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The ability to provide the joint war-fighter with near-real-time tactical intelligence and targeting information is now a military necessity. Command, Control, Communications, Computers and Intelligence (C4I) for the Warrior may be the foundation upon which the military builds its ability to analyze, act and assess information faster than its' opponents. Because of this, the intelligence community must ensure timely dissemination of its products, and the communications community must continue to develop, procure, manage and maintain the communications required by the disseminators.

The objective of this issue of *The DTIC Review* is to highlight the capabilities, design and architecture of intelligence communications as well as to document current efforts in Command, Control, Communications, Computers and intelligence (C4I) that supply "real-time" intelligence and "real-time" communications. The technical documents and bibliography examine the research and strategies developed to integrate C4I systems and migrate C4I networks into the envisioned seamless, global, interoperable environment.

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FOREWARD

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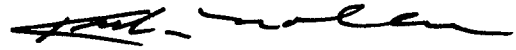
This edition of *The DTIC Review* focuses upon the latest developments in the area of real-time communications.

The editorial staff hopes you find this effort of value and appreciate your comments.



Kurt N. Molholm
Administrator

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INTRODUCTION

The ability to provide the joint war-fighter with near-real-time tactical intelligence and targeting information is now a military necessity. Command, Control, Communications, Computers and Intelligence (C4I) for the Warrior may be the foundation upon which the military builds its ability to analyze, act and assess information faster than its' opponents. Because of this, the intelligence community must ensure timely dissemination of its products, and the communications community must continue to develop, procure, manage and maintain the communications required by the disseminators.

The intelligence community must build intelligence communications equipment that is fully compliant with current and emerging communications standards and protocols. The communications community works to present the war-fighter with products in real-time or near-real-time as well as in the form and format necessary for a specific user.

The objective of this issue of *The DTIC Review* is to highlight the capabilities, design and architecture of intelligence communications as well as to document current efforts in Command, Control, Communications, and Computers and Intelligence (C4I) that supply "real-time" intelligence and "real-time" communications. The technical documents and bibliography examine the research and strategies developed to integrate C4I systems and migrate C4I networks into the envisioned seamless, global, interoperable environment.

The selected documents and bibliography are a representation of the material available on real-time communications from DTIC's extensive collection. Additional references, including electronic resources, can be found at the end of the volume. In-depth literature searches may be requested by contacting the Reference Team, Network Services Division at the Defense Technical Information Center: (703) 767-8274/DSN 427-8274;
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DOCUMENT 1

Intelligence Training for Stability and Support Operations—Can the Military Intelligence Officers Advance Course Do Better

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May 1999

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INTELLIGENCE TRAINING FOR STABILITY AND SUPPORT OPERATIONS--CAN THE MILITARY INTELLIGENCE OFFICERS ADVANCE COURSE DO BETTER?

A MONOGRAPH
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ABSTRACT

INTELLIGENCE TRAINING FOR STABILITY AND SUPPORT OPERATIONS - CAN THE MILITARY INTELLIGENCE OFFICERS ADVANCE COURSE DO BETTER? by LTC Steven W. Rotkoff, USA, 43 pages.

Futurists depict a world dominated by increased ethnically based transnational threats using asymmetric tactics to engage U.S. forces. These type operations are categorized under the rubric of Stability and Support Operations (SASO).

Currently our training strategy is to remain ready for Major Regional Conflict (MRC) and prepare for SASO on a case by case basis. This monograph examines the intelligence skills required to operate in a SASO environment and then evaluates how well the Military Intelligence Advanced Course (MIOAC) prepares students for SASO challenges.

The monograph methodology is to define the intelligence skills required for SASO and validate the proposed skill set against doctrine and Mission Essential Task Lists for Army Intelligence XXI. Following definition of the skills a review of recent SASO operations to include; Haiti, Somalia, and Bosnia document the quality of intelligence officer performance in SASO operational environments. MIOAC is then reviewed for how well it addresses operational shortfalls based on standards correlated to the intelligence skill set identified earlier

Finally the monograph concludes with recommendations for improving MIOAC within the constraints of the current TRADOC system as well as recommendations on a new paradigm for officer training.

SCHOOL OF ADVANCED MILITARY STUDIES

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Lieutenant Colonel Steven W. Rotkoff

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INTELLIGENCE TRAINING FOR STABILITY AND SUPPORT OPERATIONS - CAN THE MILITARY INTELLIGENCE OFFICERS ADVANCE COURSE DO BETTER? by LTC Steven W. Rotkoff, USA, 43 pages.

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Introduction

Since the end of the Cold War the US Armed Forces are no longer primarily focused on a conflict between two robust conventional military forces. In recent years Military Operations Other than War (MOOTW) and Stability and Support Operations (SASO) have constituted the bulk of our engagements. Of the eighty wars since 1945 only 28 have fit the traditional mold of industrial age conflict between the armies of two or more nation states. [1]

Conventional military operations require a doctrinal context to assess information and forecast enemy actions. SASO and MOOTW (henceforth referred to simply as SASO) operations also require a cultural context to anticipate potential enemy actions. As a result, traditionally non-military areas such as economics, crime, and local politics increasingly impinge on military operations.[2]

While technology evolves rapidly, the capacity of humans using technology does not. Therefore, it is critical that we teach our junior officers to sort and fuse information. This knowledge will allow them to operate, manage and lead effectively in the threat environment of the twenty-first century.

During the late nineteenth and early twentieth century the amount of information required to fight and maintain an army increased. The staff evolved as a means to organize information in order to think about, plan for, and direct warfighting.[3]

In the intelligence area, disaggregating, processing, fusing, and analyzing became organized by intelligence disciplines (Signals Intelligence = SIGINT, Human Intelligence = HUMINT Imagery Intelligence = IMINT) and by the level of information needed by

the supported commander (tactical or operational versus strategic intelligence officers and organizations). As a result, training of all-source intelligence leaders focused on creating soldiers who were able to assemble the pieces of information from the various "INTs", then focus them on the level of the supported commander and fuse them into a coherent whole.[4]

As we have discovered in our recent SASO operations, the distinction between tactical, operational and the strategic levels of war are often flattened. As a result, national agencies have developed standard procedures to provide support packages to tactical units involved in SASO operations.[5] Simultaneously, the exponential growth of information technology threatens to overwhelm staffs. Thus, the intelligence staff armed with a discrete process and training, faces a future threat that is more ambiguous.

Our army has a structured process for dealing with changing conditions - it is the Doctrine, Training, Leadership, Organization, Material, Soldiers and Experimentation (DTLOMS-E) methodology developed by TRADOC.[6] This paper will focus on the Training and embedded education aspect of the TRADOC model as a means to address the coming ambiguity.

While the world has become more complex, new technologies provide an opportunity to create new training methods. The Internet and cheapening video technologies provides the prospect of increased "distance learning," and increasingly sophisticated simulations may provide opportunity for "synthetic experience" in complex environments.

Training of junior intelligence officers is critical if future intelligence organizations are to cope with future threats. This paper is limited to examining the training of captains. Unlike lieutenants, captains have a basic understanding of how the Army works (are no longer apprentices) and are closest to the lieutenants, warrant officers, non-commissioned officers and enlisted soldiers doing the first order analytic work. At Divisions and Corps they translate the commander's information requirements as delineated by the G2 into mission tasking for intelligence fusion analysts. They are the first to note key but unanticipated factors associated with ambiguous situations. They are charged with training intelligence soldiers on a daily basis. Finally, at the battalion and brigade level captains are generally the senior intelligence officers on the staff.

There are many in the Army today who believe our current training regimen is "about right." We remain ready for Major Regional Conflict (MRC) and prepare for SASO on a case by case basis.[7] These leaders argue that the myriad of potential conflicts is so large that we cannot anticipate them and the safest course is to prepare to fight the worst case and adjust as required to the rest. They may be right. However, if we believe as an Army that the worst case is the least likely, it is prudent to examine the intelligence skills required of our all source leaders to provide succinct, timely and coherent enemy assessments in the most likely and most ambiguous contingencies.

To determine whether the current training program is sufficient for the threats of the twenty-first century it is first necessary to identify the challenges of intelligence fusion in ambiguous environments. The first step is to have a common understanding of the character of future threats. Once the threats have been characterized, the kinds of data

analysts and leaders need to know to assess future threat capabilities can be identified. Additionally, the flattening of the tactical-operational-strategic levels of war influences the analytical skills and training required of junior intelligence officers. There are a plethora of types of information associated with the many threats we may encounter. It is necessary to distinguish between that type of information a leader/analyst must master and that type of information others can be relied on to master. Finally, reliance on others to provide critical data in ambiguous situations implies integration skills that warrant examination.

Once the critical skills required are identified it is possible to assess how well the current schoolhouse (Ft. Huachuca) training prepares captains to perform these tasks. Central to this examination are the curriculum and training objectives of the Military Intelligence Officer Advance Course (MIOAC). Additionally, the experiences and after-action reviews (AARs) of recent SASO operations provide insight into how well intelligence analysts and leaders have performed in ambiguous situations.

The comparison of critical tasks to curriculum and training objectives should reveal areas for improvement or wholesale revision of the current training program. All proposed changes must be made in the context of improving our ability to conduct intelligence in SASO without sacrificing our ability to perform intelligence tasks associated with MRC operations. The ambiguous threat environment of the future may require a radical shift in the way intelligence officers are trained. Ideas which this paper addresses are: curriculum modification, the role of simulations, and an examination of when and for what types of training, officers go to school.

In summation, this paper examines the characteristics of our most likely future threats and how those threats affect the knowledge base required of junior (captain) Military Intelligence officers. This paper then examines whether the current schoolhouse based training program trains captains in the skills they will require. This examination is based on both standards developed in the body of the paper as well as a survey of lessons learned from recent SASO operations. In cases where it is demonstrated that the current level of training is inadequate recommendations for improvement are made.

Part I - Future Threat Based Training Requirement

In the broad sense intelligence personnel will continue to make sense out of data and information. Primarily intelligence personnel will answer "what does the information mean" ...recognizing possible outcomes...predicting order and likelihood of these possibilities happening

BG Hall 'End of September Stray Voltage' - 27 Sept. 1998 [8]

To understand the nature of future threats, it is necessary to have a common vision of the future environment. The Army recently formed the Intelligence XXI Study Panel under the tutelage of BG Hall, who was quoted above. This panel was charged with looking to the future, identifying the threat, and making recommendations on how to adjust Army intelligence to prepare for that future threat. The author participated in some of the study's work.

The study's foundation was built on a threat white paper characterizing the future world. The white paper laid out the following four dominant trends for the future:[9]

1. Demographics - rich states will continue to age and have a population decline, poor states will grow and remain predominately young. Both rich and poor states will increasingly urbanize. This will result in three distinct worlds: advanced societies (< 1 billion people), developing states (5-6 billion people) and chaotic states (1-2 billion people).

2. Economics - a widening of the gap between rich and poor states will lead to increased interstate migrations and potential ethnic conflict.

3. Information - a continued explosion of information processing and transmission capability will result in cheap and ubiquitous access to information.

4. Technology- rapid development of new technologies with military application will take place primarily among civilian research and development. The result will be that military technology will lag commercial development.

This same view of the future is articulated in Joint Vision 2010 and summarized as follows: "In sum, the U.S. must prepare to face a wider range of threats, emerging unpredictably, employing varying combinations of technology and challenging us at varying levels of intensity."[10]

A survey of the literature addressing the shape of future conflict reveals the following consistent themes:

1. Increased transnational threats - criminal cartels, terrorists, etc.[11]

2. Increased ethnically- based conflict.[12]

3. Decreased recognition for the laws of war.[13]

4. Increased use of asymmetric tactics by US opponents - these include use of information operations, as well as increased ability of the enemy to learn and adapt.[14,15,16,17]

5. Greater reliance on our ability to exploit tactical to national intelligence capabilities and databases.[18]

6. Decreased ability to decipher enemy intent based on Western interpretation of enemy interests.[19]

7. Continued sensitivity of the US to losses and resultant strategy of killing U.S. soldiers as key element of asymmetric warfare.[20]

In summary, the threat may be characterized as ethnically- based, transnational, learning and adaptive, unconstrained by conventional ethics or thought processes and predisposed to attack American interests. Clearly, this poses a dangerous and ambiguous situation under which to commit American soldiers.

Nonetheless soldiers will be committed to such operations. Tactical commanders and their S-2s will be the first line of analytical defense in these future wars. As stated by LTC Daniel Bolger in Savage Peace - Americans at War in the 1990s

> The nature of OOTW, strategy, operations and tactics have an unnerving tendency to neck down to about the level of lieutenant colonels or colonels...In the three big post-Gulf War operations (Haiti, Somalia, Bosnia) ...key decisions fell to men with a lot to do, men with twenty years experience or less, men without a staff.[21]

Given the nature of the threat described above, the types of information S-2s need to be able to navigate to support their commanders may be put into five general groupings. First and foremost remains *Military Capabilities.* Even though the weapon of

choice may change from a T-80 tank to a rifle it remains a basic tenet of professional competence that the S-2 know the enemies *military capabilities* within the constraints of local weather and terrain.

The intelligence briefing format for major regional conflict has a placeholder for biographic information about the opposing enemy commander. However, as an example, it was not necessary to know the politics, history or prejudices of the 8th Combined Arms Army (8th CAA) commander to defeat him. Clearly SASO is different in this regard. Unlike the 8th CAA whose objectives, doctrine and SOPs were easily identifiable, the SASO enemy is more a product of the personality of the leader then the doctrine of the Army. An understanding of the leader requires an understanding of the roots of the conflict from his or her perspective. This requires knowledge of the local history and historical myths, an appreciation for the inter-relationships among the local actors in the political, social and economic communities and some basic understanding of the psychology of the individuals to include religious or ideological beliefs. These criteria may be called *Socio-Biographic.*

As the strategic and operational levels of war collapse on the tactical level, the S-2 must know how to navigate among the intelligence organizations operating at each level. This will be referred to as *Parallel Effort Optimization.* There is the long-standing apocryphal tale in the intelligence community of "false separate-source confirmation." It goes like this: Imagery Intelligence detects the presence of elements of the 56th Tank Battalion of the 8th CAA in the 5th CAA's sector of operations. SIGINT simultaneously intercepts communications from the 56th Tank Battalion in 5th CAAs sector and

HUMINT processes a report from an IPW of the 56th Tank Battalion found in the 5th CAA's sector. Each of the separated "INT" stovepipes reports evidence of "elements of the 8th CAA committed in the 5th CAA's area." The fused product reaches the conclusion, based on what appears to be three separate sources, that the 5th CAA has been committed in the 8th CAA's sector, when in fact the lead company of the 56th Tank Battalion is merely lost. [22]

This type of error is exacerbated by distance from the fight. The unit in front of the lost company knew there was not enough evidence to reach such a conclusion. Another element is stovepiped collection. The ultimate example of which is our current national agencies. Finally, analysts, particularly those far from the action, want to make a contribution by making an assessment.

Today's situation in Bosnia reveals elements of the same syndrome. The competing assessments of when the Train and Equip program should be terminated provides an example. Task Force Eagle in Bosnia has one assessment of when the Train and Equip program will make the Croatians military peer competitors to the Serbs. The 66th MI Group in Germany has a different assessment, and the Joint Analysis Center in England has a third.[23] To a large degree their perspectives reflect where they sit and who they work for. We must prepare our junior officers for this reality. It is critical that tactical analysts have a clear understanding of the capabilities and limitations of the supporting national and operational level intelligence centers coupled with the ability to ask the right questions when such assessments are provided.

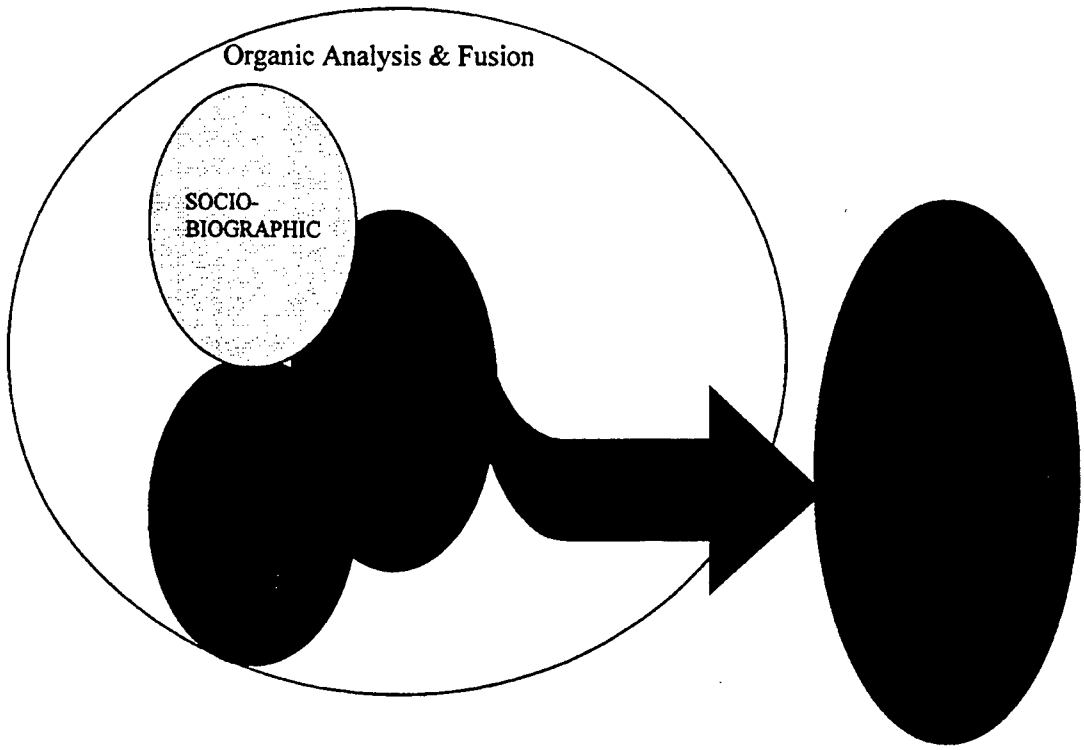
Another aspect of *Parallel Effort Optimization* is the leverage of non-DOD agencies. SASO is characterized by a large number of Non-Governmental Organizations (NGOs) and Private Volunteer Organizations (PVOs) on the battlefield. These include agencies such as the International Red Cross, Doctors without Borders, etc. Although these agencies do not conduct intelligence activities, they do have a great sense for the atmosphere among the populace. It is important that our training expose officers to these agencies and begin early to build respect for their capabilities and contributions.

Finally, it is critical that intelligence professionals at all levels communicate the critical details of their analyzed product to their supported commander. As Richard Friedman points out in his article on "Open Source Intelligence", "Research and analysis are at the core of intelligence...facts are without meaning...senior [leaders still] want timely, accurate intelligence...".[24] This area will be called *Presentation.*

Embedded across all four of these functional areas is a fifth, *Organic Analysis and Fusion.* This is the ability to analyze and synthesize across the other four areas.

In sum there are five functional areas that form the criteria for research into the effectiveness of MIOAC to prepare captains to conduct intelligence fusion, in future SASO operational environments. These areas are illustrated below:

Functional Area Paradigm



Having identified the five functional areas for intelligence training, it is important to ensure that these cover the spectrum of conflict to include MRC. Part of the groundwork upon which the Intelligence XXI study was built was a "Mission Essential Task List (METL): [for] Army Intelligence 2010." These METL tasks addressed both SASO and MRC requirements.[25] The 19 METL tasks are cross-walked to the five functional areas in the matrix below.

METL TASKS	*Presentation*	*Parallel Effort Optimization*	*Organic Analysis Fusion*	*Socio-Biographic*	*Military Capabilitie*
Articulate requirements	X	X	X		
Collect Info	NA	NA	NA	NA	NA
Cross-cue sensors		X			
Automate, manipulate data	X		X		
Share Info	X	X			
Provide Intelligence support to Targeting				X	X
Develop knowledge of METT-TC (Mission, Enemy, Terrain, Time - Troops, Civilians)				X	X
Seek and Create synergy		X	X		
Adapt to change			X	X	
Provide Intelligence support to Information Operations		X		X	
Shape the Future	X		X		
Find foe's center of Gravity (COG)				X	X
Protect friendly centers of gravity				X	X
Visualize Information and Intelligence	X				
Think: What does the collected info mean?	X	X	X	X	X
Predict activities of foes			X		X
Suppress enemy activities				X	X
Leverage capabilities of national intelligence community		X			
Plan, conduct force protection operations		X	X	X	X

Table 1 - Army XXI Intelligence METL - Functional Area X-Walk

A roll-up of the 19 METL tasks cross-walked against the five training criteria reveals several things. In depth training and education in the five functional areas will prepare MI Captains to conduct quality analysis and fusion in all environments from SASO through MRC. This construct will not address the particulars of actual collection as that is a stovepiped activity. Note, the most frequently cited criterion is *Socio-Biographic* which is cited nine times. It is critical that MIAOC prepare leaders to operate in this arena. Both *Military Capability* and *Parallel Effort Optimization* are cited eight

times. While *Presentation*, though important, is only cited six times and is the area where we can assume the most risk.

Doctrine provides a final cross check of the proposed paradigm. The current Army FM 34-130 Intelligence Preparation of the Battlefield (IPB) addresses IPB for Operations Other Than War (OOTW). In Chapter Six of FM 34-130 there are ten types of operations. An examination of the doctrine for IPB in support of each of these operations reveals that every functional area except for *Presentation* is addressed in the doctrine. Instead of *Presentation* there is some general guidance such as: prepare "peace violation templates" or "drug activity support templates." There are however, no examples of what these might look like. The matrix below cross-walks the ten OOTW operations, the phases of IPB and where *Military Capability* (MC), *Socio-Biographic* (SB), *Parallel Effort Optimization* (PE) *and Organic Analysis and Fusion*(OA) are addressed.[27]

Type Operations	Define Battlefield Environment	Define Battlefield Effects	Evaluate Threat	Determine Threat Courses of Action
Human Assistance and Disaster relief	MC PE	SB PE	MC	MC OA
Support to Counterdrug Operations	MC SB	SB	SB MC	MC OA
Combat Terrorism	MC SB	SB	SB MC	MC OA
Show Of force	MC PE SB	SB	MC SB OA	MC SB OA
Attacks and Raids	MC	MC	MC	SB OA
Non-combatant Evacuation Operations	PE SB	SB	MC	SB OA
Peace Enforcement	SB	SB	MC SB	MC SB OA
Support to insurgency & counter insurgency	SB MC	SB	SB MC	MC SB OA PE
Support to Peacekeeping	MC SB	SB PE	MC	OA
Support to domestic Civil Authorities	NA	NA	NA	NA

Table 2 - FM 34-130 & Training Criteria X-walk

The table above reveals *Military Capability* and *Socio-Biographic* analyses are addressed twice during the IPB process for almost every operation. In every process

Organic Analysis comes to the forefront during the determination of threat courses of action. *Parallel Effort Optimization* is addressed in most, but not all OOTW operations. It is primarily focused on NGOs vice parallel intelligence agency collection and processing.

