once the systems were in place, individual operators arrived and began an intense training program designed to give them the basics before participating in the exercise.

Like the NAMs before, standard BAR 2007 exercise aircrew training consisted of various flight safety briefings and classes. These briefings and classes are required for safe operations and are mandatory for all flying personnel. This type of mass training can be accomplished because virtually all flying personnel, no matter the nation, possess certain basic skills. These skills include but are not limited to filing flight plans, maintaining safe separation and employment of their national weapon systems. Each nation provided flying operators with a baseline level of expertise. This allowed the

BAR 2007 planning staff to provide scenarios and missions that tests national capabilities within the multinational environment.

From this point however, TQ 2007 operations and training diverged, both in requirements and in presentation. Because TQ 2007 employed developmental systems, doctrine and procedures, this training had to be more detailed and individually given on site just prior to exercise start. This training would have to be both thorough and fast, providing a basic level of understanding from which operators could safely and efficiently employ their systems in support of the exercise commander.

BAR/TQ 2007 as a Learning Organization

BAR/TQ 2007 is actually a temporary organization. The only permanent members of the organization are the planners that provide the resources, scenario development and direction that forms the BAR/TQ 2007 environment. All other participants join the planners at various times in the planning cycle to ensure their requirements are being met before deployment to the exercise itself.

Because these participants come from more than 21 nations and are trained at varying levels of competence, the organization they comprise must learn quickly to operate effectively together or the exercise will fail. For this reason the training must be tailored to fit both the individual and the organization. At the individual level, training had to be devised for each system operator and technician, taking into account both varying levels of technical training and English language comprehension. At the organizational level, training on BAR/TQ operational processes had to be performed. Ideally, individual training should support organizational training through application of tasks and problems in support of organizational goals. In the case of BAR/TQ 2007, the training audience was diverse on a number of levels requiring a very steep learning curve prior to and during exercise operations.

Dampening the Learning Curve

The learning curve is a human characteristic that describes the increased performance over time of a person or organization engaged in a repetitive task. The aerospace industry was the first to develop the learning curve but it is also used to support cost analysis, cost estimating, or profitability studies related to the examination of future costs and confidence levels in an analysis [DOE, 2007]. When applied to data collected from a worker or workforce performing a task, the curve reveals a decrease in effort per unit as the task becomes more familiar. The curve is often described as an irregular line that starts high, decreases rapidly on initial units, and then begins to level out. The curve shows that there is progressive improvement in productivity but at a diminishing rate as the number produced increases [DOE, 2007].

For exercises like BAR/TQ 2007 the learning curve is often very steep. As noted earlier, participants are expected to come to the exercise with a standard baseline of

training. The training provided by the BAR/TQ 2007 staff is designed to provide knowledge about the local operating environment as well as the exercise scenario.

In some cases this is known as “difference training”. Difference training is specifically designed to provide an update to baseline knowledge in order to allow the participant to operate effectively in the environment. This in turn dampens the learning curve as operators become familiar with their missions earlier. An example of this would be the learning of air traffic control (ATC) procedures for Oerland Main Air Station (MAS). Even though participating aircrew come from nations as diverse as Turkey, Greece, Spain and Romania, they must still follow Norwegian ATC rules as they will be operating within their airspace.

The training program for BAR 2007 was not appreciably different from previous NAMs as the focus of the air operational training remained on safe, effective operations within Norwegian territorial airspace. However, the addition of TQ 2007 and its accompanying requirements for C2 and ISTAR employment and exploitation added a complexity to the exercise that was previously not considered. The learning curve associated with the employment and exploitation of systems and capabilities previously unknown to the operator would be steep indeed, characterized by many contentious events throughout the early phases of the exercise. Because the time allocated to the exercise is very limited, operators supporting TQ 2007 were required to learn more quickly than they normally would.

To support these operators and to dampen their learning curve specialized training would be required. The question then is what is required and how should it be presented given time limitations? To answer this BAR/TQ 2007 planners first reviewed the mission itself to determine what was significantly different about BAR 2007 and TQ 2007. Once the changes were identified the planners then had to identify the staff members and operators required to complete the additional training. This is an important task as TQ 2007 operations do not pertain to every operator or technician. Provision of this type of training to a Spanish fighter pilot would be superfluous if he or she was not involved with the ISTAR mission.

Once the required training and the target audience had been identified, the training program was developed. For TQ 2007 the additional training was identified as the following:

- ISTAR System Collection Management Processes and Procedures
- ISTAR System Communications and Formats
- Exercise Scenario Development
- ISTAR support to Time Sensitive Targeting (TST)

The target audience for the training was identified as the following:

- CAOC Operations Personnel
- CAOC Intelligence Personnel

- TST Cell Members, specifically the ISTAR Manager
- ISTAR System Operators
- Land Component Staff Officers and ISTAR Operators

Planning for TQ 2007 training began in March 2007 with the establishment of two full days of academic training to include briefings and rock drills. A rock drill is a simulation using discussions to establish common knowledge on processes and procedures. Rock drills allow participants to step through a process or procedure without being distracted by their own systems. In many cases, the rock drill provides the best overall solution to complex problems through cooperative problem solving among participants when coupled with formal training. The third day of training involved a series of communications and system tests designed to force the operators to employ the relevant capabilities of their systems. The overall objective at the end of the three day training event was a working knowledge of ISTAR tasking, allocation, exploitation and communications procedures in support of military operations.

Cross Cultural Issues

As noted earlier in the paper, BAR/TQ participants came from 21 nations. These multinational operators and planners were required to integrate highly complex systems within a very short period of time in order operate effectively from the start of the exercise. Within this group a number of cultural differences were observed. For example, not all operators are trained to the same level of capability. In some cases this is because their systems are not built to the same level of capability, thus their training was not as intense in some areas (e.g. Romanian 2nd generation Mig 21 vs. French 4th generation Rafael fighter aircraft[1]).

Another interesting example of cultural differences lies within the rank structure of each nation. For example, in most NATO nations the fighter controllers flying aboard AWACS are officers. In some nations, enlisted personnel fill these billets. This is normally not an issue because military units rarely operate with multinational crews. One exception to this rule is the NAEW E-3 AWACS aircraft flying from Geilenkirchen Main Operating Base, Germany.

These aircraft are one of the few who routinely fly with multinational crews. As a result, it is not unusual to have an enlisted Master Sergeant in command of a Lieutenant Colonel during flying operations. For most crewmembers, this is not a problem as their training provides a degree of maturity.

[1] When discussing aerospace systems, the term generation is often used to describe an evolutionary expansion of capability coupled with the date a specific system was fielded. In the case of fighter aircraft, this evolution usually infers increases in operational capabilities brought about by technological advances. These advances include but are not limited to power plant, materials, avionics, weapon systems and sensor capabilities. In the case mentioned above, the Mikoyan Mig 21 was first fielded in the 1960s, and has a limited aspect weapon system. The Dassault Rafael was first fielded after 2000, uses a multi-aspect weapons system and is manufactured with composite materials. Ergo, the Mig 21 is regarded as a second generation fighter while the Rafael is regarded as a fourth or fifth generation fighter [Aerospace.com, 2007].

For ISTAR system employment in support of TQ 2007 the major cross cultural issue came as a result of the integration land force operations into what was largely an air exercise. Because the doctrine for land and air operations is so different, initial training was required to ensure that both elements understood the basic procedures and processes for ISTAR operations. While the processes and procedures appeared to be well defined, the challenges to understanding, from doctrine to semantics complicated the first three days of the exercise. By the end of the third day of operations, detailed discussions between leadership at both elements had agreed upon a series of new contracts that allowed operations to run smoothly. Ever the learning organization, TQ planners and evaluators collected these results for integration into future events.

Six Modes of Learning

The following paragraphs detail specialized training applied to TQ 2007 using six modes of learning. Each mode will be discusses separately with regard to plans and results of the training. The six modes of learning provide a common "configuration" of mutually supportive elements. It should be noted that while the learning modes are presented sequentially they often co-exist and in many cases are complimentary [Miller, 1996]. Discussion of each mode will include a description followed by its employment with regard to BAR/TQ 2007. The modes are being used to better illustrate learning issues associated with operations in a multinational environment.

Analytic learning

Analytic learning emphasizes hard intelligence data, deductive logic and numerical calculation. A large part of the gathered information is quantitative and is monitored and checked via formal systems [Fredman et al, 1999]. Analytic learning is characterized by intensive and systematic information gathering by members of the organization. Options are analyzed within the context of the environment to discover problems and opportunities [Miller, 1996]. During decision making, evaluation of alternatives are made to maximize key planning objectives. Results of the evaluation then provide new options, which in turn begin another learning cycle [Miller, 1996].

Prior to BAR/TQ 2007, exercise planners and national representatives worked closely on the development of the scenarios and vignettes required to meet training and operational requirements. These requirements were generally static but on occasion had to be modified when conditions suddenly changed. For example, during initial planning both BAR and TQ assets planned to use their systems in support of a mission known as combat search and rescue (CSAR).