Having vetted the proposed criteria against both the Intelligence XXI METL and IPB doctrine it is now appropriate to determine how to evaluate the quality of present-day training against the criteria.

First, a survey of recent SASO lessons learned will reveal those areas where training has been weak in the past. In reviewing operational AARs, performances in the five areas are embedded in comments on IPB (*Military Capabilities, Socio-Biographic* and *Organic Analysis and Fusion, Presentation* products) and CMD (*Parallel Effort Optimization*).

Having identified operational evidence of strengths and weaknesses it is appropriate to examine the MIOAC curriculum. Haiti, Somalia and Bosnia AARs reflect the quality of the MIOAC of previous years but do not provide insights into the current or recent curriculum. An examination of the current curriculum will show whether the lessons learned from recent SASO operations are being addressed. Standards are required to judge the performance of the curriculum in training against the five functional areas. Assessment of the quality of the current training program results from review of how well the curriculum addresses the shortfalls in the performance of intelligence soldiers in recent operations

Since the *Socio-Biographic* area is the most critical based on our analysis, it is the standard that needs to be addressed first. This category of knowledge poses a challenge.

Clearly no training program can possibly anticipate the myriad of places in which soldiers may be called to serve. Thus any proposed training standard cannot focus on the specifics of *Socio-Biographic* information but rather must focus on training skills. Therefore it is not realistic to hope to create a "master" *Socio-Biographic* expert at the junior officer level. It is clearly necessary to create an officer who knows how to ask the right questions and can both analyze (break down into components) and synthesize (fuse into a holistic view) the specifics based on the mission.

As addressed earlier in describing future threats, *Socio-Biographic* knowledge requires detailed understanding of the culture and history of a nation as well as the key personalities, effecting the local situation.

There are two general approaches to teaching the skills required to be *Socio-Biographic* "smart." The first would include a vast array of specific classes on areas that provide the background to navigate *Socio-Biographic* waters. These include anthropological classes on the nature of society, survey classes on economic political, and religious systems, psychology classes on how people are motivated etc. This approach is both too time consuming (MIOAC is about six months long) and, although they expose the student to a wide range of facts, they are generally not interactive.

The second method for teaching an appreciation of the *Socio-Biographic* factors is the case study. The case study requires that students delve into the various details of *Socio-Biographic* information for a specific area. Students learn and understand the key factors impinging on that area and they forecast threat activity or recommend ways to influence the threat. The endstate is for the captain to know how to ask better questions

about the various *Socio-Biographic* factors that come to play in a given situation. Considering the time available and the ability to build some real-world experience the case study is clearly the preferable of the two methods for training in this area.

In building a training evaluation matrix the first standard is: (1) - What is the quality of the SASO-related case studies included in the training?

The second criteria needing standards identification is *Parallel Effort Optimization.* There are two general areas where higher, lower and equal (i.e., a brigade S-2 talking to his counterpart in another brigade) intelligence agencies can assist an S-2. The first area is collection, and the second is production. There is a general feeling that tactical collection management is broken.[28] This is in large part because there are a plethora of agencies whose collection capabilities are constantly evolving.[29] In recent years the National Intelligence Support Team (NIST) concept has come to the fore. This is because as tactical-operational-strategic levels of war flatten, higher to lower intelligence support becomes more critical and the inability of S-2s and G-2s to know and understand the changing capabilities of national agencies requires on-site liaison. Additionally, the primacy of HUMINT in SASO operations further complicates the collection effort. HUMINT operations are extremely sensitive because of the danger incurred to collectors. It is very difficult, therefore, for tactical intelligence organizations to really know the capabilities of supporting higher echelon HUMINT without risking compromise of the source. A key aspect of *Parallel Effort Optimization* becomes the capabilities and uses of NIST teams.

The analyticai portion of the paradigm laid out earlier reflects the second area of *Parallel Effort Optimization*, namely production which is analysis and fusion focused. This aspect is critical to building a quality leader of all-source analysts in their fusion effort. Focus of the *Parallel Effort Optimization* criteria will be on accessing and integrating analytical products and optimizing collection systems.

It is critical that we train leaders to make better use of parallel products. There exists within the tactical community, a common belief that assessments from higher organizations lack the understanding of the situation that those closest to the situation have. In some cases as was pointed out in an earlier illustration this is true. In many cases it is false. In SASO operations as in MRC operations the tactical unit generally knows better than anyone what is happening RIGHT NOW! Because the unit is engaged in the "right now" there is little time to think. Ultimately, quality analysis requires an understanding of the situation, to include key players, a set of quality assumptions about the future, and time to think.

Those not embroiled in the action often have good (if not better) information about the players. Frequently analysts in "sanctuary" have had time to research key aspects of the situation. Sometimes analysts have special training, and may have the Masters in the culture of Phalangestan that the tactical analyst does not. Clearly they have more time to think. The disconnect between their assessment and that of the engaged unit is frequently a result of different set of assumptions.

We must teach our analysts two things. The first is the importance of parallel agency production and the second is how to discuss it intelligently when assessments are

at variance with the facts or simply "do not make sense." Ultimately this boils down to how to think critically. Key to any discussion of how to think critically is the elimination of the lecture method of learning. Critical thinking requires examination of ones' beliefs as well as an examination of the underlying assumptions of that being analyzed. It is founded in dialogue.

The next two standards by which to measure the quality of training are: (2) How much of the training is dialogue versus lecture and (3) How much exposure do students get to national level collection system capabilities and management?

The next area to examine is *Military Capabilities*. The understanding of *military capabilities* and their impact on enemy courses of action have been the bread and butter of intelligence training. After learning the mechanics of tracking order of battle, performing IPB, and preparing an assessment, the key feature of learning the intricacy of *military capabilities* assessment has been the simulation wargame. The benefits of the simulation wargame are so apparent that they serve as a cornerstone of our training program for Division and Corps commanders and their staffs. The simulation wargame allows S-2s and their commanders to conduct *organic analysis and fusion* based on the situation, terrain and threat military capabilities. The results of that analysis are tested by the success of the selected course of action.

For SASO operations the simulation wargame needs to remain the centerpiece for training. Unlike conventional operations, where the databases are dominated by large numbers of limited feature icons, the SASO simulation will require fewer icons with many more individualized capabilities. It is not clear that technology supports this

requirement. The purpose of this paper is not to design a SASO simulation. However, it is important that some form of simulation be included in properly training our officers to go into a SASO environment. It is possible that this simulation can be merged with the interactive case study addressed earlier. Nevertheless, the standard for this criterion is: (4) The use of simulations for both MRC and SASO environments as part of the training program.

Next it is appropriate to look at the *Presentation* area and address standards by which to measure it. For the military intelligence officer at every level, "Our weapons are words, written and spoken".[30] Unlike *Military Capabilities* or *Parallel Effort Optimization* where the intelligence officer is expected to be the resident expert, there is a lot of help available to the junior officer needing to refine his or her *Presentation* skills. Nevertheless, as SASO operations are extremely complex, with much ambiguity, it is incumbent upon the training base to provide some tools and experience in presenting complex information to commanders.[31]

Military decision making at the tactical level is not normally made by means of written reports, but rather by means of briefing. The ability to write well is certainly positive. However, most military intelligence officer presentations will not be written, and the focus of this standard will be on oral presentation. The best training for oral presentations is briefing an audience who understands and can role-play the target audience. The standard for this criterion is: (5) both the number of presentations and the quality of the audience. Student *presentations* to the commandant of the school or

Colonels stationed at the school are more valuable than student *presentations* to each other.

The final area in the analytical paradigm was that of *Organic Analysis and Fusion*. Just as conduct of this function is dependent upon an understanding of *Socio-Biographic* information, *Military Capabilities* information, *Parallel Effort Optimization,* and coherent *Presentation*, the training for this area is dependent on the quality of training for the other four.

To recap, how well intelligence officers perform against the criteria will be evaluated against two venues, operational and schoolhouse. For the operational evaluation, Haiti, Somalia and Bosnia will be examined. Particular attention will be paid to the areas of IPB and collection management as they best embed the functional areas identified. In evaluating the schoolhouse curriculum there are five more objective standards recapped below:

1. Quality and quantity of case studies.

2. The degree of lecture versus seminar mode of instruction.

3. The degree of exposure to national level organizations and systems.

4. The quantity and quality of wargames.

5. The number of times briefing an experienced audience.

With this as a framework it is now appropriate to examine the after- action reports of Haiti, Somalia and Bosnia and delve into MIOAC and evaluate the current state of training and education.

Part II - Training Assessment - Recent Operational AARs

A review of Haiti, Somalia and Bosnia AARs suggests mixed performance in those areas associated with IPB, i.e., *Military Capabilities*, *Presentation*, and *Socio-Biographic* intelligence. The review also reveals an overwhelming weakness in collection management and *Parallel Effort Optimization*, associated with it. In the paragraphs that follow each of the earlier developed criteria are examined through the lens of intelligence AARs from the aforementioned operations.

Military Capabilities is the raison d'être for Military Intelligence training. It is the natural place to begin. The failure to perform competent *Military Capabilities* analysis is most conspicuous in Somalia where it contributed to the misallocation of forces. As stated in the Operation Restore Hope Lessons Learned report:

> Defining the battlefield must expand the area of interest to include military, paramilitary, and NGOs. A better definition and description of the battlefield in Somalia (and) a more complete analysis of clan, sub-clan, and warlord alignments and loyalties might have changed the nature of the mission and allocation of forces.[32]

Similarly, the compilation of lessons learned at CMTC during the conduct of the Bosnia- focused Mountain Eagle exercises, is that S-2s do not make the adjustment to factional order of battle tracking and IPB well. [33]

In Haiti conversely, great attention was devoted to modifying the targeting process to the environment and supporting targeting with unique intelligence collection. The targeting mission in Haiti focused on weapons caches in private residences of key personalities within and outside the government. A JTF targeting board met twice daily

with the commanding general to get his approval. Some of the products developed to support targeting in this arena included: drive-by and airborne video, airborne photography, detailed sketch maps and strip maps addressing both the target and the surrounding area (to preclude collateral damage), and information on the key personalities. As a result of this "high-resolution" approach there was a 25% success rate against these extremely ephemeral and well-protected targets.[34]

The success of this targeting not only reflected an ability to track *Military Capabilities* of the targets but was a result of unique approaches to *Presentation* of information to decision makers. The in-country JIC (Joint Intelligence Center - the 10th Mountain G-2 and his staff) created a unique, nonstandard means to portray known and suspected arms caches. A circle divided into four quadrants was color-coded to depict the Haitian unit involved, number of reports, timeliness of reporting, and number of different sources reporting. This tool was essential for visualizing the accuracy, timeliness and nature of potential targets.[35] In part the reason for 10th Mountain G-2's successful adjustment to the *Presentation* requirements for Haiti reflected their experience in Somalia. Many of the senior analysts (but few of the collection managers) had served in Somalia before coming to Haiti. They had learned the hard way. The Center for Army Lessons Learned noted in their compilation of OOTW lessons regarding Somalia, the following:

> The standard military situation briefing does not convey the essential information needed for a refugee support operation. The briefing sequence, weather, intelligence, task organization and conduct of the operation do not place enough emphasis on the supported population. [36]

Mountain Eagle AARs also reflected a shortfall in the ability of S-2s to succinctly present data on factional activity in a way that was easily understood by their commanders.[37] The aforementioned difficulties in *Presentation* reflect the biggest challenge in all three operations which was the transition to *Socio-Biographic* information collection, analysis, and presentation. A Center for Army Lessons Learned (CALL) newsletter captured the extent of the *Socio-Biographic* challenge in Bosnia in the following observation:

> US forces, even at the tactical level, found themselves engaged in a political process... commanders could not expect to function successfully using purely military principles and logic. The ability to also manipulate a combination of political power and interests, cultural values, personalities and perhaps most important perceptions was critical to mission success. [38]

Interestingly, a CALL report on Disaster Assistance in the U.S. and elsewhere observed the same shortfall:

> Specific requirements for the planning preparation and execution for IPB in disaster assistance operations should be developed. The following should be considered for the IPB process when deploying to a disaster area:
>
> Location of state and local seats of power
> Names of key officials-elected and professional
> List of agencies working within the area and who is in charge [39]

Clearly this was the area of greatest shortfall during the Somalia operation. The AARs are rife with examples of our inability to appreciate the complexity of the *Socio-Biographic* environment and incorporate it into the intelligence process. The following quote best sums up the myriad of areas requiring intelligence collection and analysis in this environment:

> Defining the battlefield must also analyze the host-nation population, government and demographics. Analysis should include housing, health of the population, hospitals, population distribution, ethnic backgrounds, languages, religious beliefs tribe/clan loyalties etc....Add personalities to the usual list of OB factors. Identify leaders and develop psychological profiles. Threat integration for operations characterized by uncertainty and ambiguity require innovative 'paradigm breaking' approaches to capture behavior patterns and develop situational event analyses. Recent experiences show that population groups or hostile elements will behave in some manner which can be identified, measured, timed, depicted graphically, and predicted with some accuracy [40]

The above description is somewhat daunting. Although, as the case of the 10th Mountain in Haiti suggests, experience in one region is easily transferred to another as analysts and leaders become sensitive to the need to focus on these non-traditional factors effecting military operations. The good news is that soldiers with training in dealing with *Socio-Biographic* issues can quickly adapt that training to a new environment. The experience of the SOF in Haiti provides an illustration of this.

> ... SF soldiers tasked with Operation PROVIDE COMFORT were not area or language oriented...however, because...of past training the soldiers recognized the importance of cultural awareness. Within a matter of days, the SF soldiers knew the customs of the people, allowing them to establish rapport, critical to mission success [41]

It is fair to say that our performance in the areas of *Military Capabilities, Presentation,* and *Socio-Biographic* has been mixed. Experience in early operations (Somalia) made a discernible difference in improved performance in later operations (Haiti) for those elements of the 10th mountain G-2 who experienced both. The same cannot be said for our ability to *Optimize Parallel Efforts*.

Difficulty in *Parallel Effort Optimization* has centered on three areas. These are, the inability to optimize production, the inability to optimize traditional collection (national agencies, higher intelligence organizations, etc.), and the inability to optimize non-traditional collection.

A CALL IPB newsletter, focused on IPB in an OOTW environment, observed that S-2s fail to highlight information that cannot be collected at the unit level but must be obtained from higher.[42] A newsletter focused on Joint Military Commissions (JMC) in Bosnia noted that commanders (and their S/G-2's by staff responsibility) often failed to go into JMCs with a good understanding of the positions of the parties regarding the peace agreement issues and that these often failed to be identified to higher intelligence organizations as critical intelligence requirements.[43] Another shortfall was the failure to require specialized experts to conduct analysis to feed the overall assessment of the situation. In Haiti for instance:

> HUMINT [was the] primary critical source that required a large commitment of staff resources...However, HUMINT personnel contributed little analytically...field collectors submitted raw reports that carried the caveat ...not trained to do analysis.[44]

In aggregate, intelligence leaders did not manage to distribute production operations in a way that optimized the capabilities of the various levels of intelligence organizations or collectors.

Besides production, both traditional and non-traditional collection efforts were not optimized. Although the JTF-190 (10th Mountain G-2) staff demonstrated an admirable ability to tailor its analytic products (as discussed earlier) to the SASO nature of the

operation, they were not as successful in making the transition from tactical to national collection operations.

> JTF-190 collection managers...unfamiliar with national systems...issued unrealistic requests for products and information....collection opportunities were lost...and time was wasted...Collection and dissemination of products were effected by the absence of a clearly defined collection plan. Analysts at Ft. Bragg and JTF-190 were unaware of available products...[45]

> Division-level collection managers familiar with Army tactical collection doctrine, systems and procedures operated at a significant disadvantage when thrust into the JTF role. Staff needed more instruction about available collection systems... [46]

The prime vehicle for national systems production is the Joint Deployable Intelligence Support System (JDISS). Any ability to leverage national production efficiently requires an intimate knowledge of this machine. However in Haiti:

> Many JDISS operators at XVIIIth Airborne Corps were unaware of certain JDISS functions buried deep in the system...field users were denied access to many databases for lack of user ID, a problem that would continue to affect analysts after deploying to Haiti.[47]

Finally, the lack of recognition of the complexity of the problem often resulted in people with the wrong background or experience being charged with leading this complex collection effort. This is best captured in a quote addressing the early challenges in establishing the Task Force Eagle command post in Bosnia:

> ...there were also early challenges to getting the right intelligence personnel mix. Initially Task Force Eagle (TFE) manned the assault command post with the G2 current operations staff. One problem with this manning is that although the standard G2 shop is good at managing current operations issues and intelligence resources, it doesn't routinely focus on broader, deeper, multi-disciplined intelligence....the G2 section needed an officer who understood how to leverage all ...collection sources ...from National Agency level down to scouts

and patrols. [48]

Along with traditional collection management challenges the SASO environment presented new organizations requiring management and optimization. These new organizations were of two types. The first were non-traditional collection support represented by CIA, DIA NSA and other National Intelligence Support Teams (NIST). The second were NGOs and PVOs. The ability of tactical intelligence officers to make the leap toward managing these organizations was poor. What follows are two observations from Bosnia on the importance of NGOs to the intelligence process :

> Most military leaders are not familiar with civilian relief agencies. The importance of their role in an operation ...cannot be overemphasized. Military training programs should include overviews of the identity, missions, capabilities and limitations of these agencies.[49]

> ...Command post training and leader professional development should increase emphasis on IPB under conditions of OOTW. ...NGOs were another valuable source of intelligence...[50]

From the Somalia experience came the growth of the NIST concept. The NIST was designed to serve as a liaison between the tactical user and national intelligence collection and production organizations not normally in direct support to tactical units. The incorporation of NIST teams was difficult at first. In Haiti, the NIST teams on site frequently had access to better data then the unit they supported.

> The NIST access[ed] the SAFE database, which proved essential to obtain biographical information regarding Haitian individuals. Access to these critical files were denied to 10th Mountain analysts for lack of a password... lacking exposure to NIST the staff initially found it difficult to integrate NIST into tactical operations [51]

The importance of effective NIST use is so central to operations in Bosnia that the key G2 leaders of units preparing to assume the Bosnian mission dedicate up to two weeks becoming familiar with their capabilities. Prior to 1st Cavalry Division assuming the Bosnian mission the division commander dedicated an entire week to visiting those Washington D.C. intelligence agencies which would be represented by the NIST team in Task Force Eagle headquarters.[52] Optimal use of NIST teams remains a crucial capability for SASO operations. One of the central lessons learned in the Haiti operation speaks directly to this requirement:

> Intelligence planners and operators would benefit from increased awareness of NIST potential uses. Deploying a NIST capability during major training exercises would allow the intelligence personnel to observe the NIST integration...recommend emphasis in resident and correspondence courses on how to integrate NISTs into tactical operations [53]

Having addressed four of the five criteria addressed in the paradigm, it is now appropriate to look at how well the four were integrated during these past operations. How well intelligence organizations adapted to the challenges of SASO operations in order to conduct analysis is revealed by the degree of flexibility and tailoring of the organizations and addresses the final criteria, *Organic Analysis and Fusion*. In Somalia after time the organizations did adjust to the environment.

> On the intelligence side, the situation in Somalia, demonstrated that intelligence analysts must be flexible and innovative in their approach to Intelligence Preparation of the Battlefield... uniqueness of conducting peace enforcement missions in a humanitarian assistance operational environment rendered some of the traditional IPB products (warfighting templates) nonapplicable. However, U.S. forces in Somalia adapted IPB methodology and internally merged requirements for humanitarian assistance, peace enforcement, and peacekeeping operations. [54]

As the analytical function matured to better reflect the SASO environment, rules of thumb also developed to better judge the quality of intelligence collection.

> The JTF J-2 pointed out analyst's rule of 10: Reduce HUMINT reports by a factor of 10. If 400 vehicles were reported treat the figure as 40. The rule of 10 was applied to all Somali sources unless confirmed by other sources. HUMINT information was put through a logic test this meant that time distance factors had to be possible and logical. [55]

In Haiti after some initial challenges in transforming from a division G-2 to an ARFOR G-2, and adjusting to the intelligence requirements of a non-traditional mission, the 10th Mountain was successful in tailoring analysis and fusion processes to the environment. As stated in the operations AAR:

> In Haiti, intelligence organizations and systems developed for highly specialized roles and missions were thrust into a situation of extraordinary military, political and diplomatic ambiguity....Intelligence dissemination in Haiti demonstrated that much progress has been made, but significant resources and high level attention are still needed to resolve persisting problems of...operator training and orienting tactical users to the capabilities and limitations of systems. [56]

In Bosnia the analysis and fusion elements have clearly transformed over time into an organization specifically tailored to the environment. This did not come naturally. Mountain Eagle AARs continue to demonstrate a trend to resist link analysis as a means of portraying the enemy and his courses of action. [57]

In conclusion, a review of our recent SASO operations reveals that with practice we can adapt skills designed for HIC *Military Capabilities* analysis to SASO operations. It is not a simple carryover from one to the other. Initial operations in Somalia were poor, and train-ups for Bosnia identified this as a weak area, but analysts experienced in this

area performed admirably in Haiti. Similarly, in the *Presentation* area experience in SASO operations counts. The ability to develop tailored products that adequately display the complexity of a SASO environment is critical but not second nature to those focused on HIC. Central to both these issues is the *Socio-Biographic* nature of SASO. Improving analysts understanding of this environment will directly correlate to improvement in the other two areas. The biggest challenge observed during all three of the operations examined was the ability to *effectively optimize* the collection and production of *parallel efforts*. This was identified as a major shortfall during Haiti:

> No suitable collection management courses were available to spin up the G2 staff before deploying for operation Uphold Democracy. The basic and advanced courses lacked substance on collection systems. A collection management shortfall was identified as - training, training, training... [58]

Finally, the ability to tailor organizations in response to the requirements of the environment were successful over time. Most critical was the ability of analysts to adjust the IPB process to each environment. That ability reflected their competence in the five identified functional areas. As stated after Somalia:

> The strategic and operational IPB process failed to provide commanders a means to clearly focus the factors of METT-T...IPB must be expanded in scope and tackle the ambiguities of the threats in the inherent complexity of underdeveloped regions.[59]

This historical examination confirms that the five developed functional areas do represent critical Intelligence training requirements. It is now time to take a detailed look at how well MIOAC addresses these functional areas against the standards developed for each.