CSAR missions require the use of specially trained personnel and dedicated support from helicopter and fighter assets. When the nation that had initially promised the CSAR assets had to withdraw them, the opportunity for support to the CSAR mission was lost. As a result of this change in capability, planners and national representatives

were required to change the exercise scenario and supporting vignettes and to scale back operational objectives for support to CSAR.

Interestingly, these changes may initiate sympathetic or "knock on" effects among other units participating within the exercise. For BAR/TQ the loss of CSAR training was further compounded by the loss of a number of CAS aircraft that had planned to use the exercise for training. This in turn further reduced training opportunities for forward air controller (FAC) operations within the exercise forcing the planners to further modify scenarios and re-evaluate objectives.

Once the exercise started, little if any analytic learning was accomplished because the planning had been completed and major changes were no longer an option. As the exercise progressed learning had to be accomplished dynamically, leaving little time for long term deliberation and evaluation of options.

Synthetic Learning

Synthetic learning is a learning mode which is less systematic but more emergent. This mode of learning emphasizes intuition in the learning process [Fredman et al, 1999]. Synthetic learning is a more holistic mode of learning combining knowledge in a way that reveals relationships and patterns [Miller, 1996]. Synthetic learning provides an overarching view of a problem thus allowing the manager or planner to focus on the big picture.

Synthetic learning further reveals focal themes such as critical relationships and systemic properties [Miller, 1996]. Once these themes have been revealed more detailed approaches may be accomplished through analysis of its constituent elements and potential options. A good example of this approach is the development of operational architecture that provides an overarching view of an operational process. Once the process is understood, deeper systemic views provide a more analytical approach.

The overarching BAR/TQ 2007 training plan was based in part on a synthetic approach to learning starting very early in the planning process. In this case the MAJIIC ISTAR procedures that were to be employed were evaluated against the BAR/TQ 2007 operational architecture to illustrate processes that for the most part were invisible to individual participants. For example, the dynamic tasking of an ISTAR asset process was decomposed into an activity model. This model was used to create a step by step process that was given to participants visually via formal briefing, reinforced by practical application during rock drills.

Early in the planning phase, planners and participants dissected each process, using the operational architecture to illustrate the operational path between the tasker (supported commander) and relevant C2 and ISTAR systems. Results of these discussions further provided operational requirements for exercise planners to use in mapping requirements for participating C2 and ISTAR systems.

Once the architectures and operational requirements were agreed, they were used to place ISTAR systems and their supporting communications at the most advantageous locations for support to the primary end-user. The architectures also revealed problems associated with low bandwidth and poor communications connectivity.

When used to create activity models, these architectures supported the training of command and intelligence personnel in the management, employment and exploitation of network enabled ISTAR. As a result, the final BAR/TQ 2007 training program was a primary user of the synthetic learning mode for the creation of briefings, exercises and other aids for use prior the exercise.

Like analytic learning above, once the exercise began there was little if any formal synthetic learning accomplished in support of the event. This is because the overarching plan was already established, leaving little options for major changes to the organization.

The one exception to this was related to TQ 2007. During the second week of the exercise the training area was restricted due to host nation requirements. In order to complete the exercise, the scenario then had to be changed to fit the new, smaller operating area. The change of plan took place during a hastily convened formal planning meeting during the exercise. Normally this would not be possible, but the loss of the range dictated that it be done or the second week would fail.

Experimental Learning

Experimentation is a rational, methodical approach to learning characterized by a deliberate attempt to systematically gather and interpret information in support of the organization [Miller, 1996]. Experimental learning is also less analytical since new information is realized and integrated during the experimentation process. This information may be integrated directly at the time of realization or at a later date.

Learning through experimentation provides the operator with access to the most current information based on latest findings. One problem with this method of learning is that given unlimited time and resources, it might never end. In this case there is a tendency to continue experimentation without setting a baseline or as some project managers describe it, without drawing a line in the sand.

Another problem with experimentation is the setting of boundaries and hypothesis. Unless firm boundaries and hypothesis are set, operators within the organization may continue beyond the original requirement. This is especially true for operators that are required to use new processes when completing specific tasks. For example, if the experimental process is cumbersome the operators will go back to the old process even though the new process will in time be more accurate and more efficient, thus defeating the experiment.