Part III- MIOAC Curriculum Review

The standard approach to evaluating a military advance course would be to examine the Program Of Instruction (POI). The POI is the military version of both a course curriculum and its embedded series of lesson plans. It normally includes a detailed laydown of resources used, the number of hours dedicated to each task, learning objectives, etc. Development and approval of POI are a time intensive process. The pace of changing requirements for intelligence officer training has been dramatic. This is reflected in a lack of a current POI. In an attempt to remain responsive to recommendations from the field, the instructor cadre at Ft. Huachuca have relied on briefing slides and coordination meetings to elicit leadership approval and rapidly modify the OAC in response to the evolving training requirement. The slides currently depicting the OAC structure and objectives are included at Appendix 1. A series of electronic mail between the author and the commander of the battalion charged with conducting OAC are included at Appendix 2.

Before examining the OAC a review of the standards are in order. As developed earlier there are five key areas that will be examined. They are, quantity and quality of case studies, degree of seminar-type instruction, degree of exposure to organizations and systems needed to optimize parallel efforts, quantity and quality of wargames and number of times briefing an experienced audience.

Before addressing each criterion, it is necessary to look at the course as a whole in terms of objectives and time available. The stated mission of OAC is to "Train Military Intelligence captains to become proficient S2's, ACE (Analytic Control Element) Battle Captains, and company commanders."[60] The schoolhouse is given a total of 88 class days (18 weeks) to accomplish this mission. Of those class days 10 are solely dedicated to Stability and Support Operations. [61] However, SASO has been integrated throughout the Brigade Operations and Intelligence module (hereafter referred to as Brigade O&I) and an additional five days of SASO have recently been added to the Intelligence Support to Division and Corps (ISDC) block of instruction. Clearly, during the past ten months the staff of OAC have made every effort to integrate SASO throughout the curriculum. Nonetheless upon conclusion of examining the current OAC it will be necessary to return and address the overall structure of the TRADOC model.

The first criterion to be examined is that of case studies. The case study standard was developed primarily to determine how well the school addressed the Socio-Biographic area. As this is a key underpinning of SASO-related intelligence analysis it is appropriate that it be examined first. Each OAC class is divided into six squads. Each of these squads is further subdivided into two sections for the contingency operations case study presentation. Each section produces a single case study that is the final graded event for the OAC. In total students hear twelve case studies addressed during a single OAC but present only one.[62] In addition two case studies (Bosnia and Ireland) are instructor delivered. Also, each of the foreign students attending OAC provides a briefing on his or her military's key operations in a case study-type format.[63] There is clearly

recognition by OAC of the value of case studies particularly as they address SASO operations. Even though students pick their case studies, these tend to be focused on Haiti, Somalia or other SASO operations and must be approved by the instructor. Case studies serve as the prime vehicle to drive seminar-type exchanges. The complex operational environment associated with each of the case studies ensures that students are challenged to think critically and imaginatively about problems. The only shortfall in this approach is that the student case studies are presented at the end of the course work.

Looking at case studies alone does not give a complete picture of how the schoolhouse has attempted to integrate *Socio-Biographic* appreciation in its students. Key to teaching this concept is the SASO block of instruction and the Brigade O&I exercise. The SASO week exposes students to the principles of SASO operations as laid out in FM 100-20 (Military Operations in Low Intensity Conflict), and IPB for a SASO environment as laid out in FM 34-130 (Intelligence Preparation of the Battlefield). These field manuals serve as a starting point for the examination of the types of data required in a SASO environment and means by which to present them.[64] Specifically the SASO block addresses population overlays, link and connectivity diagrams, as well as tactical questioning and interviewing skills.[65] The SASO week leads directly into Brigade O&I. The Brigade O&I scenario has a division (of which the brigade is a part) deploying as both a JTF HQ (Joint Task Force Headquarters) forward and the ARFOR (Army Forces) to assist a host nation (hereafter HN) in a counter-insurgency effort. The mission of the brigade is to secure key facilities and free the HN military to deal with the insurgents. Terrorists and guerrilla forces are included in the threat scenario and the exercise

culminates with a conventional force attack by the insurgents.[66] As this operation builds directly on the previous two weeks of SASO training, it reinforces the importance of *Socio-Biographic* type intelligence. Recently the school developed a Country Study for the fictional country they use in the aforementioned scenario.[67] This has greatly enhanced the quality of the *Socio-Biographic* training associated with this event. As the Brigade O&I exercise is both part case study and war game, it is appropriate to now look at the quality and quantity of wargames conducted.

There are three major wargames conducted during OAC. They are a SASO wargame conducted during the SASO block of instruction, the BDE O&I wargame, and a wargame embedded in the ISDC module. Both the SASO wargame and the BDE O&I wargame are conducted in the SASO environment described earlier, the ISDC exercise is a Korean HIC scenario with minor rear battle skirmishes in lieu of SASO. Notably, the SASO case study is personally evaluated by the battalion commander. None of these exercises has any SASO-type simulation and the SASO portions of the wargame are described as "verbally walking through critical events, action/reaction/counteraction, and recording the results."[68] This problem is beyond the scope of the schoolhouse to solve, but it is critical that it be remedied if we are to have the ability to examine interactively the consequence of differing approaches in a SASO environment.

It is during the ISDC wargame that most collection management operations are interwoven. This wargame is integrated with ASAS (All Source Analysis System) and JDISS training. As ASAS capabilities remain optimized for HIC operations this module is focused on a HIC (Korean) scenario.[69] By association so then are the JDISS and

collection management training during this module.[70] Since events in Haiti and Somalia revealed the shortfall in Army intelligence officers exposure to JDISS, the school has done an admirable job in increasing its focus in this area. The CMD instructor attends refresher training at DIA to ensure currency of information and there is an effort to ensure that Huachuca-based introductory training dovetails with more detailed resource management training available from national agencies.[71] However, as this is clearly the area where AARs show we are weakest, it merits a more detailed examination. Currently, there is limited training on how to leverage the collection of NGOs or PVOs during OAC. The schoolhouse decided that this subject is extremely sensitive and more accurately belongs as a skill set for field grade officers. NGOs and PVOs are addressed in detail during a separate G2/ACE chiefs course as opposed to OAC.[72] Although there is some examination of how to leverage the production capabilities of national agencies, the primary focus is on the collection system management. However, the collection management training is not subject to the same rigor as most of the other training. This is evidenced by the designation of the following three tasks as "knowledge" versus "skills".

1. Utilize joint and national intelligence capabilities in collection plans.
2. Utilize national and theater-level all source products for intelligence operations.
3. Plan tactical tailoring for split based IEW operations.[73]

Knowledge means the student must understand the topic in his/her head but does not necessarily have to produce anything with it. Skill means the student must produce a product, i.e., a DST (Decision Support Template) or ISM (Intelligence Support Matrix).[74] This implies a less rigorous focus on these vital tasks. Currently there is no focused collection management course. The strategy is that collection management is a core

competency of MI officers and as such must be embedded throughout OAC and follow-on additional skill training courses which all OAC graduates attend.[75] This embedded training does not currently address the RMS (Resource Management System) or JCMT (Joint Collection Management Tool). These two systems are as critical to modern leveraging of national systems as is JDISS to access national production. It is critical that once the schoolhouse has acquired these systems (they are in the process of doing so) the course be modified to include them. Finally, nowhere in the course curriculum is integration and use of a NIST team mentioned as an objective. Examination of the AARs from Bosnia, Haiti and Somalia clearly identifies effective integration of a NIST as a major shortcoming. Recently the G2/ACE chief's course has added a module on use of the NIST team. This includes briefings by former NIST team members from recent operations. These same guest instructors do address the OAC in session during the time of their visit. NIST has also been added to the ISDC study guide.[76]

The large amount of time dedicated to exercises and hands-on training on ASAS and JDISS leaves relatively little classroom time. Of the total course only 20% is pure classroom time. However, all of this is lecture.[77] The school has done everything possible to integrate seminar vice lecture type training. The case study presentations are actually jumping off points for seminar discussion. Lectures are limited to those common core courses mandated by TRADOC which are conducted in lecture fashion to ensure consistency across branches.

The final area for review is that of briefings. Each student gives approximately five briefings during OAC. The nature of these briefings varies but all reflect some

portion of the intelligence cycle. Students primarily brief their squad advisor, though some will have an opportunity to conduct a brief for the school battalion commander or his brigade commander. The squad advisors are majors serving as instructors in the school or as XO/S-3 of the school cadre battalion. Each is selected and validated by the battalion commander before assuming their duties. At one time the school attempted to leverage the lieutenant-colonels and colonels serving at Ft. Huachuca to receive student briefs. They discovered that competing requirements, conflicting schedules and general unfamiliarity with the scenarios prevented participation by these senior officers from being effective.[78]

On balance, a detailed review of the OAC curriculum reveals a clear appreciation of the lessons learned from our recent SASO experiences. There is a comprehensive effort to embed SASO related training wherever possible. The integration of the Brigade O&I and SASO modules is a great effort in this direction. Ongoing efforts to develop a detailed country study is another positive initiative, as is the development of a Humanitarian Assistance exercise. The presentation of the Northern Ireland and Bosnian case studies as well as the presentation of SASO-related case studies by students all reflect a heavy focus on this mission requirement.

Nonetheless there remain areas for improvement. Neither case studies nor wargames are truly interactive. As a result students are limited in their ability to test various solutions against a given scenario. Case studies are group work presented towards the end of the course - a period when students are generally least focused. Current

collection management focus is heavily HIC and does not give sufficient exposure to NGO/PVO or NIST integration.

Most of the shortfalls identified above are a function of time available. Time and emphasis within OAC are dramatically effected by two factors. The first is the requirement to adhere to the TRADOC model. Currently there are as many days dedicated to TRADOC core curriculum courses (primarily focused on company command)[79] as there are days for SASO specific training.[80] The other major factor competing for time is the grim reality that a fairly large percentage of each graduating class will be assigned to Korea immediately after OAC.[81] Both of these factors are related. Because the TRADOC model mandates a continuous OAC course (versus a modular one) the course must address the full range of required training in the time available.

The last portion of this paper addresses shortfalls in OAC from two perspectives. The first addresses what can be improved within the constraints of the TRADOC model, the second suggests training options that would become available were the structure more flexible. In each case these recommendations will focus on how to improve the quality and time available to conduct SASO case studies, seminars and wargames, and how to improve the depth of exposure to NGOs/PVOs, NIST and other parallel efforts.

Part IV Recommendations and Conclusions

In examining how to improve the curriculum under the current TRADOC model this paper addresses the shortfalls in priority, with the order based on degree of weakness in the current curriculum.

It is critical that the Army develop a SASO wargame that has enough depth and complexity to allow students to run multiple iterations and gather lessons learned. The strength of the Battle Command Training Program has been it's ability to expose leaders to a thinking enemy and allow organizations through multiple iterations to develop staff procedures and warfighting strategies to defeat that enemy. The field is replete with examples of this. The Apache deep strike and associated tactics, techniques, and procedures were a direct outgrowth of the need to develop a mechanism to defeat OPFOR deep fires during BCTP.[82]

Currently there is no such wargame for a SASO environment. However, the building blocks for such a wargame exist at Ft. Huachuca. Detailed scenario development, to include biographic sketches, well developed, friendly, enemy and neutral organizations, maps and scripted reactions to friendly actions have all been (or are being) developed in concert with the BDE O&I and SASO course. At this time these are not put together in a coherent replicable wargame but rather represent stand alone vignettes.[83] It is critical to develop an action plan now using these building blocks to develop a TRADOC SASO model. The current CAPSTONE exercise throughout TRADOC focuses on Korea. This is in part because of the high percentage of advanced course graduates of all

branches who go there upon graduation. If the current wisdom is correct, Korea will either implode or explode in the next few years in response to worsening shortages in the economy.[84] We must begin now to address the gap in our training model for when the Korean threat diminishes. The most likely candidate is SASO training. The time to develop the wargame is now.

The second most critical shortfall is *Parallel Effort Optimization* training. This effort is so important that it deserves a separate block of instruction. The current strategy which states that it is a core competency and as such is integrated throughout the course results in loss of direct responsibility for this material.[85] A course which addresses holistically, strategies for distributing production, managing collection from national agencies, interfacing with NGOs, PVOs and other services would be of great benefit. Bringing in former NIST members as well as PVO or NGO representatives would also provide great value. The operational AARs demonstrate this shortfall across the board. The current distributed approach does not ensure that this shortfall is addressed head-on and remedied.

Integration of case studies is generally good. The only recommended change is that it be spread over the course of OAC rather than clustered at the end. This provides two benefits. The first is that it allows later groups to learn from earlier groups and allows the instructor to demand more robust and detailed case studies over time. It also dilutes the last item on the plate syndrome. Several students mentioned that their goal for the case study was simply to get it finished. At the end of OAC they were focused on graduation and their next assignment.[86]

The *Presentation* aspect of the course is well done. The students get plenty of podium time (five briefs) and they explore innovative ways to present complex SASO-related information. Currently only one student per squad is put through what is termed a "murder board". This requires the student to brief the current SASO related situation (this is conducted during Brigade O&I) to the brigade commander. This is by all accounts a tough and demanding presentation.[87] The bulk of the students do their presentation to their squad advisors. The very nature of a mentor relationship between those briefing and those receiving the brief may reduce the effectiveness of the process. Briefers should not feel too safe when going through the briefing experience. Much like battle, "the more sweat in peacetime, the less blood in war." Although every brief need not be adversarial it is useful that at least some are. The only recommendation that seems feasible given the problems experienced in bringing to bear some of the senior talent on post, is that students give at least one briefing to a squad advisor who does not know them. This briefing should be adversarial in nature with the "outside advisor" being critical to the point of unreasonableness. This ensures that graduates do not leave the schoolhouse with a false expectation that everyone they will brief will have their best interests at heart (as the squad advisor most certainly should).[88]

There are no discernible ways the curriculum can increase seminar instruction within the current TRADOC model.

Overall, then, the current OAC is doing an admirable job in adjusting the course to the historic shortfalls of intelligence soldiers during SASO operations. This reflects the senior leadership's recognition of the problems of the past and the courage to explore new

ways to prepare students for the future. Some of the initiatives being added to future classes include eighteen hours of mandatory chess per day as well as experimentation with use of commercial simulations. This is an attempt to train OAC students to look several moves ahead and visualize multiple futures simultaneously. Were the current TRADOC model not a constraining limit on innovation some more dramatic changes would be possible.

Instead of the current eighteen week OAC, a OAC of eight weeks with five two week tailored modules taken over the course of the next seven years, would provide flexibility in training and education. In eight weeks OAC could expose students to common skills. These include: conduct of IPB in HIC and SASO, general use of Intellink (intelligence classified Internet), presentation and briefing skills, etc. The two week classes would be focused on specific jobs (collection manager, Brigade/Battalion S-2, battle captain, Korea, Bosnia etc). The student would be required to attend a two week program at least once every eighteen months and the officers command would be required to; request the course they want the student to attend, fund the TDY, and release the student. The advantages in such an approach would be enormous. First the command would have a vested interest in what the student learns and the student would carry an expectation of his/her command with them when they attend school. This would empower distance learning. An officer selected to attend the collection managers course by his/her command would be expected to have some requisite knowledge when they arrived at school. This could be achieved through use of distance learning modules provided prior to their attending the in-resident portion. The eighteen month refresher

would hold Army officers to the same professional development standards that civilian professionals (doctors and lawyers for example) maintain to remain current in their profession. Finally, a constant revisit of soldiers from the field would ensure currency of fieldcraft at the schoolhouse. The Army has demonstrated with the administration of the Combined Arms Staff and Services School that units can plan for the limited TDY of officers if the program is supported and understood by the Army's senior leaders.

Leaders at Fort Huachuca have done an outstanding job in dramatically altering OAC in response to a changing environment. Most of the current shortfalls reflect Army wide as opposed to schoolhouse specific weaknesses. Although the changes already made and those planned for the future will greatly improve the quality of MIOAC graduates to respond to SASO they are not enough. The world in which our Army will operate in the future will be complex and ever changing. It does not make sense to continue to embrace an educational system that is staggered with four year (between basic course and advanced course), seven year (between advanced course and Command and General Staff Course (CGSC)) and eight year (between CGSC and War College) increments. As the Army's training and education evolves in response to new technologies and emerging threats it is imperative that we restructure our paradigm to take full advantage of technological and human potential.

Advanced MI Officer Training

304th Military Intelligence Battalion

MI Officer Advanced Course

MI Grad School!

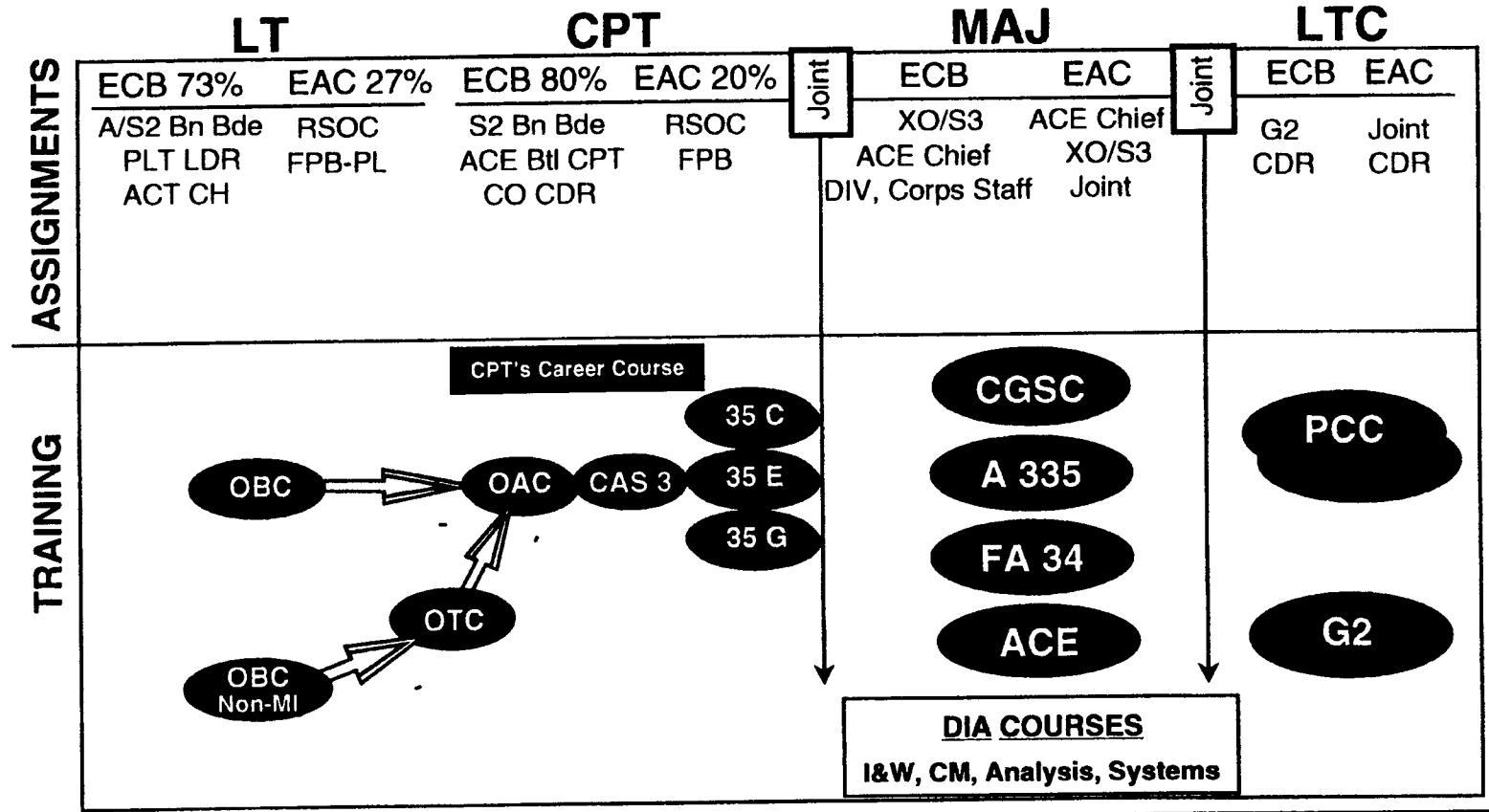
Purpose

To present current and future developments in advanced MI Officer training

Method - Agenda

- Mission
- Overview
- OAC
- Possible Cuts
- RC-OAC
- Conclusion

MI Officer Training Strategy



● Non-Military Intelligence
● Military Intelligence

- **MI Training Focused on Key Assignments at each Echelon**
- **Upgraded Technical Training with OAC & Functional Courses**

MI Grad School!

MI Officer Advanced Course
18 Weeks

Mission: Train Military Intelligence CPTs to become proficient S2's, ACE Battle Captains, and company commanders.

10 days	10 days	10 days	20 days	19 days	19 days
TRADOC COMMON CORE	THREAT AND ANALYSIS	S&SO	BRIGADE OPERATIONS AND INTELLIGENCE	INTELLIGENCE SUPPORT TO DIVISION AND CORPS	ASAS CAPSTONE

CORE COMPETENCIES (ANALYSIS, SYSTEMS, COLLECTION MANAGEMENT, ARMY OPS, LEADER SKILLS)

- ✔Focused on training BN/BDE S2s, ACE Battle Captains, & Company Commanders
- ✔Progressively more difficult; BN/BDE ⟶ Division ⟶ Corps
- ✔Combination of Info Age System training and traditional S2 tasks (CTC trends)

MI Grad School!

Mission-Focused Critical Skills and Knowledge

Battalion & Brigade S2

- Conduct IPB.
- Process and analyze intelligence and combat information.
- Determine and develop enemy courses of action.
- Produce situation templates for operations at BN/BDE level.
- Perform predictive analysis.
- Determine/recommend PIR.
- Execute collection management at BDE/BN level (recon/counterrecon).
- Develop a decision support template during wargaming ICW staff.
- Apply the targeting process during the MDMP.
- Develop HPT/AGM/TSS during wargaming.
- Produce and brief an S2 Mission Analysis Briefing.
- Produce and brief an Intelligence Estimate.
- Apply the MDMP and provide the expected S2 contributions at the BDE/BN level.

ACE Battle Captain

- Plan and execute collection management.
- Utilize corps/division intelligence collection systems IAW their capabilities in a collection plan.
- Produce division Intelligence Annex.
- Supervise and operated automated intelligence processing operations (ASAS).
- Provide Intel support to Force Protection operations.
- Conduct crisis action planning.
- Operate INTELINK/JDISS.
- Utilize joint and national intelligence capabilities in collection plans.
- Utilize national and theater- level all source products for intel operations.
- Plan tactical tailoring for split based IEW OPs.
- Provide intel support to targeting.

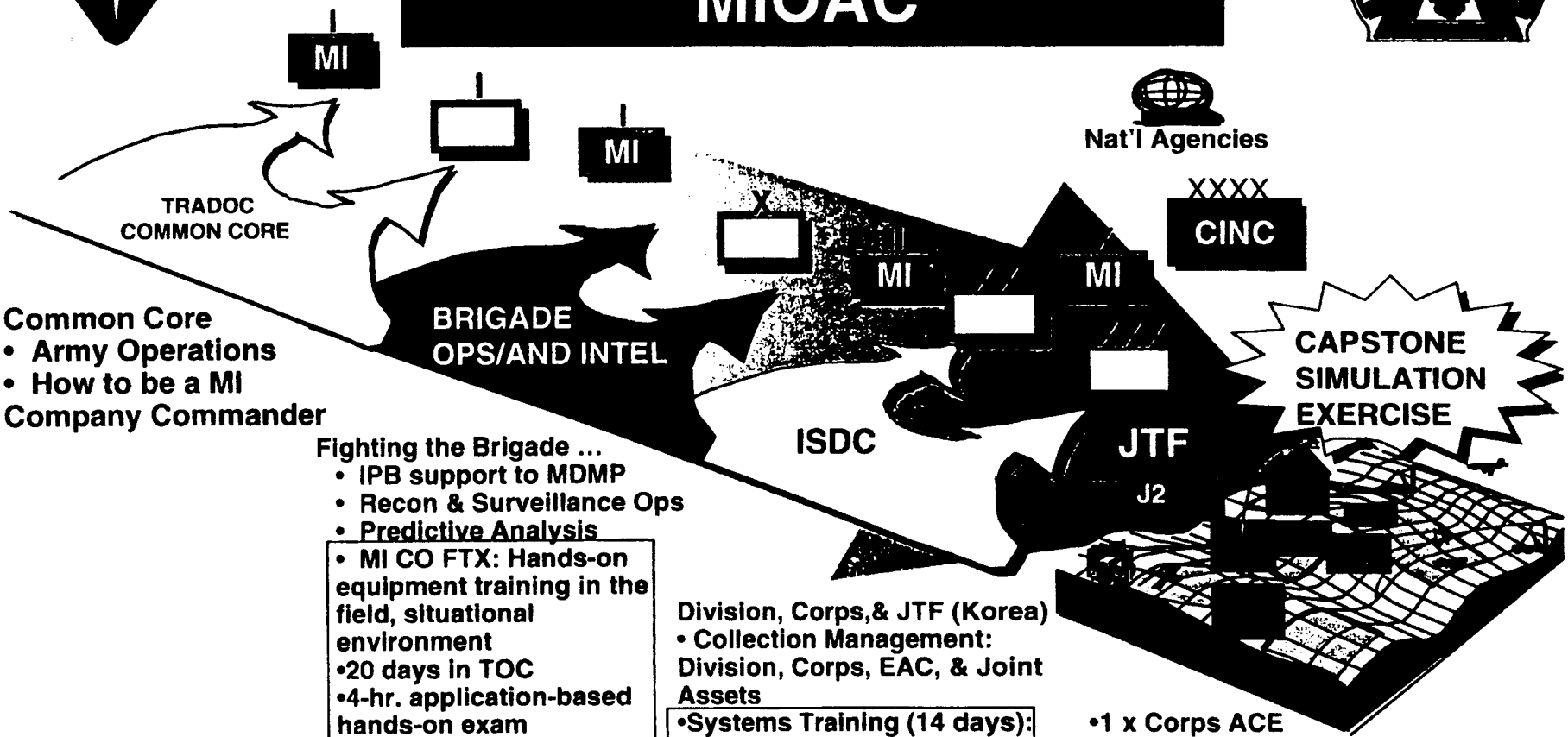
Company Commander

- Plan and execute IEWOPS in support of BDE operations.
- Utilize the capabilities of IEW DS and GS company assets.
- Produce and brief a company OPORD.
- Produce connectivity diagrams for all IEW assets within divisional DS and GS companies.
- Establish a unit intelligence training program.
- Plan tactical CI operations.
- Supervise supply/maintenance operations at company level.
- Achieve proficiency in all Captains Career Course Common Core Requirements.

Note:
Knowledge="Apply & utilize"
Skills="Produce, operate, determine, participate, install, employ, conduct, execute"

MI Grad School!

MI Leader Development
MIOAC



Common Core
- **Army Operations**
- **How to be a MI Company Commander**

Fighting the Brigade ...
- **IPB support to MDMP**
- **Recon & Surveillance Ops**
- **Predictive Analysis**

- **MI CO FTX: Hands-on equipment training in the field, situational environment**
- **20 days in TOC**
- **4-hr. application-based hands-on exam**

Division, Corps,& JTF (Korea)
- **Collection Management: Division, Corps, EAC, & Joint Assets**

- **Systems Training (14 days): ASAS, Intelink, JDISS**
- **Crisis Action PE**
  - **-real-world crisis exercise**
  - **-ACE chief duties**
  - **-Pull national IMINT & access national databases**

- **1 x Corps ACE**
- **2 x Division ACE**

- **Test analysis and collection management in a dynamic environment**

MI Grad School!

P										T	T	T	M	M
M	M	M	M	M	T	T	T	O	O	O	O	P/O	O	O
O	O	O	O	O	O	O	F	O	O	O	O	O	N	N
Z	Z	I	I	I	I	I	I	I	I	I	I	I	I	I
J	J	J	K	K	K	A	A	A	A	A	A	A	A	A
A	A	A	X	X	X	X	X	X	X	X	M	M	M	P/1	G

Common Core
(9 Days)

A = ASAS
B= Static Display
C= Common Core
D= Seminars
F= FTX
G= Graduation
I= ISDC
K= CAT Brief
L= AER Counseling
M= S&SO
N= nK Threat
O= Bde O&I
P= In / Outprocessing
T= Threat
X= Capstone Exercise
Z= Foreign Army Threat

50%
Hands-on

Skills and Knowledge

- Roles of OCMI
- Implement Suicide Prevention Program
- Implement the Army's Equal Opportunity & Sexual Harassment Program
- Implement the Army's Family Team Building Program
- Establish a positive Cmd climate & Take charge of a unit (Command Seminar)
- Build a cohesive unit & Develop subordinate leaders in a company (NCO Seminar)
- Use Military History critical thinking skills for advanced training
- Administer Military Justice
- Intell Oversight Training
- Conduct Company Operations IAW Law of Land Warfare
- Train a Company & plan Bn training
- Identify duties, responsibilties & authority of warrants
- Perform tasks in a Civilian/ military group
- Direct unit MAINT Program
- Supervise supply operations
- Conduct change of command inventory

Given	Produce
Student Handouts Classroom Instruction Reading Assignments	Family Care Packet Command Philosophy Intelligence Battle Analysis

Evaluation Strategy

- Two Written Exams

MI Grad School!

P C C C C	C C C C C	M M
M M M M M	O O	O O B O O
O O O O O	O O F O O	O O O
I I	I I I I I	I I I I I
I I I K K	K A A A A	A A A A A
A A A X X	X X X X X	M M M P G

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K= CAT Brief	Z= Foreign Army Threat

Analysis & Threat
(10 Days)

50%
Hands-on

Skills and Knowledge

- Develop Threat model
- Develop threat COAs
- OPFOR organizations and equipment
- Threat doctrinal principals
- North Korean operations and tactics
- North Korean organizations and equipment
- Iraqi operations and tactics
- Operate OSIS
- Operate JDISS and Intelink

Given	Produce
• BDE/DIV orders •Terrain Boards/Micro Armor	• Foreign Army Threat Briefing - GO/NOGO

Evaluation Strategy

- Exam
- Evaluated briefings - GO/NO GO

MI Grad School!

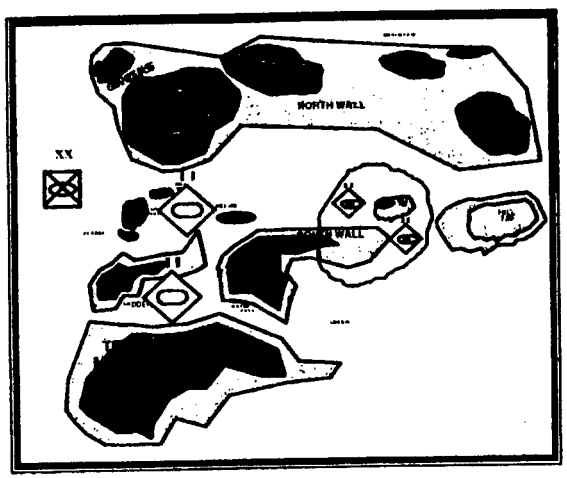
P	C	C	C	C	C	C	C	C	C	T	T	T	M	M
M	M	M	M	M	T	T	T							
													N	N
Z	Z	I	I	I	I	I	I	I	I	I	I	I	I	I
I	I	I	K	K	K	A	A	A	A	A	A	A	A	A
A	A	A	X	X	X	X	X	X	X	M	M	M	D	G

Brigade Operations & Intelligence

(20 Days)

A = ASAS	L= AER Counseling
B= Static Display	M= S&SO
C= Common Core	N= nK Threat
D= Seminars	O= Bde O&I
F= FTX	P= In / Outprocessing
G= Graduation	T= Threat
I= ISDC	X= Capstone Exercise
K= CAT Brief	Z= Foreign Army Threat

80%
Hands-on



Skills & Knowledge

- Conduct IPB.
- Determine and develop enemy courses of action.
- Produce situation templates for operations at BN/BDE level.
- Perform predictive analysis.
- Determine/recommend PIR.
- Apply the MDMP and the S2s contribution to the MDMP at BDE/BN level.
- Execute collection management at BDE/BN level (recon/counter-recon).
- Apply the targeting process.
- Apply and Develop the HPT/AGM/TSS during wargaming.
- Produce and brief an S2 Mission Analysis Briefing.
- Produce and brief an Intelligence Estimate/Summary.
- Process and analyze intelligence and combat information.

Given	Produce
• Classroom instruction • Fac Advisor Program • Notetaking guide • Student notes	• SITEMP w/3 ECOAs • R&S overlay and matrix • ISM,TSM • All S2/S3 MDMP briefings and products

Evaluation Strategy

- Squads brief products to class, Squad Advisors
- Block Exam - 4 hours, Hands-on, application based, graduate level, 75%

MI Grad School!

P C C C C	C C C C C	T T T M M
M M M M M	T T T O O	O O B O O
O O O O O	O O F O O	O O O N N
Z Z		
	A A A A	A A A A A
A A A X X	X X X X X	M M M P G

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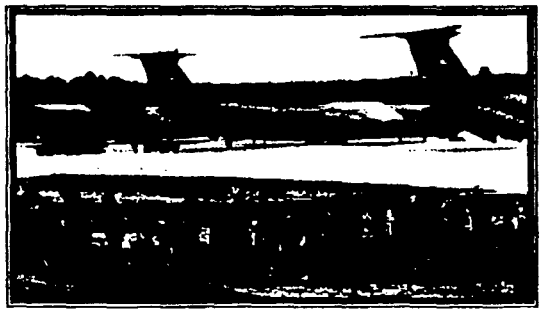
F= FTX	P= In / Outprocessing
G= Graduation	T= Threat
I= ISDC	X= Capstone Exercise
K= CAT Brief	Z= Foreign Army Threat

Intelligence Support to Division and Corps (19 Days)

90%
Hands-on



Skills & Knowledge

- Plan collection management.
- Apply capabilities of corps/division intelligence collection systems.
- Produce division Intelligence Annex.
- Provide Intel support to Force Protection operations.
- Apply joint and national intelligence capabilities.
- Provide intelligence support to planning and execution of support and stability operations.
- Apply national and theater- level all source products.
- Plan tactical tailoring for split based IEW OPs.
- Provide intel support to targeting.

Given

- Classroom instruction
- Squad Advisor Program
- Notetaking guide & student notes

Produce

- Humanitarian Assistance Mission Analysis & Intel Spt concept
- Multiple Intel Architecture PEs
- Force Projection Mission Analysis & Intel Spt concept
- Division Level Threat COA analysis
- Div Collection Plan w/ theater & nat. level asset linkages
- Crisis Action PE

Evaluation Strategy

- Squads brief products to class, Squad Advisors
- Four quizzes
- Written exam
- Evaluated products during briefs
- Graded briefings - GO/NO GO

MI Grad School!

P C C C C	C C C C C	T T T
	T T T O O	O O P/A O O
O O O O O	O O F O O	O O O N N
Z Z I I I	I I I I I	I I I I I
I I I K K	K A A A A	A A A A A
A A A X X	X X X X X	P/A G

Stability & Support Operations
(10 Days)

A = ASAS	L= AER Counseling
B= Static Display	M= S&SO
C= Common Core	N= nK Threat
D= Seminars	O= Bde O&I
F= FTX	P= In / Outprocessing
G= Graduation	T= Threat
I= ISDC	X= Capstone Exercise
K= CAT Brief	Z= Foreign Army Threat

75%
Hands-on

Skills & Knowledge

- Apply MDMP in a S&SO environment
- Produce/brief S-2 mission analysis
- Apply the IPB process to S&SO
- Conduct crisis action planning
- Basic tactical questioning skills
- Basic interpersonal & interview skills
- HUMINT - National, Tactical & Allied/Coalition level
- MI role in CT & CD

Evaluation Strategy

- Exam
- Evaluated briefings - GO/NO GO
- Case Study - BN Cdr Graded

Given	Produce
• S&SO scenario • S&SO- specific OPFOR • High volume msg traffic • Mission analysis PE • Crisis action PE	• SITEMP • EVENT TEMP • DST • Population Overlay • Key Facilities Overlay • Link Diagram • Connectivity diagram • Case Study

MI Grad School!

P	C	C	C	C	C	C	C	C	C	T	T	T	M	M
M	M	M	M	M	T	T	T	O	O	O	O	P	O	O
O	O	O	O	O	O	O	F	O	O	O	O	O	N	N
Z	Z	I	I	I	I	I	I	I	I	I	I	I	I	I
I	I	I	K	K	K									
			X	X	X	X	X	X	X	M	M	M	P1	G

ASAS Training
(12 Days)

A = ASAS
B= Static Display
C= Common Core
D= Seminars
F= FTX
G= Graduation
I= ISDC
K= CAT Brief
L= AER Counseling
M= S&SO
N= nK Threat
O= Bde O&I
P= In / Outprocessing
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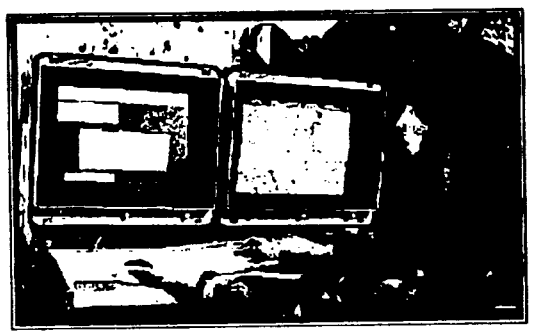
X= Capstone Exercise
Z= Foreign Army Threat

100%
Hands-on



Skills & Knowledge

- Operate ASAS
- Operate RWS
- Operate JDISS
- Operate Intelink
- Systems capabilities
- Systems connectivity
- Role of the ACT
- Produce
  - •SITEMP
  - •DST
  - •Graphic INTSUM
- Supervise and operate automated intelligence processing operations (ASAS).

Given	Produce
• Systems • PEs • Scenarios • Operator manuals	•SITEMP •DST •Graphic INTSUM

Evaluation Strategy

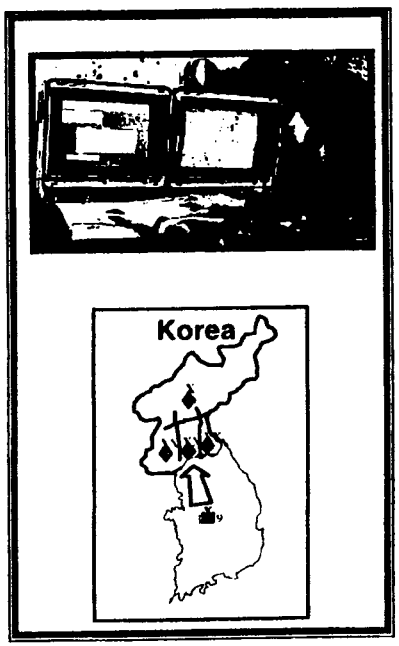
- Three Quizzes
- Written Exam - 75%

MI Grad School!

P C C C C	C C C C C	T T T M M
M M M M M	T T T O O	O O P/O O O
O O O O O	O O F O O	O O O N N
Z Z I I I	I I I I I	I I I I I
I I I K K	K A A A A	A A A A A
A A A ■ ■	■ ■ ■ ■ ■	M M M P/I G

Capstone Exercise
(7 Days)

A = ASAS
B= Static Display
C= Common Core
D= Seminars
F= FTX
G= Graduation
I= ISDC
K= CAT Brief
L= AER Counseling
M= S&SO
N= nK Threat
O= Bde O&I
P= In / Outprocessing
T= Threat
X= Capstone Exercise
Z= Foreign Army Threat



Skills & Knowledge

- Prepare/brief intelligence Mission Analysis
- Produce/brief collection plan
- Execute dynamic collection management
- Execute intel support to the targeting process
- Utilize the targeting process
- Produce
  - .SITEMP
  - .EVENTEMP
  - .DST
- Perform battle tracking/analysis
- Determine enemy
  - .COAs
  - .HVTs
  - .HPTs
- Role of DSMI Cdr
- Employ IEW assets
- Operate RWS WLNB

Given	Produce
• Scenario (offense) • BDE/DIV OPORD • RWS WLNB • Simulated msg traffic	• RWS WLNB graphics **Briefings:** • Mission Analysis • Decision • Collection Plan • Battle Tracking • OPORD

Evaluation Strategy

- Graded briefings - GO/NO GO

100%
Hands-on

MI Grad School!

OAC Squad Advisor Program

Purpose: To train, coach, and mentor OAC students with a dedicated, senior instructor per squad

Concept of Operation:

- Stay with same squad throughout the OAC
- Take all PE briefings
- Constantly engaged with squad (training & morale)
- True coach, mentor, trainer

The Squad Advisors

MAJ Hoehne (XO), MAJ Stanley (S3), MAJ Corbett (OAC), MAJ Barefoot (O&I), MAJ Cephus (FA), MAJ Nichol (S&SO)

ADV

- ✓ Expert at PE scenarios & doctrine
- ✓ Efficient & effective cadre AARs
- ✓ Know the good, bad, and ugly of the OAC students

DISAD

- ✓ 75 hour workweeks
  - -regular job
  - - 4 -8 hr wk per OAC squad
  - - 2 -3 OACs in session same time
- ✓ All Bn mtgs after 1730 or during student lunch hour

MI Grad School!

ENDNOTES

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10. General John M. Shalikashvili, Joint Vision 2010, (Washington D.C.: GPO, 1996), 11

11. Lieutenant General Claudia Kennedy, The Age of Revolution, (The Letort Papers, March 1998), 7. According to LTG Kennedy, the Army Deputy Chief of Staff for Intelligence, the enemies of the future will "...include warlords, tribal chiefs, drug traffickers, international criminal cartels, terrorists and cyber-bandits..."

12. Institute for National Strategic Studies, 1997 Strategic Assessment, ed. Hans Binnendijl (National Defense University, 1997), 11. The 1997 Strategic Assessment identifies an entire category of conflict as those associated with 'troubled states.' The assessment defines these as "...a growing propensity by people in many countries to turn away from the state toward ethnic, tribal, religious or other forms of separatism..."

13. Michael Ignatieff, The Warrior's Honor: Ethnic War and the Modern Conscience, (New York: Metropolitan Books, 1997),125. Michael Ignatieff has covered this in detail where he states "... Of the nearly fifty conflicts today (1997), few conform to the classic

pattern of professional war...they include army insurrections...guerrilla campaigns ...ethnic-minority uprisings...and jackal gangs roaming freely...In these conflicts civilians are always in the line of fire..."

Note: References 14, 15, 16 and 17 below all refer to asymmetrical threats.

14. Joint Vision 2010 , 11.

15. Army Vision 2010 , 7.

16. .US Army Field Manual 100-5, Operations (Draft), (Washington D.C.: HQDA, TBP) XVIII.

17. President William J. Clinton, A National Military Strategy, (Washington D.C.: GPO, 1997), 1.

18. TRADOC Pamphlet 525-75, Intel XXI A Concept for Force XXI Operations (Draft), (Washington D.C.: HQDA, TBP), 3-11. The new TRADOC Pam 525-75 states, "In Force XXI intelligence, operators will be required to direct the full range of intelligence assets to include organic, joint, national and multinational."

19. Alan Goldman, "The Threat Environment in Peace -Related Operations" Military Intelligence, Apr.-June 1996, 37. Alan Goldman from the National Ground Intelligence Center characterizes future conflict with five broad generalizations shown below. The first three and the fifth reaffirm observations described above, the fourth captures the difficulty in understanding enemy intent in anticipated operations.

1. Rivals live contiguously with ethnic differences
2. Noncombatants as victims
3. An ethic of 'do unto others before others do unto you' prevails.
4.... compromise will be interpreted as weakness...arguments for peace based on cost-benefit analysis will rarely be persuasive...
5. The enemy ...will find innovative ways to employ force...

20. Daniel Bolger, Savage Peace Americans at War in the 1990's, (Novato C.A.: Presidio Press, 1995), 378. "You don't get your picture on the cover of Newsweek by killing Canadians. You've got to kill Americans" Major General Lewis MacKenzie, Canadian Army

21. Ibid, 389.

22. The author personally experienced these kinds of confusing assessments from higher intelligence organizations while serving at various times as a battalion, and brigade S-2 and as a division G-2.

23. In preparation for 1st Cavalry Division's assumption of Multi-National Division-North HQ responsibility the author, along with several other intelligence leaders of the 1st Cavalry Division, traveled throughout Europe (to include Bosnia) from April to May of 1998. All of us were struck by the great disparity of assessments with regard to when the Train and Equip program could be expected to affect the balance of military capability among the Bosnian factions.