Still another problem with experimental learning is that may result in local knowledge which is more fragmented making it more difficult to integrate knowledge derived from this form of learning throughout the organization than it would be for most of the other learning modes [Fredman et al, 1999]. For this reason leaders must ensure that objectives are understood and adhered to. Within military organizations this is known as commander's intent. All operational decisions must be made with the commander's intent in mind. Otherwise execution will be piecemeal and confused.

During BAR/TQ 2007, planners and participants alike performed some degree of experimentation before and during the exercise. Before the exercise, planners and participants reviewed various options for the integration and employment of assets given physical and temporal limitations of the exercise. Based on these variables, scenarios and architectures were developed to ensure the most efficient use of available resources. During the exercise, participants reviewed and updated their plans based on changes in operations and requirements.

In the case of TQ 2007, employment of ISTAR system collection management systems for the tasking and allocation of sensors and exploitation stations was a prime objective of the exercise. Because these systems were new and the processes relatively unknown there were some inevitable problems integrating the system into the early phase of the exercise. To solve these problems, operators and planners used experimentation to modify and/or create procedures that supported the exercise and the evaluation of the collection process. Failure to do this would have caused this portion of the exercise and evaluation to fail. It should be noted that the processes created as a result of this experimentation will be integrated into future systems and exercises.

These new procedures and processes were given to TQ 2007 participants during initial training held at both Oerland and Rena. The target training audience for these events included the CJTF, LCC, ACC, CAOC staff and the TST Cell as well as participating ISTAR system operators. The primary objective of the training program was the standardization of ISTAR system management and employment processes and procedures for the exercise.

MAJIIC/ISTAR management and employment processes provided by the trainers were the result of several years of experimentation, exercise as well as research and consultation with various intelligence and operational SMEs. During the training the processes and procedures were discussed openly rather than given formally. During these discussions participating operators and staff were able to modify processes and procedures before the exercise. These processes and procedures were then discussed with trainers, operators and staff located at Rena.

In order to provide a common baseline of knowledge prior to the start of the exercise, trainers in Rena and Oerland used common briefings occurring on the same day at the same time. Initially, the training was to be performed using a teleconference from both sites. Unfortunately, this did not occur because of communications issues between presentation areas. The plan to perform the same training at the same time did continue

so that trainees would be able to participate in upcoming communications checks and rock drills as planned.

The training program was further broken down into three separate but interrelated events. First, operators and staff would receive classroom training on processes and procedures. Participants would then apply these processes and procedures during rock drills designed emphasize the use of network enabled ISTAR capabilities through both operational and technical processes. The third phase required participants to access ISTAR data via their respective systems, then locate, connect and send message traffic via text and voice to their respective commands and staffs. This phase, known as the communications check was also accomplished at the same time using the same requirements and processes at both Oerland and Rena.

The primary problem associated with the training program as described was based on missing critical personnel. The CJTF TCM and ACC ISTAR manager were not initially not present for classroom training. However, their previous participation in MAJEX 07 provided them with the basic MAJIIC/ISTAR system and process knowledge required to participate effectively in Trial Quest 2007 [Mahaffey, 2008]. As a result, they were provided individual difference training upon their arrival at the exercise location. Similarly, while MAJIIC exploitation station operators were initially absent from classroom training, most had participated in MAJEX 07 or were familiar with their national systems as well as MAJIIC/ISTAR process thereby reducing their training requirements.

In contrast to Oerland, participation in training at Rena was less robust as some of the ISTAR system operators and LCC staff participating during the exercise arrived on the day of the exercise. Unlike Oerland, a number of the incoming Rena staff was unfamiliar with MAJIIC/ISTAR processes and procedures. Because of this, the Rena instructor was required to accomplish a number of remedial training events as the exercise was standing up. This in turn complicated the integration of Rena based ISTAR systems and assets into the exercise.

This was especially evident during the first three days of the exercise, particularly with regard to TST events and joint level ISTAR planning and execution. During these events, previously briefed procedures had to learned “on the job” by Rena staff causing a great deal of confusion between the TCM, the TST ISTAR Manager and the LCC.

Interactive Learning

Interactive learning involves “learning-by-doing” [Miller, 1996]. In some organizations this is known as on the job training (OJT). Interactive learning is different from experimentation because operators learn in a more emergent and implicit way. This is because the results of their learning tend to be both immediate and related to their actions. Interactive learning often results in the spontaneous process of local adjustment to local and emerging global requirements.