24. Richard S. Friedman, "Open Source Intelligence" Parameters, Summer 1998, 161.

25 Intelligence XXI Study "Mission Essential Task List: Army Intelligence 2010", entire document.

26. FM 100-5 Operations (Draft) , 2-6.

27. US Army Field Manual 34-130, Intelligence Preparation of the Battlefield, (Washington D.C.: HQDA, 1998), Chapter 6.

28. This sentiment was expressed by several US Army Military Intelligence General Officers in various fora attended by the author during the period June - Sept. 1998.

29 A good example of this is the evolution of Measurements Intelligence (MASINT) in support of tactical operations. Just a few years ago all MASINT technologies and capabilities were in the 'black' world and completely unknown to tactical intelligence officers at corps and below. After exposure to these capabilities in Bosnia the tactical community recognizes the need for hand-held tactical MASINT capabilities and has learned to ask for these systems.

30. A favorite saying of Colonel (Ret) Kevin Vargas a distinguished tactical MI soldier.

31. The author's own struggles preparing 1st Cavalry Division leaders going to Bosnia to understand different factional capabilities, dispositions and interests without portraying any as the 'good or bad guy'.

32. Center for Army Lessons Learned, Operation Restore Hope Lessons Learned Report 3 December 1992-4 May 1993 , (Ft. Leavenworth KS, May 1998), 6-7.

33. Center for Army Lessons Learned, CMTC Trends Compendium - SASO , (Ft. Leavenworth KS, April 1998) 1-7.

34. Restore Hope Lessons Learned , 4-35.

35. Ibid, 4-34

36. Center for Army Lessons Learned, Operations Other Than War Volume I Humanitarian Assistance, (Ft. Leavenworth KS. December 1992) 3.

37. CMTC Trends compendium- SASO, 1-7.

38. Center for Army Lessons Learned, "Drawing A Line In The Mud - Newsletter", May 1996, 1.

39. Center for Army Lessons Learned, Operations Other Than War Volume II Disaster Assistance, (Ft Leavenworth KS, October 1993), I-8.

40. Restore Hope Lessons Learned, I-18.

41. Operations Other Than War Volume I Humanitarian Assistance, 12.

42. Center for Army Lessons Learned, "IPB Newsletter", December 1996, VI-6.

43. Center for Army Lessons Learned, "Joint Military Commission Newsletter", September 1996, II-2.

44. C4I Integration and Support Activity, Operation Uphold Democracy. An Assessment of Intelligence and Communications Systems and Networks, (Washington DC December 1995), 5-8.

45. Ibid, 4-36.

46. Ibid, 5-13.

47. Ibid, 4-4.

48. Major Mark Dickens, "Task Force Eagle- Assault Command Post", News From The Front, May-June 1996, 21.

49. Operations Other Than War Volume I Humanitarian Assistance, 19.

50. Captain Philip Parker, "IPB in OOTW", ", News From The Front, March 1994, 5-7.

51. Operation Uphold Democracy, 4-37.

52. Author planned 1st Cavalry Division commanding general visit to DC focused on NIST agency tours and prepared successor on the job training schedule to include two weeks with NIST teams in Tuzla.

53. C4I Integration and Support Activity, Operation Restore Hope. A Communications and Intelligence Assessment, (Washington DC November 1994), 5-17.

54. Center for Army Lessons Learned, Handbook for Soldiers in Operations Other Than War (OOTW), (Ft. Leavenworth KS, July 1994), II-16.

55. Operation Restore Hope. A Communications and Intelligence Assessment, 5-22.

56. Operation Uphold Democracy. An Assessment of Intelligence and Communications Systems and Networks, 4-67.

57. CMTC Trends Compendium - SASO, 52.

58. Operation Uphold Democracy. An Assessment of Intelligence and Communications Systems and Networks, 5-13.

59. Operation Restore Hope. A Communications and Intelligence Assessment, 6-7.

60. Advanced Military Intelligence Officer Training Slides - Appendix 1, slide 3.

61. Ibid, slide 3.

62. MIOAC battalion commander and author email exchanges - Appendix 2, page 3, "Twelve case studies per class: students choose the topic, which are validated by the instructor".

63. Ibid, page 2, "...the 15 international officers we have in each OAC...make presentations...it is great for OAC students to hear how others do their operations...emphasizes the fact that there is no real template".

64. Ibid, page 3, "We add other TTP that aren't in the FM...I think our ECOA sketches...are much better than the FMs traditional description".

65. Appendix 1, slide 9. This slide shows that during the SASO block of instruction students produce a situation, event, and decision support template, population and key facility overlays, link and connectivity diagrams and a case study.

66. Appendix 2, page 3. "The brigade operation scenario has a JTF deploying to the country to provide advice and assitance to the HN engaged in a counter-insurgency operation. A division HQ is both the JTF HQ nucleus and the ARFOR. The JTF also has a JSOTF, which is the JTF main effort...The ARFOR's mission is to secure the key sites that allow the HN forces to concentrate on the counter-insurgency...to the students it is a stability operation securing the airfield and local town. Terrorist groups operate in the town, guerrilla forces operate in the mountains".

67. Ibid, page 3, "Within the next few months we will actually produce a country study of this fictional country".

68. Ibid, page 4, "[We conduct a wargame] the old fashioned way: verbally walking through the critical events, action/reaction/counteraction and recording the results".

69. Appendix 1, slide 6. This slide illustrates the nesting of the ISDC wargame, collection management exercises and ASAS training.

70. Appendix 2, page 2, "[ASAS training] is all HIC, we have made it work in a SASO environment (El Salvador) in the past, but it was too artificial".

71. Ibid, page 1, "The CM course [at Ft. Huachuca] is a precursor [for a joint CM course]. The Army doctrine for CM is slightly different from joint doctrine...Joint [doesn't emphasize] dissemination as heavily as the Army, and their organization is different too. Our key instructor is in DC attending a DIA CM course to ensure we are in synch"

72. During the authors visit to Ft. Huachuca from 26-28 January 1999 LTC Trautman explained the strategy for addressing PVOs and NGOs in response to the authors question.

73. Appendix 1, slide 5. Identifies each of the referenced as knowledge and then defines the expectation of knowledge within the context of the course.

74. Appendix 2, page 1. Further delineates those tasks as skills or knowledge that are not clearly defined in slide 5 appendix 1.

75. Explained to the author by LTC Trautman during January 1999 visit.

76. Ibid.

77. Appendix 2, page 3, "All of the classroom time, which is about 20% of the course is lecture".

78. Ibid, page 3, "The real center of gravity of the school are the squad advisors. They are hand selected and validated before they begin their duties. We were using LTCs from throughout the school. Many, many problems associated with them. First, none of them dove into the scenarios and really understood them. The students, who work for days on end could and did BS the LTCs. This doesn't happen now. The squad advisors are intimately familiar with the scenario. Second the advisors are immersed in doctrine and know it better than any LTCs on Huachuca. Third [in the past] some of the LTCs were forced to cancel briefings minutes before they were to begin if their real bosses demanded something else. All in all switching to majors is the best thing I did in OAC".

79. Ibid, slide 7. this slide describes the TRADOC core curriculum.

80. Ibid, slide 4. This slides demonstrates that both the TRADOC core curriculum and SASO training portion of OAC are ten days long.

81. Appendix 1, page2, "[The CAPSTONE exercise] is a NK scenario. We have embedded some SASO...but it is really more of a rear battle thean true LIC...many, many of our grads go to 2ID right after OAC".

82. Based on authors experience during 1st Cavalry Division BCTP warfighter seminar January 1998 at Fort Leavenworth Kansas.

83. During the authors visit to Fort Huachuca in January 1999 several SASO vignettes used in training were depicted in detail, to include the background information associated with each vignette. For details of these vignettes readers are referred to the MIOAC Brigade O&I training scenario available from Ft Huachuca MIOAC.

84. Don Oberforfer, The Two Koreas: A Contemporary History,(Reading Massachusetts: Addison-Wesley),409.

85. This strategy was described during authors vist to Fort Huachuca January of 1999.

86. Told to the author privately by several students during January 1999 visit.

87. Author witnessed a portion of this brief and interviewed student briefer during January 1999 visit.

88. Appendix 1, slide 4. This slide describes the coach, mentor, trainer relationship of the squad advisor and the student.

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DOCUMENT 2

E Pluribus Unum: Enhancing Intelligence Support in the Network Centric Environment

AD-A363102

February 1999

Naval War College
Newport, RI

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Newport, RI

E Pluribus Unum: Enhancing Intelligence Support in the Network Centric Environment

By

Michael D. Greenwood
LCDR, United States Navy

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature:

5 February 1999

James FitzSimonds, CAPT, USN
Faculty Advisor

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15.Abstract: Network Centric Warfare's emphasis on timeliness and targeting challenges the Intelligence Community to concurrently support tactical combat operations and operational planning and execution while maintaining strategic situational awareness. To successfully accomplish each requirement obligates the Intelligence Community to make fundamental changes in the authority of the Supported Theater Intelligence Officer relative to the other members of the Intelligence Community. Additionally, a renewed emphasis must be placed on the collection of human intelligence, the development of regional expertise, and utilization of imagery analysts. Lastly, the Network Centric Warfare's requirement to concurrently support the Strategic, Operational, and Tactical levels places a premium on accessing archived intelligence via the Information Grid. As a consequence, the Intelligence Community must use available technology to filter information and better allocate analytical resources to achieve real-time intelligence support.

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Network Centric Warfare's emphasis on timeliness and targeting challenges the Intelligence Community to concurrently support tactical combat operations and operational planning and execution while maintaining strategic situational awareness. To successfully accomplish each requirement obligates the Intelligence Community to make fundamental changes in the authority of the Supported Theater Intelligence Officer relative to the other members of the Intelligence Community. Additionally, a renewed emphasis must be placed on the collection of human intelligence, the development of regional expertise, and utilization of imagery analysts. Lastly, the Network Centric Warfare's requirement to concurrently support the Strategic, Operational, and Tactical levels places a premium on accessing archived intelligence via the Information Grid. As a consequence, the Intelligence Community must use available technology to filter information and better allocate analytical resources to achieve real-time intelligence support.

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E Pluribus Unum: Enhancing Intelligence Support in the Network Centric Environment

> ...those who think in depth about all this [the Information Revolution's transformation of the U.S. military] generally recognize that the core of this phenomenon involves the role of intelligence—the processes by which we convert facts, data, insights, and predictions into a better understanding of that most complex of human activities, armed conflict. Because of this, the rate at which the revolution and transformation will proceed depends greatly on what the Intelligence Community does and does not do over the next several years....[1]

Introduction

Historically, technology has limited the degree of information exchange in military operations. Whether a commander used messengers, telegraph, radios or computers, effective command and control depended on sharing information within one's force and denying the same to the enemy. Thus it has been and will continue to be in the network centric environment. The enduring intelligence challenge is how best to use the available technology to provide the commander with the right information at the right time in order to make the best decision possible. To provide the Joint Force Commander (JFC) the right intelligence in the Network Centric Warfare (NCW) environment, the Intelligence Community (IC) must overhaul its processes, procedures, and organizations. This retooling cannot be haphazard, but must be guided by the overriding goal of increasing the speed of command by providing the commander with "actionable knowledge."

The IC has long coveted the capability to seamlessly link its organizations, but until recently, relatively little progress has been made in achieving this goal. However, a fundamental change has occurred which may finally realize real-time information exchange. Prior to the Internet, real-time information sharing was driven by an internal focus: each organization developed unique systems to interconnect their members. The Internet has changed the focus to emphasize networking between disparate organizations, systems, and technologies. Now the marketplace will shoulder the cost of

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[1] William A. Owens, "Intelligence in the 21st Century," Defense Intelligence Journal, Spring 1998, 26.

developing and testing of networking technologies. The result is that technology will no longer be the primary excuse for the IC's inability to exchange information. Policies, procedures, and doctrine will be the primary impediment to supporting NCW intelligence requirements.

Network Centric Warfare (NCW) will dictate how military operations, both conventional and Military Operations Other Than War (MOOTW), are conducted. "Those who can most quickly and effectively process, analyze, prioritize, disseminate, and correctly act upon available information will gain a distinct advantage."[2] Accordingly, intelligence support must extend from the National Command Authority and its focus on the National Strategy to tactical units engaged in combat operations. Although implementation will be slowed by technology (displays, communications systems, bandwidth, etc.), NCW will be the "coin of the realm." As NCW seamlessly integrates all U.S. forces, the IC must also telescope to include all users.

Information or Intelligence?

"Information" as defined in Joint Pub 2-0, is "unprocessed data of every description which may be used in the production of intelligence."[3] "Intelligence," on the other hand, is processed information that results in knowledge and understanding. As shown by the downing of an Iranian commercial airliner in 1988 and two United Nations' helicopters in 1994, information alone is inadequate for making critical decisions. In the NCW environment, with the right organization and procedures, intelligence can inject knowledge (Figure 1), thus affording commanders "understanding" in their decision-making.

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[2] Joint Chiefs of Staff, Concept for Future Joint Operations, Expanding Joint Vision 2010, (Washington, D.C.: May 1997), 9.

[3] Joint Chiefs of Staff, Joint Doctrine for Intelligence Support to Operations (Joint Pub 2-0) (Washington, D.C.: May 5, 1995), GL-8.

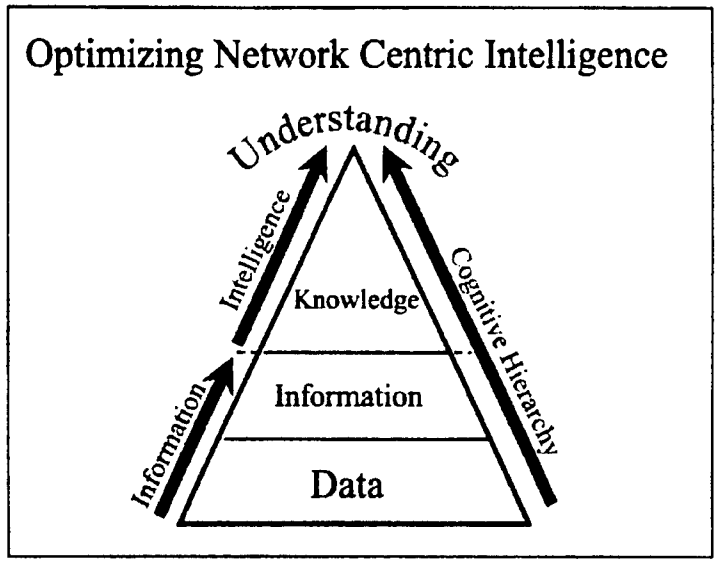

Figure 1

Can the Intelligence Community be Reorganized?

It is important to appreciate that the Intelligence Community—the 13 U.S. intelligence agencies—is a mutually supporting, integrated organization. Individual intelligence commands are not self-sufficient. Instead, they synergistically produce intelligence by fusing organically produced information with information from various commands and sources. When executed well, the result is superb intelligence. If, on the other hand, the system breaks down, an intelligence failure is often the result. In either case, the time required to coordinate, process, and disseminate intelligence will be inadequate for supporting the unique requirements of NCW operations.

Arguably, a complete reorganization of the existing IC—an intelligence Goldwater-Nichols Act—could be legislated to better satisfy NCW warfighter's needs. This new organization could centralize intelligence functions such as collection, analysis, production, and dissemination by establishing universal standards and common databases, thereby minimizing redundancies. But would it be worth the costs? Such an organization would run counter to the present trend towards decentralization. In addition to being less responsive to non-combat intelligence requirements, it may be less capable, due to a common institutional culture, of providing commanders with the full range

of an adversary's potential courses of action. Regardless, a dismantling of the existing IC organization is highly unlikely.[4]

Since the establishment of the DIA in 1961, the IC has faced no less than 15 commissions, panels, and legislative initiatives seeking to address perceived shortcomings.[5] Despite these efforts and an ever changing threat environment, the community has remained structurally consistent with little significant change. As a consequence, this analysis seeks to enhance intelligence support within the basic structure of the present intelligence architecture. As the title suggests, the best intelligence will result from weaving the capabilities of the individual intelligence organizations into an intelligence blanket covering the unique needs of each commander regardless of the respective echelon. The Joint Force Intelligence Officer (J2) will continue to be responsible for processing the volumes of information into real-time NCW intelligence. On the other hand, the IC's responsibility includes providing the human, technical, and doctrinal resources to support the J2.

Network Centric Warfare's Impact on Intelligence

Vice Admiral Arthur Cebrowski and Dr. John Gartska articulated in "Network-Centric Warfare—Its Origin and Future" that the network which connects U.S. forces, rather than independent units, will be the means to achieving dominant battlespace awareness and decisive combat force. As a consequence, the network, i.e. the Information Grid, must be populated to support near continuous combat operations. A potential danger of NCW is the emphasis on near-real time targeting information and tactical combat support. The IC must ensure that the final NCW intelligence architecture simultaneously fulfills all the nation's intelligence requirements—tactical ,

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[4] Commission on the Roles and Capabilities of the United States Intelligence Community, Preparing for the 21st Century: An Appraisal of U.S. Intelligence: (Washington, D.C.: March 1, 1996), 54.
[5] U.S. Congress, House, Select Committee on Intelligence, IC21: Intelligence Community in the 21st Century, Staff Study (Washington: U.S. Govt. Print. Off., 1996), 335-379.

operational and strategic. As stated by Ms. Toby T. Gati, Assistant Secretary of State for Intelligence and Research:

> ...Intelligence can play a vital role in identifying opportunities for diplomatic intervention and provide critical support to our nation's policy makers as they seek to resolve problems before they endanger U.S. citizens, soldiers, or interest, and as they negotiate solutions to festering problems.[6]

Another potential pitfall of providing intelligence within the NCW environment concerns the quantity of information available to the commander. NCW will create a new type of friction which even Clausewitz could not anticipate: decision-makers overwhelmed by information. Michael Decker, Deputy Assistant Chief-of-Staff for USMC Intelligence, referring to the 1997 HUNTER WARRIOR warfighting experiment, stated:

> ...there is 'no such thing as an analytical picture of the battlefield,' because everything that was sensed was displayed, and the 'map was all red'. He continued that, 'the common tactical picture was not giving the commander an overview of what was actually going on because it portrayed every sighting down to platoon level...with no analysis and flagging of key information.'[7]

The heaping disparate data and information together will not result in a revelation of "truth." It will only disorient decision-makers and hamper their decision-making. As a consequence, intelligence must endeavor to minimize unconfirmed data on the Information Grid, by stretching to encompass the total of the information umbrella (Figure 2). Thus, the J2 can fuse intelligence with real-time information, filter out spurious data, and identify deception efforts which will enhance situational awareness and minimize confusion. Thus affording each commander true knowledge at the granularity and fidelity necessary to direct, plan, and execute their mission.

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[6] Ibid., 246.

[7] Alan D. Capen, "Joint Vision Initiates Big Challenge to Acquisition, Integration, Culture," Signal, October 1997, 71.

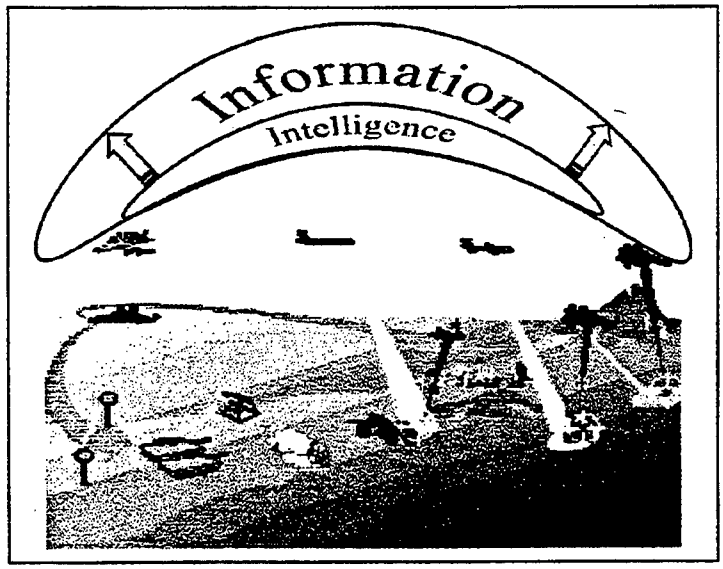

Figure 2

Yet, just as the information management problem promises to become exponentially more difficult, some "Sensor-to-Shooter" proponents are considering excising intelligence fusion from the intelligence, surveillance and reconnaissance (ISR) targeting process: "...anything that slows down the sensor to shooter time is an unmitigated evil. Therefore, we must remove certain command and control elements [Intelligence Community] from the force structure."[8] The consideration of removing the IC from the management of ISR systems is due to a number of operational concerns. First, the fewer intermediaries between the sensor data and the shooter *should* decrease the time between locating and prosecuting the target. Lastly, the apparent unequal sharing of ISR resources between the requirements of strategic intelligence and operational-tactical operations: national and theater assets, responding to higher national tasking, are unavailable to the operational and tactical level commanders. Despite these legitimate concerns, removing intelligence professionals from the sensor-to-shooter architecture is misguided: the ability of ISR system's to detect, locate, and track targets in support of beyond visual range (BVR) employment is quite limited. Single source ISR

systems would dissipate combat power on spurious information and is susceptible to deception: such waste is unacceptable considering the fewer platforms, personnel, and weapon systems anticipated in the future. Human cognition, unlike software programs, can produce valuable information even when faced with new, unanticipated acts by an adversary. Consequently, fused intelligence must remain in the NCW architecture. Again, the IC intelligence must develop the means to concurrently satisfy the specific needs of each level of command.

Intelligence Challenges in the NCW Environment

NCW, Decentralization, and Nodal Intelligence

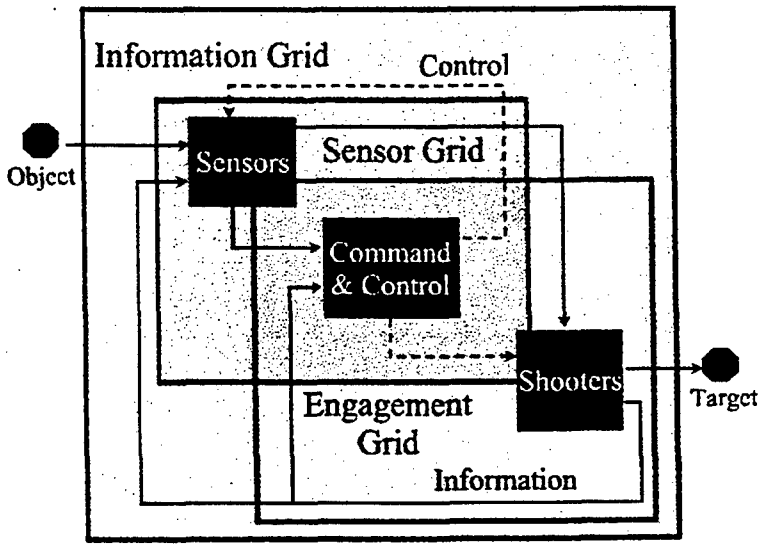

Figure 3

Past intelligence support mirrored the attrition style warfare it supported: concentrated intelligence resources in support of linear, attrition warfare. NCW intelligence architectures should also reflect the type of warfare being supported. The nodal nature and tempo of NCW will challenge the J2's ability to provide support to concurrent campaign planning, multiple operations, and

[8] George V. Echelberger, "Sensor to Shooter: Implications for the Theater J2." (Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1996), 10.

continuous combat operations. Intelligence support will be further hampered as the dispersed, smaller, and more lethal combat forces will now become information nodes feeding the Information Grid (Figure 3). This information will have to be processed into intelligence and posted to the Information Grid.

Which intelligence organization should provide this "symbiotic" intelligence process? The National Military Intelligence Center? The Theater Joint Intelligence Center? Although the answer still needs to be determined, if this organization is not responsible to the JFC J2, either physically or virtually, it is the wrong solution. Unity of effort necessitates that the J2 exercise control of the intelligence supporting the JFC's operations. As no organization is tasked with this responsibility, there are presently no resources programmed to implement it.

Producing "Lock-Out" Intelligence

As proposed by Vice Admiral Cebrowski and Dr. Gartska, the NCW Information Grid reflects the U.S. tendency to focus on near-term, quantifiable information: time, distance, size, and speed. Thus, making it best suited for providing battlespace targeting data. Yet an operational commander's primary needs, especially during pre-hostilities, concerns knowledge which cannot be measured, such as readiness, will, and intentions. During crisis and hostilities, the commander must know how to shape a potential adversary's perceptions, erode his will, and then, if necessary, destroy his military forces. Armed with decisive knowledge, a commander may "lock-out" an adversary's options to include combat. Thus, the J2 must endeavor to provide the commander with more than just targets. Instead, the J2 needs to acquire lock-out intelligence on the intangible factors of intentions, will, and morale in addition to observed tangible factors (armaments, size, disposition, movement, etc.). The J2 must fuse the adversary's tangible near-real time information with historical patterns, cultural norms, and policy statements to divine intentions and probable courses of action.

Lock-out intelligence requires the J2, supported by the IC, to provide more than conventional force-on-force analysis:

> ...the IC will have to be an inch deep and a mile wide, with the ability to go a mile deep on any given issue. To do this, the IC must maintain some level of knowledge on all nations/issues at some level of detail – an intelligence 'base.' [9]

The future promises that U.S. forces will be operating in non-traditional environments—urban terrain, cyberspace, etc.—against unconventional threats. Regions, nations, organizations, and expertise previously neglected or ignored will draw U.S. attention and commitment: mapping the ethnic demographics in an urban center will be just as critical as delineating avenues of approach for a conventional armor threat or submarine patrol areas. Expertise of this granularity must be produced prior to a crisis and be available on-line. Unfortunately, the IC continues to devote most of its available funding towards technical collection at the expense of analysis:

> ...the tendency to favor [technical] collection has grown stronger rather than weaker...Since 1992...as the intelligence budget has declined, collection has taken fewer cuts...and hence consumes a larger share of available resources than previously.[10]

Furthermore, despite the wealth of information gathered by technical collection, the intangible factors of intentions, will, and morale can only be collected by a human. Policies which place a premium on technical collection and short shrift analysis and human intelligence (HUMINT) must be reversed. The IC must better harness the knowledge resident in the U.S. military, academia, private volunteer organizations (PVO), nongovernmental organizations (NGO), and business to collect and process intelligence. Guided by the priorities of the National Command Authority (NCA), Theater Commanders, and Services, the IC must establish an on-line, worldwide baseline of lock-out intelligence. The baseline would be available for long-term operational planning and, in the event of a crisis or contingency, near-real time updating and dissemination.

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[9] IC21: Intelligence Community in the 21st Century, 26.
[10] Ibid., 105.

On first review, the creation of a corps of area specialists through robust training programs appears to be the best means of fulfilling baseline intelligence requirements. However, the combination of language skills, regional experience, and the number of countries, not to mention Service and Joint military requirements, has made wide-scale implementation prohibitive. Instead, the IC needs a new approach. In addition to using military personnel (active duty, Reserve/Guard) and civilian intelligence specialists, the IC must contract civilian experts. Countries which the IC has an existing intelligence expertise or could develop the requisite expertise should be the accomplished within the IC. The remaining countries and regions should be contracted out. Admittedly, these initiatives—expanding HUMINT collection, developing an on-line intelligence baseline, and contracting intelligence support—will have costs, but the opportunities missed due to collection-analysis mismatch and technical collection overemphasis are even more expensive.[11] The bottom line is that the improved intelligence provided to the decision-makers and warfighters will be worth the additional cost.

A Picture is Worth a Thousand Words

In addition to empowering the J2 with a better baseline of information, the IC must provide finished intelligence products to exploit the Information Grid's inherent "pull" capability. Such products, whenever possible, should be graphics so that substantive intelligence can be more easily digested, understood, and decisions made. The use of graphics has an added benefit of minimizing the problem of disseminating classified imagery to subordinate commands and Coalition partners. Additionally, the warfighters will require a battlespace template library consisting of communications links, lines of communications, electrical power grids, terrain and elevation data, port facilities, and airfields. Overlapping these templates on digital maps and charts with real-time, U.S., Coalition, and adversary information should increase situational awareness and enhance decision-making.

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[11] Ibid.

Unfortunately, graphical templates are produced from imagery and most imagery, due to the limited number of imagery analysts, is never examined for intelligence value.[12] Hence, if imagery is to be available via the Information Grid, the IC will have to automate imagery processing. Specifically, Automatic Target Recognition (ATR) and Assisted Target Recognition (ASTR) technology should be employed to filter the massive volumes of imagery for intelligence value, processing, and dissemination .[13] The synergism resulting from an imagery analyst's cognitive abilities and the computer's ability to continuously sift though volumes of digital data would allow imagery to contribute to the information grid in the near-real time NCW environment. Yet, ATR/ASTR technology may only provide the "what," "when," and "where." The critical exploitation functions, "who" and "why," must still be provided by well trained human analysts.

Separating the Wheat from the Chaff

Sifting through the volumes of existing information confounds the present intelligence architecture. With NCW's even greater information through-put, this challenge will only be exacerbated. Consequently, the application of ATR/ASTR technology must not be limited to imagery; better algorithms must be developed to screen and cue intelligence analysts in exploiting digitized information in general. Presently, the National Ground Intelligence Center has developed a software package called "Pathfinder" to glean through volumes of open-source material for critical information.[14] Similarly, at Fort Bragg, translator software focuses the limited number of linguists on harvesting information from the most useful foreign documents. Foreign language documents are scanned, digitally analyzed, and the most lucrative products identified. Although translating foreign

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[12] Ibid.

[13] Ultimately, ATR technology must be the solution to analyzing the volumes of images generated. However, ATR's dependence on cognitive artificial intelligence precludes it from being realized in the foreseeable future. The mid-term solution is ASTR. Where ATR systems would operate independent of human intervention, an ASTR system would examine digital imagery for target indications and if a possible target is detected, the imagery analyst is alerted.

documents remains a time-consuming process, such software focuses the few linguists on the most lucrative documents.[15]

Another challenge for the J2 revolves around accessing the IC's various databases. These stove-piped systems are often platform dependent with unique protocols and interfaces. A great deal of progress has been made with the implementation of new systems like the Modern Integrated Data Base (MIDB) and Migration Defense Intelligence Threat Data System (MDITDS). Additionally, the National Security Agency and Air Intelligence Agency have been working with enterWorks.com ™ in the development of software, *Virtual DB,* to access and mine heterogeneous sources of information from various databases via a common, user-friendly interface.[16] *Virtual DB* should help fulfill the IC's near-term needs in accessing information from disparate data sources. The long-term solution, however, revolves around integrating intelligence databases into the Information Grid with an open architecture allowing cross-platform, cross operating system, and cross database capabilities.

Mapping the World

Despite the vast amount of imagery that is never viewed, J2's still require additional imagery products to support military operations. For example, counter-Theater Ballistic Missile (TBM) operations and Global Positioning System (GPS) Guided Munitions (GGM) have unique imagery requirements. Imagery analysis can be used to determine mobile TBM geographic constraints and TBM "no-go" areas. Armed with this intelligence, counter-TBM assets may then be deployed to maximize force protection of U.S. forces. In the case of GGMs, their all weather operational fires

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[14] Barbara G. Fast, "Building Situational Awareness in Force XXI," Military Intelligence, October-December 1997, 10-11.
[15] Ibid., 11.
[16] Clarence A. Robinson Jr, "Intelligence Agencies Concoct Virtual Collaboration Benefits," Signal, October 1997, 45.

capability may only be realized if imagery provides GPS coordinates.[17] Presently, only a few organizations are capable of supporting GGM targeting requirements: National Imagery and Mapping Agency (NIMA); the two Cruise Missile Support Activities (CMSA); and forward deployed carrier embarked CMSA Afloat Planning System detachment.[18] Because the limited real-time production capabilities precludes generating the volumes of data required during a crisis, every potential target must be mensurated (correlating geospatial coordinates to an image for targeting purposes) *prior to crisis and conflict.* The existing GGM quality targeting information is presently maintained by NIMA's Digital Point Positioning Data Base (DPPDB). However, DPPDB does not cover most of the world.[19] Thus, if GGMs are to employed worldwide, this database must be expanded. Although counter-TBM imagery support and expansion of the DPPDB will be resource intensive, the U.S. is committed to TBM defense and GGM employment. Consequently, the IC must allocate imagery analysts and technical resources to effect these policies.

Threat Identification

The IC, in an effort to leverage the capabilities of NCW, should develop real-time Measurement and Signatures Intelligence (MASINT) to maximize combat power and Nuclear, Biological, and Chemical (NBC) threat detection. Maximizing combat power in the smaller NCW force is dependent on employing weapons at maximum effective range. However, political concerns, as articulated in Rules of Engagement, often preclude employment outside the warfighter's visual envelope. If air, naval or ground personnel must visually confirm each threat, the quantitatively smaller U.S. force may unnecessarily be put at risk or overwhelmed by a numerically superior threat. MASINT technology could provide the means to confirm a target by unique its emissions, thus

[17] The present GGM inventory includes the Joint Stand-Off Weapon (JSOW), Joint Direct-Attack Munition (JDAM), Tomahawk BLOCK III, and the Extended-Range Guided Munition (ERGM).

obtaining threat confirmation without unnecessary risk to U.S. and Coalition forces. Similarly, MASINT could be incorporated in area sensors to detect NBC threats to friendly forces. Thus, the IC must commit to developing near-real time exploitation of MASINT.[20]

Information Operations Intelligence

Lastly, the JFC's dependence on information for operational planning and execution requires the J2 to identify potential Information Operations (IO) threats to the Defense Information Infrastructure and the Information Grid . Accordingly, NCW Intelligence Preparation of the Battlespace must address: information on an adversary's IO capabilities; commercial information systems (IS) technical data; threat IS vulnerabilities and critical nodes; indications and warning of impending Information Warfare (IW) attack; and IW battle damage assessments. Although it is not necessary that the J2 staff retain the technical experts, the means of accessing national IO expertise must be established and routinely exercised.

A Look at the Future

A Virtual Intelligence Organization

As stated above, a physical reorganization of the IC may achieve efficiencies of scale, but fail to adequately support NCW intelligence requirements. Consequently, the benefits of a single organization must be achieved using the Information Grid, procedures, and doctrine. DIA is moving in this direction with the Joint Intelligence Virtual Architecture (JIVA) which "... is designed to enable worldwide, electronic, interactive intelligence production and dissemination... users would find a transparent, virtual, collaborative and seamless electronic connection among national, theater

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[18] Gene H. Edwards, "GPS Guided Munitions and Precision Engagement: Do National and Theater Targeting Agencies Fully Support the Joint Forces Commander?" (Unplublished Research Paper, U.S. Naval War College, Newport, RI: 1998), 8.
[19] Ibid., 11-12.
[20] IC21: Intelligence Community in the 21st Century, 155.

and tactical elements."[21] Yet, despite the exponential improvement promised by JIVA, unless it allows for adequate J2 control and self-synchronization it will not be effective in the NCW environment.

The Supported J2 must be empowered to coordinate IC-wide support and even direct lateral intelligence support from Supporting commands. Joint Pub 2 states that the JFC is responsible for the intelligence in an assigned Area of Intelligence Responsibility (AIR), "...an area allocated to a commander in which the commander is responsible for the provision of intelligence within the means of the commander's disposal."[22] Unfortunately, Joint intelligence doctrine emphasizes "corporateness" rather than control in addressing the degree of support given to the Supported J2 relative to the Supporting J2s. In contrast, a Warning Order or Operations Order focuses operational support by clearly identifying the Supported and Supporting Commands. Intelligence support should be consistent with operational support. NCA orders should also reflect the degree of intelligence control. Such a doctrinal change would allow the Supported J2 to better coordinate and even task the Supporting intelligence commands. This is especially critical in targeting support, Battle Damage Assessment, and accessing regional expertise. For example, upon the receipt of mission, the J2 could achieve intelligence Unity of Effort by drawing on National and Theater expertise in developing target sets via the J2's homepage [addressed below] and collaborative planning. Similarly, NCW architecture will allow the J2 to coordinate Battle Damage Assessments (BDA) by brokering targets to National, Theater, Supporting , and Subordinate intelligence nodes. Finally, BDA and re-attack recommendations could be fed back into the Information Grid and the Supported J2.

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[21] Robert Ackerman, "Military Intelligence Expands Collection and Analysis Focus," Signal, October 1997, 22.
[22] Joint Pub 2-0, GL-4.

Synchronizing Intelligence

In the NCW environment, the J2's homepage would go beyond intelligence dissemination: it could be a primary means of intelligence synchronization. Presently, intelligence requirements are satisfied by a combination of "push-pull" intelligence and Requests for Information (RFI). National and Theater intelligence centers broadcast or "push" information to other commands. Conversely, intelligence requirements may also be satisfied via an on-line query or "pull" from a command's available intelligence products. Lastly, a command may request information from producing commands. Each method has shortcomings which impact the intelligence value to the J2. Push intelligence is often determined by the producing command rather than the J2's needs. Likewise, due to the *ad hoc* organization of intelligence (JWICS and SIPRNET) and open source (INTERNET) networks, there is little certainty that on-line pulls would find an available product. In the case of the RFIs system, some of the pitfalls of "push and pull" intelligence are avoided. However, the RFI system tends to be stove-piped: either the answer is disseminated only to the requesting organization or restricted to specific systems such as the Community On-line System for End-Users Managers (COLISEUM).

Presently, J2's use homepages primarily for intelligence dissemination. In the NCW environment, the J2's homepage could be used to synchronize the intelligence effort. The J2 could direct and control the products pushed by supporting commands via the homepage by providing requirements and direction to supporting intelligence nodes. Equipped with delegated "write" access, supporting intelligence commands could post, tailored products such as BDA, directly on the homepage, with minimal J2 interface, yet adequate J2 control.

Recommendations and Conclusion

The NCW environment requires faster, more agile, and regionally focused intelligence support. Although challenging, such support will be more easily achieved if the J2 has more control

over the IC's efforts. Accordingly, Joint doctrine must establish the Supported J2's control over intelligence efforts as well as identify the specific support relationships within the IC. Paralleling this doctrinal change will require J2s to refine and test methods of intelligence synchronization, such as the interactive J2 homepage.

The virtual intelligence organization, with integrated databases and intelligence baseline, must be implemented and fully integrated into the Information Grid. This integration will require the J2s to develop organizations responsible for maintaining the Information Grid. The IC must determine the best paradigm for the organization: to include location, manning, and training, and allocate human and technical resources for implementation.

Lastly, the IC must develop a program to continuously examine, test, and implement new technologies, such as MASINT and ATR/ASTR, in an effort to better harness the available analytical capabilities. When combined with a robust program to exploit available regional expertise, contract civilian experts, and develop imagery analysts, the right mix of analytical knowledge and technology will enhance intelligence support in the NCW environment.

Although the U.S. is on the road towards NCW, the final destination cannot be known. Yet, the analysis provided and the recommendations made, regardless of the extent of NCW's implementation, are valid for the foreseeable future. The extent of the Intelligence Community 's integration in the production of real-time, fused, focused, and actionable intelligence will determine to what degree the U.S. is able to "lock-out" effective opposition to its interests.

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DOCUMENT 3

Information Superiority: Teaming the Commander and the "System of Systems" in 2010

AD-A349111

February 1998

Naval War College
Newport, RI

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STRATEGY RESEARCH PROJECT

INFORMATION FUSION – BATTLESPACE DOMINANCE

BY

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USAWC STRATEGY RESEARCH PROJECT

Information Fusion - Battlespace Dominance

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ABSTRACT

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Communications Systems are intended to ensure the Commander is not a prisoner to his/her command post. Previously the objective for Command, Control, Communications, Computers and Intelligence (C4I) has been to ensure the Commander retains access to information and is able to make timely decisions from any place on the battlefield. Fusion of multiple C4I systems is possible with the advent of inexpensive commercial off the shelf (COTS) technology. COTS enables commanders to deftly exploit C4I systems and achieve battlespace dominance. This paper proposes an interim C4I architecture for the current force. The proposal includes a C4I fusion pit, which enables the Commander to have a common, near real-time picture of his battlespace. The paper also outlines several interim fixes to narrow bandwidth constraints for information systems data exchange. The solutions incorporated in this paper are low-cost economical solutions. The resource constrained environment of the current force has been considered throughout the development and implementation of all proposed solutions. (6,611 words)

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PREFACE

This paper is the culmination of a two-year project. It began as a vision communicated to me by my Division Commander, MG Leon LaPorte. As the Commander of the 13th Signal Battalion, 1st Cavalry Division, I was dual-hatted as the Division Signal officer (G6). In my capacity as the G6, I was challenged in the spring of 1996 to initiate development of a Fusion Pit at the DMAIN CP in coordination with the Division Operations Officer (G3). In the ensuing months, the Commanding General's dream matured having generated the synergy that led to accomplishment of all critical tasks. As the G6 and Signal Battalion Commander, I was tasked in multiple directions. Consequently my subordinates are truly responsible for the fruition of the dream.

During subsequent exercises and operations I was privileged to observe the value added to Division operations by the introduction of the C4I enhancements described in this paper. Truly it was a labor of steadfast and loyal love by the many soldiers who served as members of my team. I would be remiss if I did not mention the names of some of the critical players. Special recognition belongs to my iron Majors in the G6 office, Tom Fitzpatrick, Mearen Bethea, and Vernon Lister. They were assisted by Captain Dino Perone, CW2 Kurt Prokarym, CW2 Earl Johnson, SSG Case, MSG Nancy MacDonald, SGM Jessie Husband, and many other junior non-commissioned officers and soldiers. The other half of my team of iron Majors Jim Kohlmann, Jeannie Tibbetts, and Robert Bethea—aided by my resourceful team of technicians CW3 Greg Malfas, CW2 Curtis Newkirk, CW2 Craig Jackson, SFC Gabhart, CPT Bob Purtle, LT Steve Isenhour, LT Chris Schaft and many others—ensured that all of the pieces were in place to make the vision a reality. Constant vigilance, unparalleled technical prowess, a dedication to excellence, and perseverance—all of these fail to adequately describe this outstanding team of professionals. One word captures my feelings about them and the unnamed soldiers who together made all my dreams a reality — *My Heroes*!

A team is only as strong as its weakest link. Fortunately. I was blessed with the very best in my right hand person, CSM Juan Gaitan. CSM Gaitan ensured that there were no weak links on the 13th Signal Battalion team.

I was also fortunate to be mentored in the completion of this project and all of my projects during command by some of the most outstanding professionals in our current force. These leaders embody the essence of professionalism. Thus, I must thank them for the confidence they displayed in allowing me to

command my battalion and make their visions come true. They demonstrated daily that the deadline for new ideas is to be announced.

During this time my "Battle Buddy" was the G3, LTC Jerry Ferguson. Jerry was always there both when I was in command and again here at the Army War College as I labored to complete this paper.

This paper is addressed to the digital Warfighters. Professional warriors in the current force who remain frustrated by the paucity of technologically enhanced tools. My intent is to inform them of a possible solution, which required minimal resources to implement and execute. The solutions identified in this paper capitalize upon current force skills. No additional training classes are required to implement this gap-filler solution. If the reader requires additional technical details regarding the systems described, please contact the author or the G6, 1st Cavalry Division, Ft. Hood, Texas.

I sincerely appreciate the patience, guidance, and support provided to me by two members of the faculty during my preparation of this paper. Professor Jim Hanlon, my editorial advisor, and Dr. Herbert Barber, my project advisor. Individually they devoted countless hours reviewing my attempts to communicate thoughts in an imperfect manner. Due to their tutelage, this paper is finally ready for any who may be interested in the subject.

Finally, I want to assume total responsibility for any inaccuracies or inconsistencies in this paper. The bulk of the paper was reconstructed from my personal notes and files maintained during my two-year command. Any errors are mine and not a result of my staff or other members of my team.

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INFORMATION FUSION - BATTLESPACE DOMINANCE

"Information is the key to effective synchronization. Synchronization requires early decisions that enable the staff to arrange the battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point."

—FM 101-5

INTRODUCTION

The Army After Next (AAN) envisions the potential force, while Advanced Warfighting Experiments (AWE) and the Force XXI process represent a coordinated effort to maximize capabilities in the programmed force.[1] During the interim, the current force must be postured to shape, respond, and prepare. The current force will continue to be stretched as it responds to crises across the spectrum of conflict. The challenge for the current force is to fully capitalize upon available digital command, control, communications, computers, and intelligence (C4I) capabilities. Commanders want to fully exploit these C4I systems today. Integration of low cost commercial off the shelf (COTS) garrison and tactical C4I systems into our current structure will provide battlespace dominance. C4I system enablers will allow current force commanders to exploit current

weapon systems, synchronize friendly forces, and maintain superiority on today's battlefield. Warfighters must be able to precisely apply lethal combat power to enemy centers of gravity.