Interactive learning also focuses on "reading people" and the objective to learn about the environment through intuition and instinct. This kind of learning typically occurs within smaller subgroups of the organization [Fredman et al, 1999]. Essentially, operators learning interactively seek to develop and implement procedures that will complete their task at a minimum level. Once this level is attained they re-evaluate and adjust their procedures in response to feedback [Fredman et al, 1999].

Exploitation station operators in TQ 2007 had to learn how to employ the MAJIIC capability that was integrated to their systems through actual operation of the system. Because the MAJIIC capability is developmental, most operators had little exposure to it before the exercise. This steepened their learning curve as they prepared for the live operations that were in many cases already on-going. Interestingly, interactive learning is normally performed during the event itself. Furthermore, because the learning takes place in a live environment, results are extremely valuable when applied to future operations. These results are often referred to as lessons learned and are a major source of operational and technical requirements capture for future development of systems and doctrine.

For some activities however, OJT or interactive training was wholly inappropriate. Flight safety training for example was mandatory and the commander established a no tolerance polity for safety violations. Flight safety learned through the OJT could easily result in a deadly situation as aircrews learned their lessons the “hard way.”

Examples of positive and negative interactive learning were evident during TQ 2007. As a positive example, ISTAR system operators were provided with opportunities to analyze and exploit multiple types ISTAR data and imagery through connectivity to the CSD and the TQ WAN. These products included GMTI and ESM data as well as EO/IR and SAR imagery.

Because this capability is new, most exploitation system operators were not fully trained to analyze and exploit all available products. For example, imagery analysts with little or no previous training on GMTI tracking found themselves having to learn the skill as the exercise progressed. To remedy this, OJT was provided by qualified personnel from other systems in order to ensure that tasks were accomplished.

This is a positive example of OJT in TQ because it provided an opportunity to expand the operator’s expertise and skill sets in a very short time. This in turn supported system developers as they were provided information on future operational and technical requirements from the operational personnel using their system. It should be noted that while this type of entry level training is appropriate for exercise purposes, the use of untrained analysts and exploiters in conflict would be ill advised.

A negative example of OJT during TQ 2007 was evident among operators and staff at Rena. In this case, many of their participants arrived after the training was complete and did not have previous experience with or knowledge of MAJIIC processes

and procedures. As a result, the Rena training staff was required to provide individual OJT during the first phases of the exercise. The resulting confusion among the TCM, the TST ISTAR Manager and the LCC caused delays in targeting and inefficient tasking of limited resources during the initial phase of the exercise. This in turn led to lost targeting opportunities and unfilled collection requirements.

Structural Learning

Structural learning involves the use of routines to teach and reinforce procedures, processes and roles. Routines are products of analytical learning and design; they codify prior learning by specifying how to carry out tasks and roles efficiently. Thus, they are perceived to be instruments of rationality [Miller, 1996]. By following a routine, the operator learns his or her specific role and procedure. Routines as procedures also dictate methods for improving efficiency, correcting errors, or refining existing processes.

This type of learning is especially useful where processes are both well defined and must be followed with a very high level of fidelity. Routines further direct and maintain the operator's attention to the task at by limiting outside interference [Miller, 1996]. Structural learning is very evident in the training of operators to complete certain tasks within a specific process. This in turn may lead to "programmed learning" since the routines normally describe standards and ways of doing things which help in ensuring reliable performance. Further, the use of routines may help in controlling what information managers receive and how they will view that information [Fredman et al, 1999]. This is not to say feedback and improvement are not considered. Indeed, once operators have learned their procedures, they may find new and more efficient methods of completing their tasks. This results in a feedback loop that provides a way to improve future routines.

As a military organization, BAR/TQ 2007 was rife with routines or procedures. Some of these routines were well defined and had not changed in decades. Flight safety processes for example, vary little between events. Integration of new systems on the other hand, represents a new set of routines or processes that must be learned and applied before and during the exercise.

One case that stands out is the employment of ISTAR products in support of TST operations. While TQ 2007 employed live ISTAR systems in support of TST operations, the processes for these operations had heretofore been largely conjectural. The initial processes were designed by subject matter experts (SME) prior to the exercise and evaluated during simulation. Once the exercise started the operators were forced to use the processes as described in their training. Over the first few days, the operators validated the processes, and suggested improvements through both interactive learning and experimentation.