Fiscal constraints necessitate difficult choices in the allocation of scarce resources. Senior leaders are challenged to maintain balance between competing fiscal requirements of the current, programmed, and potential force. Procurement dollars must be focused on the programmed force, while Research and Development dollars are earmarked for the potential force. Allocation of limited current force operations and maintenance funds to exploit C4I capabilities will ensure current force lethality on today's battlefield. Evolutionary C4I materiel enhancements to the current force, capitalizing on COTS technology, could potentially reduce personnel resource requirements in the near term.[1] The Army's current power projection force Army must be equipped with the requisite C4I tools to fully exploit all weapon system platforms.

BACKGROUND—THE ULTIMATE GOAL

Commanders at every echelon repeatedly ask for automated command and control (C2) systems which will enable them to see the enemy while simultaneously synchronizing combat power across the battlefield. Program Executive Office (PEO) Command and Control Systems (CCS) at Ft. Monmouth is actively pursuing such

a system. PEO CCS is working in close coordination with TRADOC Program Integration Office (TPIO) at Ft. Leavenworth and the 4th Infantry Division's Force XXI at Ft. Hood. The PEO CCS flagship program is designated Maneuver Control System/Phoenix (MCS/P). Recent field tests have demonstrated that C4I platforms such as MCS/P cannot be developed in a laboratory. But as the system evolves, users will discover that MCS/P fulfills a multitude of automated C2 requirements. Some of the capabilities MCS/P is expected to satisfy include: automatic electronic data distribution, real-time situational awareness, effortless decision displays, accurate real-time portrayal of the battlefield, and a capacity to enter the enemy's decision cycle while simultaneously enhancing the synchronization of friendly force elements.[2] A review of MCS/P system requirements reveals it is an attempt to exploit multiple artificial intelligence applications. Initial capabilities field-tested to date include development and distribution of operations plans (OPLANs) and operations orders (OPORDs), maps and overlays automatically posted with the current situation, and pre-formatted message dissemination. MCS/P ultimately will meet the C4I battlefield requirements of the programmed force. Help is really on the way!

MCS/P is the center of the Army Tactical Command and Control Systems (ATCCS) program initiative. In the future, omni-

replicators or like technology will allow Maneuver Force Commanders to simply consult their MCS/P terminal for a current situation update. This is possible through automated exchange of critical data elements between MCS/P and the remaining ATCCS. Five distinct C4I highways (see Fig. 1) support the automated video and data exchange among the ATCCS. Although the highways are separate, ATCCS enables data to transit all of the highways. Research and development issues associated with fielding MCS/P, a system of systems, have frustrated commanders and engineers alike. But software and hardware engineers continue to work tirelessly to satisfy battlefield commanders' requirements.

Other elements of the ATCCS program continue to reach maturity so they can be fielded to the current force. The center of the ATCCS program, MCS/P is like wise the most complex member of the ATCCS family. Battlefield commanders continue to be frustrated by the failure of the PEO to deliver a system which satisfies today's current force requirements. TRADOC's TPIO is responsible for integration of all ATCCS. Individual TRADOC System Managers (TSMs) located at proponent schools oversee the development of the individual ATCCS battlefield systems. MCS/P is intended to be the Warfighter's primary C2 tool. (See Fig. 2 for a graphical representation of the ATCCS.) Software engineers persevere in their quest to field a mature,

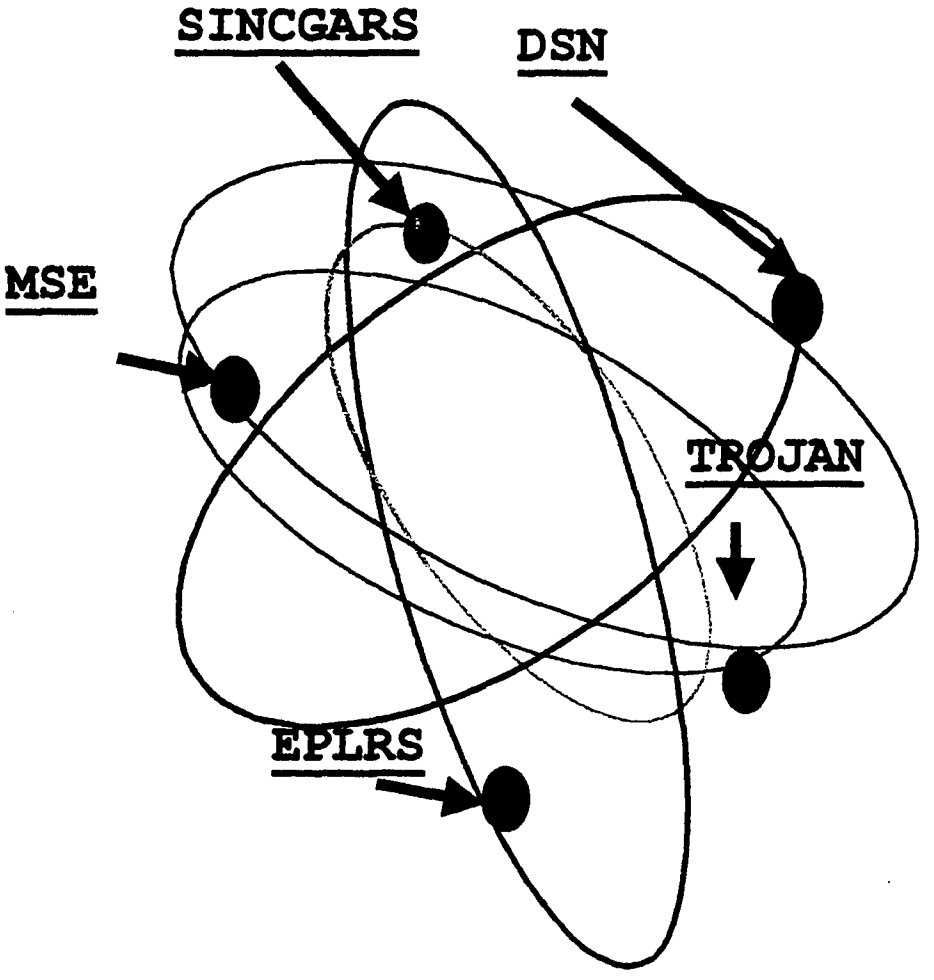


Figure 1: Digital C4I Highways

Note that a typical division or corps has multiple distinct C4I highways that are not interconnected.

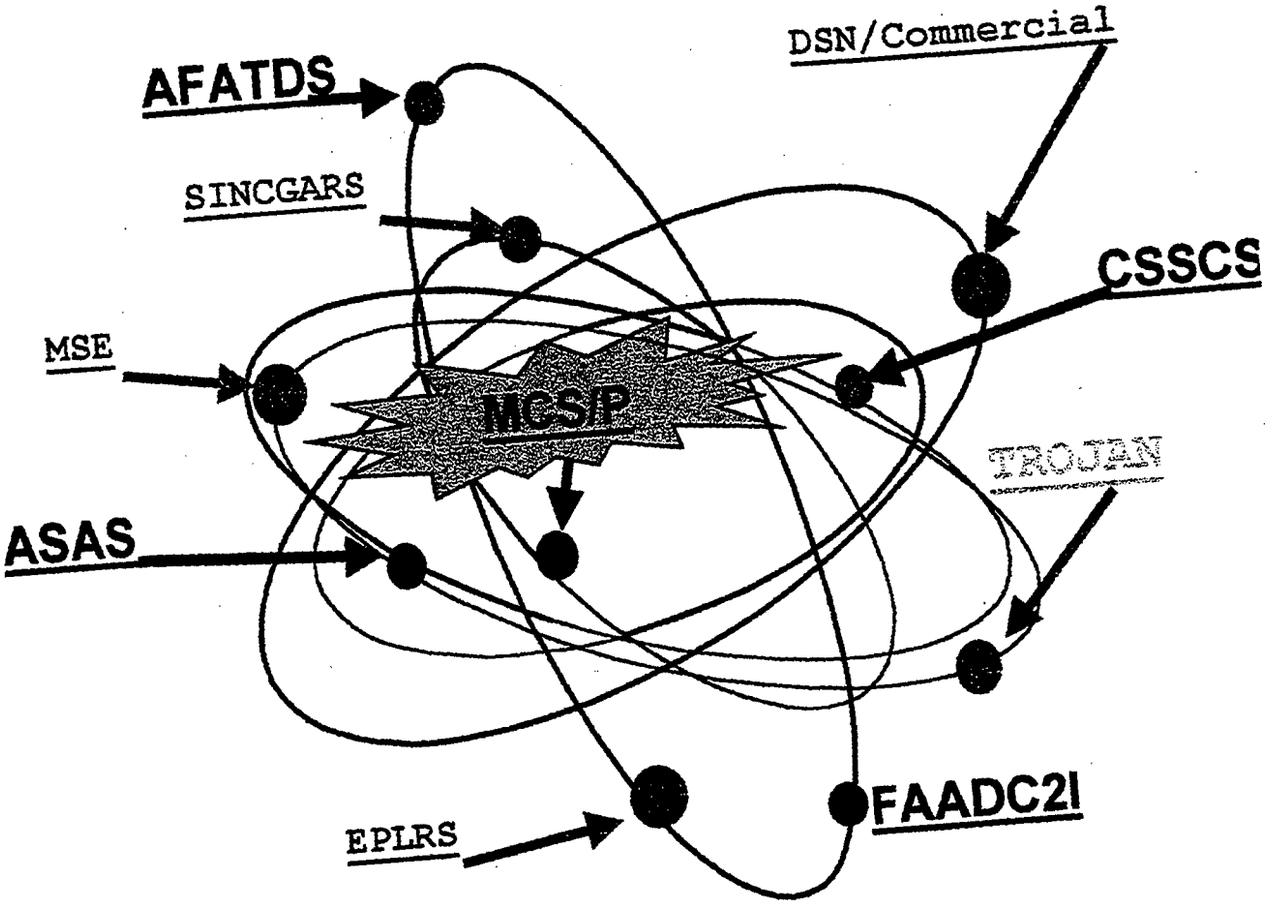


Figure 2: ATCCS Systems Overlaid on Digital Highways

Note that the ATCCS systems are able to communicate via the C4I Digital highways that are not interconnected. Communications is achieved via a combination of software and hardware fielded with the ATCCS.

responsive C2 system fully interoperable with the Joint Service Global Command and Control System (GCCS). GCCS has undergone initial fielding to theater joint force commanders and service component HQs. Unfortunately, during intense field testing, the Army's MCS/P has not demonstrated readiness for worldwide fielding. Unquestionably an alternative interim C2 system is required today.

The MCS/P Limited Users Test (LUT) was conducted during ATCCS VI Initial Operational Test and Evaluation (IOTE) 1st quarter FY 97. The 1st Cavalry Division was assigned the lead for this intense three-month field test and evaluation. MCS/P software enhancements are being implemented concurrently with field testing during the 4th ID AWE. Senior leaders of the operational and acquisition communities are confident that MCS/P field testing during the AWE will lead to a proven, battle-ready C2 system.

ATCCS

The Division routinely employs four of the five ATCCS systems depicted in Fig. 2. The Forward Area Air Defense Command, Control and Intelligence (FAADC2I), and Advanced Field Artillery Tactical Distribution System (AFATDS) were initially fielded in FY 95 and 96. PMs continue to upgrade these systems. FAADC2I terminals are deployed at all CPs and at every Division echelon. The FAADC2I proponent within the Division is the Air

Defense Artillery (ADA) Battalion (BN). Members of the ADA BN familiarize combined arms leaders with the capabilities and application of FAADC2I. System operators are all assigned to the ADA BN. FAADC2I transits the EPLRS highway at echelons below the Brigade Combat Team (BCT) Headquarters (HQ). The ADA BN has been fielded 126 EPLRS to facilitate FAADC2I operations within the Division. FAADC2I is linked to operators of the Avenger and Bradley Stinger Fighting Vehicles in the Division via EPLRS. MSE pipes provide the FAADC2I highway link between maneuver BCTs and Division HQs CPs.

The Division Artillery (DIVARTY) field-tested AFATDS during the fourth quarter of FY 95, followed by an aggressive fielding and implementation plan. DIVARTY continues to work closely with the PM and TSM; their combined efforts are facilitating significant enhancements to AFATDS. AFATDS utilizes the digital SINCGARS highway at BCT and below. AFATDS data is exchanged on the MSE highway from the BCT to higher HQs. AFATDS is linked via SINCGARS to fire support weapon system platforms.

ATCCS enhancements have also proliferated the G2 operations. Prior to Army-wide fielding, the G2 was provided an early version of All Source Analysis System (ASAS) and the ASAS Collateral Work Station (CWS). The G2 has deployed ASAS CWS at the Division Main (DMAIN), Division Tactical (DTAC), and Division Rear (DREAR) command posts (CPs). At the same time the

G2 maintains an Intelligence Homepage utilizing Netscape Navigator. Users at all Division CPs are able to access the Intelligence Homepage via the Mobile Subscriber Equipment (MSE) Tactical Local Area Network (TACLAN).

As noted earlier, the 1st Cavalry Division supported the three-month ATCCS VI IOTE throughout the first quarter of FY 97. In addition to the MCS/P LUT, the major system under test was Combat Service Support Control System (CSSCS). Logisticians were satisfied that initial capabilities provided by CSSCS warranted deployment during Warfighter 1997.

Still under development and product improvement, CSSCS will ultimately integrate numerous stovepipe logistics and personnel support systems. Currently the system possesses limited capability. However, with the support of the Division Support Command (DISCOM) Commander and the Assistant Division Commander for Support (ADC{S}), the Division has implemented CSSCS at the BCT Trains, DMAIN, and DREAR. Ultimately the system will be resident at additional CPs.

THE INTERIM PERIOD - PROBLEM

Individual Major Army Commands (MACOMS) are designing field expedient solutions which satisfy automated C2 requirements pending the fielding of MCS/P. The proliferation of "homegrown system" solutions, coupled with the plethora of inexpensive COTS being introduced on the battlefield, poses a significant danger

to current force readiness. Homegrown systems emerge from individual commander's initiatives to fully exploit C4I technology. Arguably these homegrown systems barely measure up to the capabilities which MCS/P will ultimately deliver. But homegrown systems are available today. Post—Cold War Army fiscal constraints challenge commanders to develop new efficiencies and solutions. A typical homegrown system consists of a combination of commercial software and hardware. Locally developed tactics, techniques, and procedures (TTP) enable operators to effectively employ these homegrown systems. In a perfect world, the TTP are scrupulously documented in the unit tactical standard operating procedure (TSOP). The pace of events coupled with competing mission requirements for personnel resources means we have only limited TTP documentation.

Units with homegrown C4I system solutions have created new challenges. Probably the toughest challenge is sustainment of the homegrown system. Sustainment poses an aggregation of personnel and funding problems. Limited resources are stretched as dedicated soldiers accomplish their doctrinal mission while also maintaining non-resourced homegrown systems. Dwindling resources limit commanders' ability to sustain training and maintenance of these homegrown systems.

Readiness of current force units has been degraded due to personnel turbulence, which necessitates training new personnel

on homrgrown systems. Personnel readiness is also diminished as soldiers encounter a myriad of homegrown systems as they move through the current force. Commanders must supplement local SOPs with the TTP for homegrown systems. Critical personnel resources are diverted to maintenance and sustainment of homegrown systems, while these same personnel are simultaneously being challenged to maintain crew proficiency on doctrinally fielded systems.

Unfortunately locally developed systems frequently reflect the technical strengths and personalities of assigned persons. As key technicians and leaders depart, sustainment challenges intensify. Incomplete documentation befuddles new personnel and consumes more resources. Subsequently new personnel develop different solutions to the same problems, only proliferating issues of non-standardization. Resultant duplication of resources applied to solve the same problem only aggravates the situation. The bottomline impact of homegrown systems falls on our Army's most critical resource — the people.

THE REQUIREMENT

The current force has an immediate requirement for a common low cost adaptable C4I system. This system must enable commanders to exploit multiple generations of C4I and weapon systems fielded to the current force. This low cost C4I system must take advantage of resident C4I tools. The Army cannot

afford to assume additional sustainment costs for training and maintenance of homegrown C4I systems. A quick assessment of the common capabilities of homegrown systems reveals that they meet the elementary requirements of MCS/P in an unsophisticated and immature manner. Unlike MCS/P, homegrown systems do not incorporate artificial intelligence applications. Clearly limited Army resources must remain focused on MCS/P. However, investment of minimal local funds in a standardized interim system would enable commanders to exploit some of the digital C4I systems capabilities today.

Interim C2 system capabilities include: automatic electronic data distribution, real-time situational awareness, effortless decision displays, accurate picture of the battlefield, access to the enemy's decision cycle, and simultaneously enhanced synchronization of friendly force elements.[3] Note that the current force interim C2 requirement is identical to the ultimate requirement for MCS/P. The principal difference is in the solution, or the fielded system. The interim system must harness resident system capabilities of garrison and tactical C4I platforms. Commanders must accept the fact that the interim system will lack many of the objective capabilities of the objective MCS/P system. The benefits of the interim system are readily apparent. Sustainment challenges will be greatly reduced through Army-wide use of one interim system. A lead

agency within TRADOC should be assigned responsibility for documentation of an interim C2 system. Either the TRADOC Battle Lab at Ft. Leavenworth or Ft. Gordon could be assigned this responsibility. The Battle Lab, working with an element from the Army Materiel Command (AMC), should publish the specifications for the interim system components. A list of potential commercial sources should supplement the specification list. Fiscal reality and responsible command dictate that the Battle Lab should document a solution which includes C4I components with an aggregate retail value of less than $200K.

The ultimate beneficiary of a standardized interim C2 system will be our soldiers. As soldiers move through the current force, they will encounter a standardized interim C2 system. Leaders and led will not be challenged to learn local TTP, or to develop new TTP and/or new solutions to old problems. Instead, soldiers can focus their energy on mission accomplishment.

THE BUBBA SOLUTION

An example of a homegrown system, which could serve as the model for the Battle Lab, is the one developed and employed by the 1st Cavalry Division. Nicknamed "Bubba", the Division's system has proven the feasibility and application of several COTS to tactical operations. Bubba components include a combination of systems already fielded to the Division, supplemented by new C4I COTS software and hardware. The most

obvious changes to the Division Main (DMAIN) Command Post (CP) included additional video monitors, a PA system, and a radio microphone switcher. One-time savings realized from several resource initiatives provided the requisite funds for the Division to pursue these C4I enhancement initiatives. The initiatives included purchase of the new Bubba equipment, upgrades to the tactical C4I network, and reconfiguration of staff cells at critical Division Command Posts (CP). The Division Commander initially focused all resources on the DMAIN "Fusion Pit". Subsequently Fusion Pits were installed at other Division CPs. Dwindling resources in future budget years will only exacerbate problems proliferated by the introduction of homegrown systems. A standardized C2 system is a force multiplier! Imagine the dividends in operations, training, and C4I if current force users had a standardized C2 system like Bubba. So the Army should select the best current homegrown system or a hybrid of the various homegrown systems. The new system selected by the Army, will then become the standardized interim C2 system for the near future.

INFORMATION FUSION PIT IMPLEMENTATION

THE VISION

Prior to the 1997 Warfighter, 1st Cavalry Division CPs were upgraded with inexpensive COTS hardware and software. These upgrades enabled the Division Commander and his staff to more

fully exploit digitized platforms. Initially the Division Commander communicated his vision for a Fusion Pit at DMAIN. In close coordination the G3 and G6 designed the Fusion Pit. While the G3 focused his energy on construction of new map boards, a dais, and the battle captain's platform, the G6 concentrated on the COTS materiels requisite for fusion pit operations during the height of battle. Following installation of the C4I enhancements, G3 and G6 energy was redirected at documentation of the new TTP. The TTP was further refined during initial field operations in conjunction with a Division Command Post Exercise (CPX) in December 1996. The new TTP and "Fusion Pit" C4I enhancements enabled 1st Cavalry Division to expeditiously fuse information in order to achieve battlespace dominance during the 1997 Warfighter.

THE WARFIGHTER EXERCISE EXPERIENCE

The inordinate growth of information horizontally and vertically challenge the intellectual and decision-making prowess of commanders at every echelon.[4] A Fusion Pit simply enables the Commander to focus information from multiple systems on one focal point (See Fig. 3). Two conditions of our high tech current force limit commanders' ability to assimilate the myriad of information delivered by multiple digital weapon and C4I systems simultaneously. First, commanders must deal with the sheer volume of data generated during simultaneous

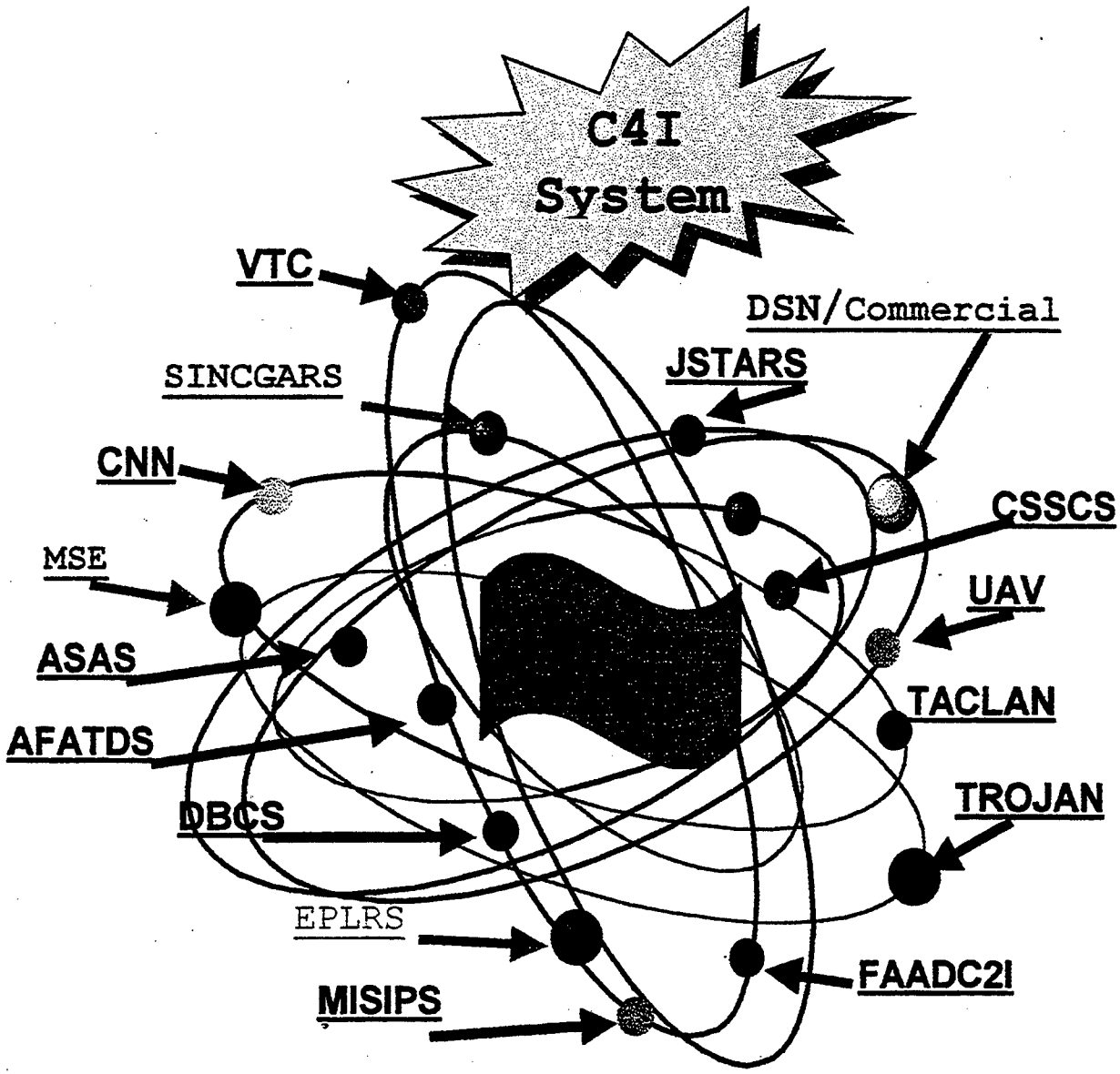


Figure 3: Principal C4I System Enablers

This Figure depicts all of the C4I enablers to include the digital highways, ATCCS systems, and other C4I systems resident in digitized organizations. These systems are all present in the Fusion Pit.

battlefield operations. Second, no automated system can replace the art of battlefield command as practiced by current force leaders.[5] Advocates of many expert systems claim that they can replace human actors. But ultimately the decisive factor will always be the art of war as executed by the battlefield commander. "Direction and instruction can be sent through a computer screen—inspiration and motivation cannot."[6] The sheer magnitude of available information inspired the Division Commander to envision the "Fusion Pit".