Rock drills are a particularly good example of structural learning. In TQ 2007, rock drills were used to teach and reinforce new and existing ISTAR processes and

procedures. TQ 2007 Participants noted the value of the rock drills in modifying and confirming ISTAR processes for collection, coordination information requirements management (CCIRM) processes, dynamic tasking of ISTAR assets and ISTAR support to TST. There were however, some problems associated with the rock drills as they were presented. In particular, the CSAR scenario chosen to train dynamic tasking of ISTAR assets was confusing because specialized mission requirements and procedures for this event were not present during the BAR/TQ 2007 exercise (e.g. no Joint Rescue Command Centre [JRCC]) [Mahaffey, 2008].

The TST scenario used for the rock drill was in general well received, but was regarded as too complicated. The result was a generally high focus among participants on near real time (NRT) tasking of ISTAR for TST operations. Because participants focused almost exclusively on the NRT tasking of ISTAR assets, more general procedures for search of the Coalition Shared Data server (CSD) for available information and ISTAR products prior to dynamic tasking was intially ignored [Mahaffey, 2008]. By adding complications to the scenario, the training audience was forced to depart from planned procedures, brainstorming new concepts. While this type of exercise is useful in developing or refining a process, it detracted from the objective of teaching a standard process prior to the exercise.

Institutional Learning

Institutional learning is an emergent, inductive process by which organizations assimilate common values, ideologies and practices from the environment or the group's leadership [Miller, 1996]. In many cases this is referred to as indoctrination and may occur subtly, as when professional or societal values are infused throughout an organization via the efforts of influential members both as leaders and as followers.

Indoctrination may also occur more overtly, as the leadership impart their collective and individual vision through their formal position (e.g. unit commander) or through their informal position (e.g. best pilot in the unit) [Miller, 1996]. For example, the unit commander may set a series of benchmarks for minimum and maximum flying hours. As the formal leader of the organization the commander has both the authority and the mechanism to set these benchmarks and ensure they are met. Any pilot not meeting their requirements could be punished by the commander for not following direction. The best pilot in the unit on the other hand, may set a series of benchmarks based on something less tangible such as pride or bragging rights. In this case the best pilot may set the standard on quality (e.g. most on time departures and landings in a given month). Other pilots would naturally emulate the best pilot in order to improve their performance and to seek favor with the command elements.

Institutional learning further harmonizes the values of a leaders and the organization creating coherence among the participants thus making it easier for them to work together [Miller, 1996]. It should be noted that this type of learning may result in a cult of personality that could in turn lead to intolerance or disregard for other options. As

a result, institutional learning should be reviewed regularly to ensure that organizations receive the benefit of a broader level of expertise.

As with any military organization, BAR/TQ 2007 had a commander and a large number of operators. Participation in the exercise was by the commander's authority alone. As a result, the processes established by the commander had to be followed or operators were forcibly withdrawn from the exercise. The formal institution of command was evident at all levels of the exercise, from the leadership to the lowest ranking operator.

The establishment of an informal leader was less evident for several reasons. First, the exercise did not last long enough to establish a clear leader for most operational and personal areas. Second, the cultural composition of the exercise made establishment of a cross cultural informal leader difficult. Personnel from 21 nations and several commands participated as national and international units. The natural tendency for these operators to" stay with their own" outside of operations limited their ability to establish an informal leader that would cross cultural boundaries. Instead, each unit in the organization was more likely to establish their own informal leadership. In some cases these leaders coordinated with other units, but were more likely to remain within their organization relying on formal leadership to coordinate cross culturally for them.

BAR/TQ Training – Participant Assessment

In order to fully evaluate ISTAR support to TQ 2007 the MAJIIC project hosted a lessons learned conference at the NATO C3 Agency in The Hague, NL. Participants in the conference included participants from the CJTC, LCC, ACC and TST Cell as well as national ISTAR system operators. The conference also invited several observers from NATO Commands and agencies interested in ISTAR operations. The following observations were collected from exercise participants both during the lessons learned conference and in the field (during the exercise).

According to conference participants, training for TQ 2007 provided a good baseline for the start of the exercise. CAOC commitment to the training coupled with a high number of previously trained or experienced operators (MAJEX 07 participants) made integration easier though there were still a number of initial problems. Late arrivals at Rena reduced coordination between the sites and changing requirements (e.g. loss of Rena range week two) reduced the overall value of some aspects of the training.

To address this, the exercise planning team noted the need for extensive training prior to the start of the exercise. This includes pre-exercise training on individual system, knowledge of procedures and processes (e.g. TTP), exercise objectives and experimentation where applicable.

The use of rock drills for practice prior to start of the exercise is also regarded as critical. Exercise participants further noted that for future exercises, they would prefer more hands-on training and less of the class-room style briefings [Mahaffey, 2008]. It is

recommended that exercise planners should first accomplish several rock drills off position to ensure participants fully understand procedures and processes. On position rock drills coupled with communications checks should follow to ensure participants are capable of employing and communicating with their individual systems

Supporting Change though Organizational Learning - Recommendations

BAR/TQ 2007 was a highly complex event that required near immediate integration of multinational forces completing highly complex operations with virtually no room for error. As a result, the planning and training had to be developed with both cultural differences and operational requirements in mind.

During normal operations, this training gets reduced or deleted due to operational requirements and modifications to the schedule. To combat this, leaders must take an active role in the learning process, from start to finish, and this means taking the time to do it right. The following recommendations provide a framework on which managers and leaders may create a successful learning organization [Robbins, 2003]:

Leaders and managers should schedule time for learning. In the case of TQ 2007, training was specifically set aside for the difference training required to effectively employ and exploit new ISTAR systems in support of the overarching exercise.

In future exercise, whether live or simulated, planning staff should be invited to an intelligence preparation of the battlespace (IPB) or pre-execution phase of the exercise [Lee, 2007]. Ideally this event will be held the week before the exercise and should involve development of the operational C2 structure, operational documents and IPB for the exercise. The impact of this will be that minimal exercise material will need to be developed for the participants prior to the exercise, which would include the 'road to war' and the C2 ISTAR architecture.

The two days prior to the exercise should be further designated as "operator familiarization with MAJIIC concepts" where operators will practice TTPs on the workstations they will be using for the exercise [Lee, 2007]. This would require any classroom or non-positional training to be pushed back even further. To remedy this, trainers should consider disseminating pre-exercise training documents and files to participants for review prior to arrival.

For MAJEX 08, this will be accomplished by providing read-ahead documents and briefings to participants in advance of their arrival at the exercise location. Highly complex training on systems and procedures such as CCIRM using the Norwegian Command and Control Information System (NORCCIS) will be provided on-site prior to the exercise. This will significantly reduce confusion and inefficiency during the opening phases of the exercise.

Leaders and managers should elicit feedback from the participants, and then use the information to improve the organization. They should also be willing when required,

to change plans based on feedback. Often subordinates within the organization have the best view of tactical or lower level problems.

BAR/TQ 2007 benefited from a number of open forums prior to the exercise. During these forums, leaders, planners and participants discussed changes and made decisions that affected everything from scenarios to the placement of telephones. The resulting plan was both complete and supported NATO and national operational requirements before a single unit landed at Oerland MAS

Learning should be expressed in terms of effects or results. Essentially, leadership should detail their view of how the organization should function. Objectives developed prior to and during the exercise were expressed in terms of the desired goal. For example, integration of the ISTAR assets in support of TQ 2007 was expressed as the ability to task, collect, disseminate and store ISTAR products and systems within a network enabled environment. These effects were tied to training that was provided before the exercise and CONEMP and TTPs that were developed for the exercise.

The organizational implications of this learning must be understood by all participants. For example, during BAR/TQ 2007 a number of new systems and capabilities were provided to commanders and their staffs. These participants had to quickly learn the capabilities and limitations of each system as well as how they change and improve their processes and procedures.

Leaders and managers should connect organizational and personal implications related to change. During the exercise a number of new procedures were implemented to integrate new capabilities and processes. In a number of cases, these processes and procedures were the responsibility of a single staff member. As a result, training prior to the exercise had to emphasize these new roles and their duties.

Organizations are made up of individuals and smaller subgroups. These entities should take responsibility for helping the organization manage change even if it isn't necessarily their job. To do this, they should identify the skills required for organizational success. When these skills are not available, the organization must identify these gaps in capability to the appropriate level of leadership. Otherwise, the capability gaps will not be bridged and the organization will suffer. During the exercise, gaps in communications capabilities were discovered between command elements and the ISTAR teams supporting TQ 2007. To remedy this, technicians were brought in to implement a partially technical and partially manual method of relay using automated chat technology. The result was a higher degree of mission completion for TST operations.

Conclusion

Change is one of the few constants for most organizations. In fact, organizations that don’t change run the risk of stagnation. Addressing these changes effectively requires a learning organization; one that provides the environment and commitment to promote learning both individually and organizationally.

BAR/TQ 2007 as a learning organization provided an excellent case study for immediate organizational learning in the multinational environment. The major changes wrought by a new set of missions and operational objectives forced a large group of multinational leaders, managers and operators to become proficient in a new operations very quickly. By leveraging different modes of training before and during the exercise the leaders and planners were able to ensure that NATO and national units met their operational requirements, thus ensuring a successful exercise.

So what of the next step? BAR/TQ 2007 will likely take place once again in 2009. By that time more than 50 percent of the leaders, planners and operators will have moved on and will not be available to plan and execute the next exercise. Will the corporate knowledge be retained or will it be lost? Past experience says much will be lost, forcing leaders and planners to start over in what many military officers often call "re-inventing the wheel." To preclude this, the learning process should provide a method of collecting and archiving this knowledge. By doing this, future operations may be planned and executed with a reduced level of learning, thereby dampening the learning curve.

Acronyms

AAR	Aerial Refuelling
AD	Air Defence
ATC	Air Traffic Control
AWACS	Airborne Warning and Control System
BAR 2007	Bold Avenger 2007
C2	Command and Control
CAOC	Combined Air Operations Centre
CCIRM	Collection, Coordination Information Requirements Management
CONOPS	Concepts of Operation
CSAR	Combat Search and Rescue
EO	Electro-Optical
ESM	Electronic Support Measures
FAC	Forward Air Controller
GMTI	Ground Moving Target Indicator
ISTAR	Intelligence Surveillance Target Acquisition and Reconnaissance
IR	Infrared
JISRCG	Joint ISTAR Capabilities Group
LAN	Local Area Network
MAJIIC	Multi-sensor Aerospace – ground Joint ISTAR Interoperability Coalition
MAS	Main Air Station
NAEW&C	NATO Airborne Early Warning and Control
NAM	NATO Air Meet
NATO	North Atlantic Treaty Organization
NoAF	Norwegian Air Force
NORCCIS	Norwegian Command and Control System
OCA	Offensive Counter Air
OJT	On the Job Training
SAR	Synthetic Aperture Radar
SME	Subject Matter Expert
TST	Time Sensitive Targeting
TTP	Tactics, Techniques and Procedures
TQ 2007	Trial Quest 2007
WAN	Wide Area Network

References

[Aerospace.com, 2007]
Aerospace web.com, Fighter Generations,
http://www.aerospaceweb.org/question/history/q0182.shtml, 2007

[Aron, 2000]
Aron, Laurie Joan, Managing to Learn: How Companies Can Turn Knowledge into Action Harvard Business School, Working Knowledge Papers, November 13, 2000

[DOE, 2007]
US Department of Energy (DOE) Archives, Learning Curve Ch 21,
http://www.directives.doe.gov/pdfs/doe/doetext/neword/430/g4301-1chp21.pdf, 2007

[Edmondson, et al, 2006]
Edmondson, A.C., J.R. Dillon, and K.S. Roloff, Three perspectives on team learning: Outcome improvement, task mastery, and group process. Working Paper 07-029 The Academy of Management Annals, Volume 1, October 2006

[Fredman et al, 1999]
Fredman, Jörgen and Horndahl, Mathias and Tong Strömberg, Lars, A Framework for the Design of Organizational Decision Support Systems - A Theoretical and Practical Study, Focusing on Group Decision, Support, Knowledge Management and Means of Communication in Organizational Decision Making Systems, Göteborg University, Department of Informatics, 1999

[Lee, 2007]
Lee P, Trial Quest (TQ) 2007 Lessons Learnt, Version 1.0 Reference Document CCS-MAJIIC-11, September 2007

[Mahaffey, 2008]
Mahaffey, John, MAJIIC Trial Quest 2007 Lessons Learned Conference Report, Version 1.0, Operations Working Group, January 2008

[Malhotra, 1996]
Malhotra, Yogesh, Organizational Learning and Learning Organizations: An Overview Brint.com, http://www.brint.com/papers/orglrng.htm, 1996

[Miller, 1996]
Miller, Danny A preliminary typology of organizational learning: synthesizing the literature, Journal of Management, Fall, 1996

[Robbins, 2003]
Robbins, Steve, Organizational Learning is No Accident, Harvard Business School, Working Knowledge Papers, 19 May, 2003

[Smith, 2001]
Smith Mark K. Peter Senge and The Learning Organization, Informal Education, Infed.com, http://www.infed.org/thinkers/senge.htm, 2001

Biography

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Major Mahaffey retired from the USAF in 2002 as a Master Air Battle Manager and Master Air Weapons Controller with more than 4300 flying hours in USAF and NATO E-3A,B,C AWACS and E-8C JSTARS aircraft. He has flown operationally in the Balkans, Middle East, NORAD and Pacific regions.

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