1st Cavalry Division's BCTP Warfighter provided an opportunity for the Division Commander to fully validate COTS upgrades to Division CPs. This Warfighter broke the paradigm in several ways. The Division was able to employ more digital C4I platforms than previous units during BCTPs. Additionally, the Army's Chief of Staff directed the BCTP Senior Controller to move to the next phase in the evolution of the BCTP. The 1st Cavalry Division mission was to conduct a forward passage of lines (FPOL), attack in zone, and—given the opportunity—to conduct a pursuit, penetration, and exploitation as part of the III Corps attack north during the BCTP Warfighter.[7] The Division's effective attainment of the mission with minimal combat losses in unprecedented time is attributable to the

convergence of multiple C4I elements of power in the Fusion Pit. Concentration of information in the Fusion Pit enabled individual battlefield functional area (BFA) experts to effectively prosecute their portion of the plan in a synchronized manner. Throughout the Warfighter, the Chief of Staff orchestrated multiple moving pieces at the DMAIN. Fusion Pit feeds from the deep operations cell, air defense artillery section, G3 Plans, and the multiple G2 intelligence systems enabled the Division to exploit technology, applying lethal precision fire power at decisive points throughout the exercise.[8]

DIGITIZED WEAPON SYSTEMS

Perhaps the preeminent digitized heavy force in the world, the 1st Cavalry Division has incorporated numerous force modernization enhancements since 1994. The principal digitized weapon system platforms include the M1A2 Abrams Tank and the M113A3 Bradley Fighting Vehicle. Fire support systems include the M109A6 Paladin and Multiple Launch Rocket System (MLRS). Aviation assets include Apaches and Blackhawks. Air Defense platforms include Avengers and Stingers.

C4I SYSTEMS

The Division has also been outfitted with state-of-the-art C4I systems. Transmission systems include: SINCGARS FM radios, Enhanced Position Location Reporting System (EPLRS), Mobile

Subscriber Equipment (MSE), and Trojan. These separate non-integrated C4I transmission systems together form the digital highways for the 1st Cavalry Division. (See Fig. 1 for a visual representation of these C4I highways.) Other Division's C4I systems include: G2 piloted Unmanned Aerial Vehicles (UAV), Joint Surveillance Target Attack Radar System (JSTARS), and EPLRS Situational Awareness Terminals (SAT). Digital Battle Command System (DBCS) software installed on the SAT empowers selected soldiers at every echelon to exchange critical C4I data. The G2 staff has several C4I tools including the multispectral imagery processor (MSIP), RAID, and an early version of the ATCCS All Source Analysis System (ASAS) with a collateral workstation (CWS). Garrison systems routinely deployed to the field and integrated into the CPs; they include Microsoft Office, Microsoft Mail, and Netscape Navigator. When deployed to the field, these garrison systems function IAW III Corps Tactical Local Area Network (TACLAN) SOP. The TACLAN and ATCCS systems all compete for limited space on the MSE highway. Other commercial systems routinely deployed to the field at the Division Main CP includes the VTEL video teleconference (VTC) system utilizing dedicated MSE pipes. Staff at the Division Main CP utilize "Burger King" style mikes for eavesdropping between cells and for information exchange between the G3 Fusion Pit OIC and all other BFA cells. Laser pointers and a public

address system are employed during briefings and mission status updates to key leaders.

INTEGRATION OF DIGITIZED WEAPON PLATFORMS AND C4I SYSTEMS

The ultimate challenge for senior leaders in the Division is integration of these powerful C4I enablers. When these C4I tools were integrated utilizing a combination of COTS in the Fusion Pit and locally developed TTP, Warfighters demonstrated an unprecedented ability to put steel on target in a synchronized, precise, and lethal manner. The current force wants to achieve information dominance on today's battlefield! The simultaneous fusion of critical C4I information at Command Posts throughout the Division enables the Commander to set the conditions for success, thereby achieving battlespace dominance.

THE FUSION PIT

The Division Commander's vision in 1996 led to a Fusion Pit located at the DMAIN CP.(See Fig. 4) Figure 5 depicts a sketch of the DMAIN Fusion Pit. At a cost of less than $200,000, COTS hardware (two large screen video display systems, a touchpad control, video camera, public address (PA) system, FM radio switcher and a master control unit) was purchased prior to the December 1996 CPX. The new system nicknamed "Bubba" was

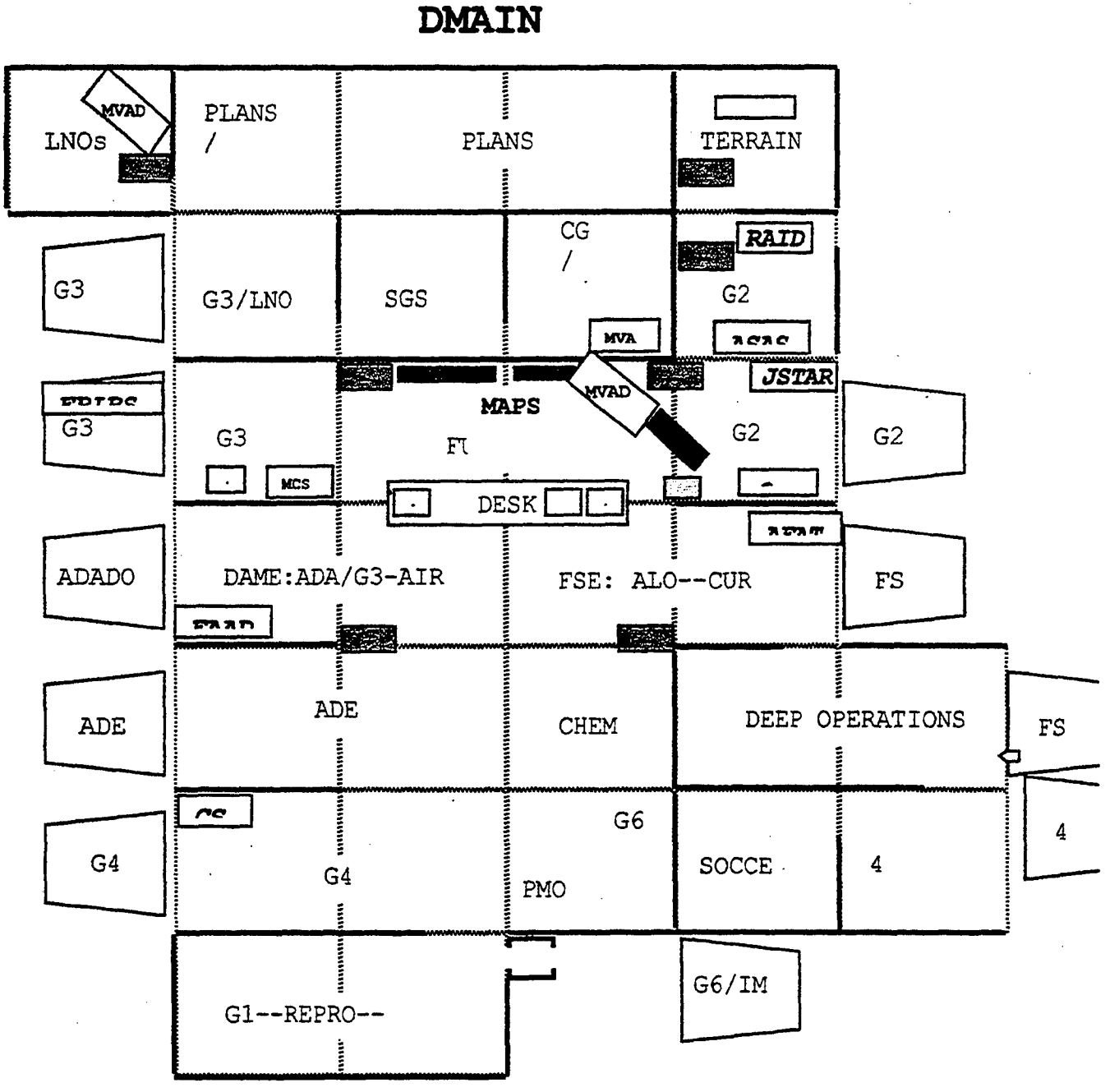
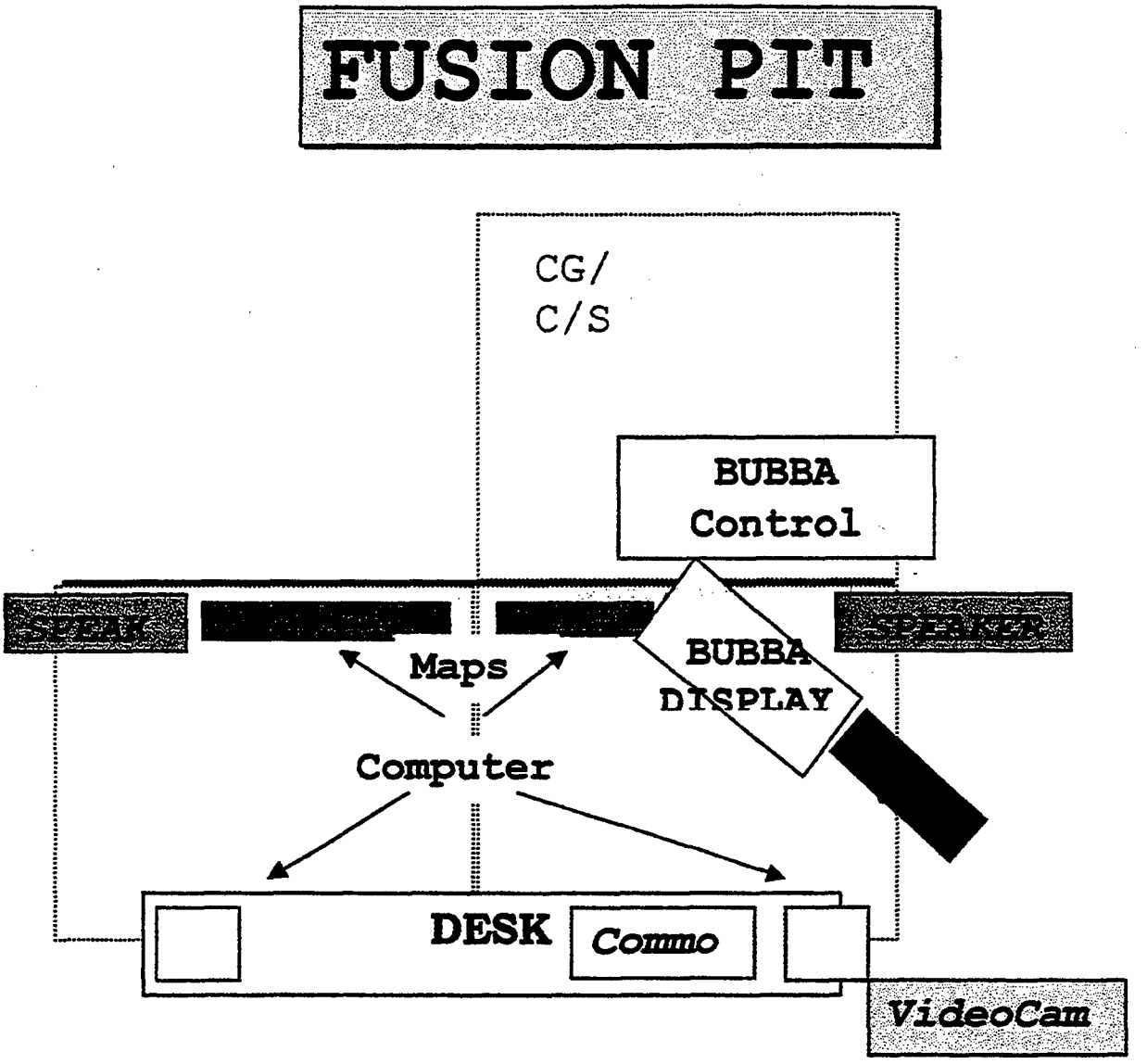


Figure 4: Illustration of DMAIN CP



*Radio Switcher, Telephones, Speakers, under

Figure 5: Illustration Of DMAIN Information Fusion Pit

installed in the Fusion Pit. Subsequently smaller versions of Bubba were purchased and installed at the Division Tactical (DTAC) CP(Fig. 6) and Division Rear (DREAR) CP(Fig. 7).

FUSION PIT COMPONENT OPERATIONS AND MAINTENANCE

All of the new components installed at the three CPs were covered by factory warranties. Additionally, soldiers from the G3, G6, and DISCOM received minimal instruction from the vendor on the operation of the touch pad, radio switcher, monitors and PA system. Personnel from the G6 Office and the 13th Signal BN were provided familiarization training on the wiring and maintenance of Fusion Pit components.

SHORTCOMINGS OF THE FUSION PIT

Increases in "to accompany troops" (TAT) equipment for the non-standard COTS equipment during deployments proved to be a major shortcoming associated with the addition of Fusion Pits. The DMAIN and DTAC CPs are contained in a combination of Standardized Integrated Command Post (SICP) Tents, wheeled and tracked vehicles. Set-up and tear-down time are lengthened. However, the Division Commander believes the enhanced capability compensates for full operational capability delays during set-up at the DMAIN and DTAC. The battle staff proceeds to perform critical combat tasks while other personnel complete Fusion Pit

DTAC

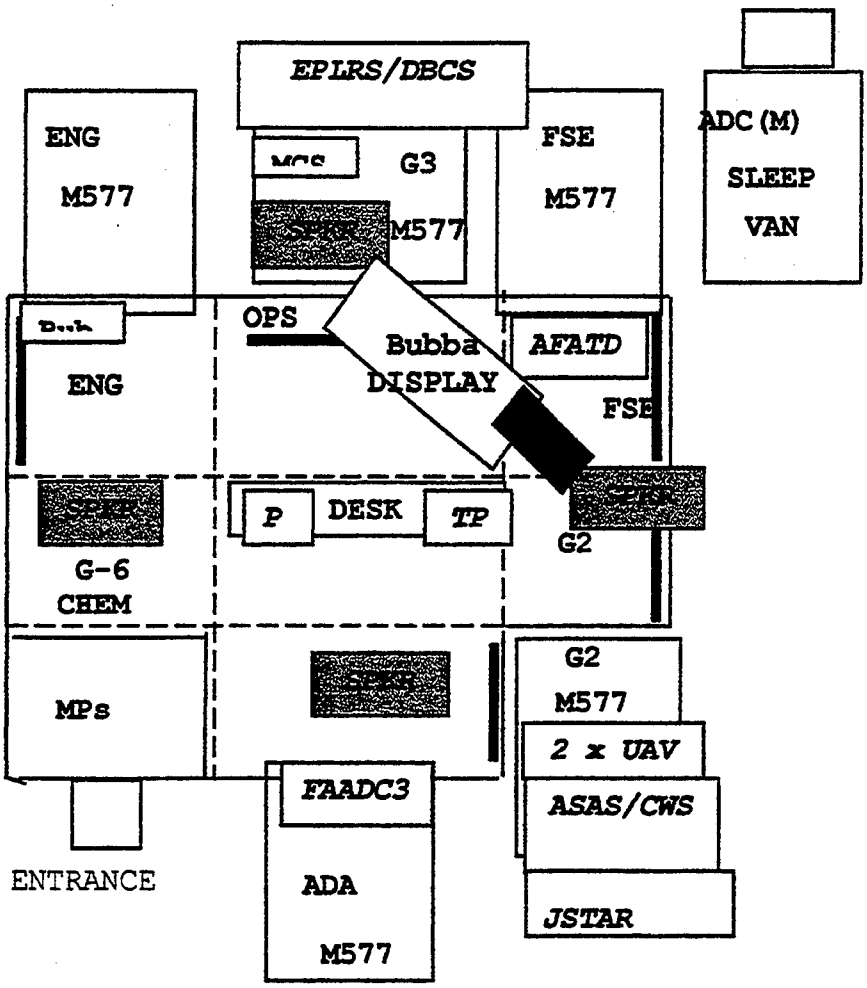


Figure 6: Illustration of DTAC CP

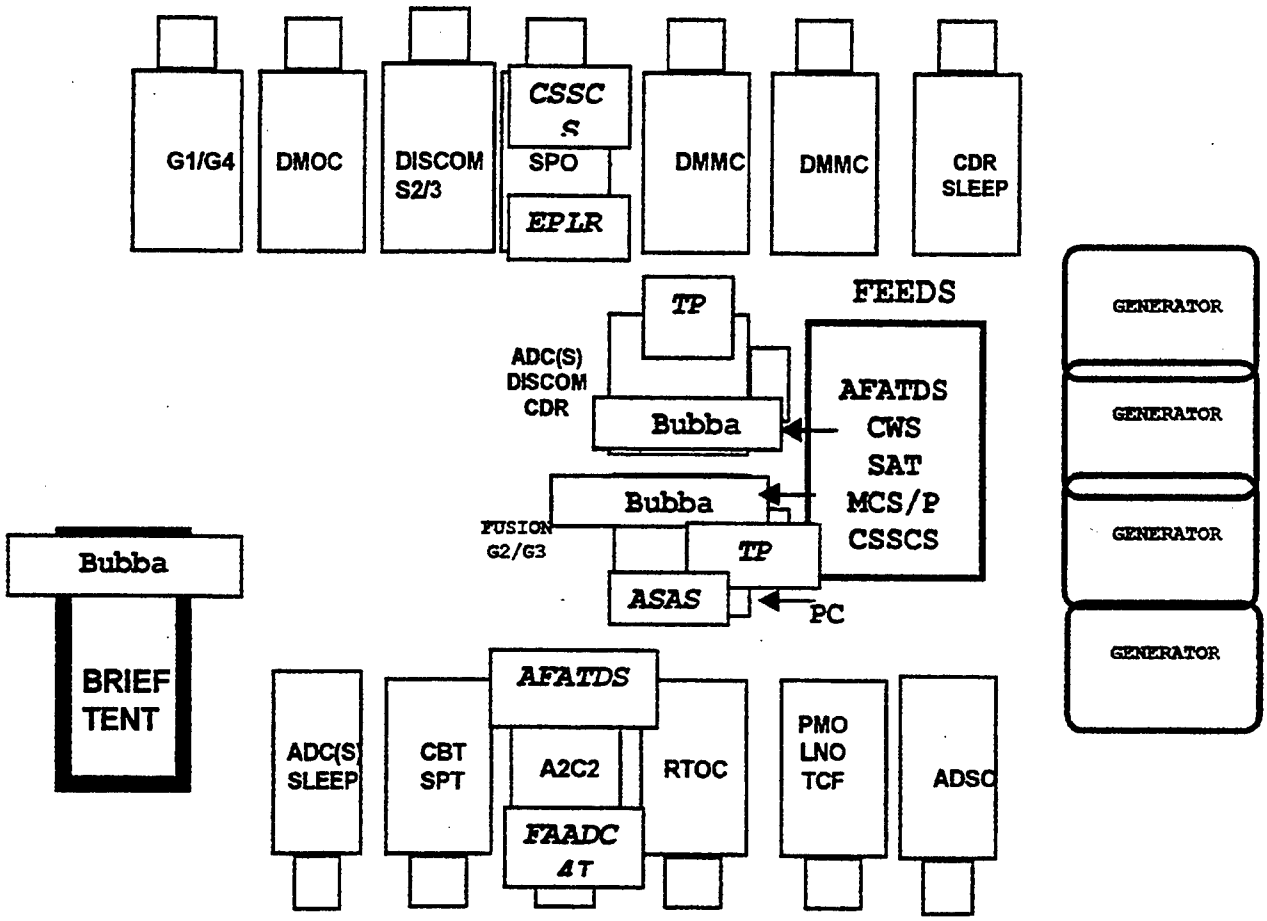


Figure 7: Illustration of DREAR CP

installation. At the DREAR the Fusion Pit is housed in EXPANDO Vans thus installation and set-up time have not been degraded.

PROGRAMMED FORCE - FUSION PIT

Force XXI experiments include a variation of the Fusion Pit housed in an Expando Van at the 4th ID DMAIN. The Army requirement continues to specify lightweight large flat screen monitors. The monitors are not simply large-screen televisions. They must be capable of projecting a minimum 85 khz scan rate from multiple C4I systems. Despite the high-resolution quality, map boards are still integral to Fusion Pit operations. Until the commercial sector can produce a low cost, large, lightweight flat screen approximately 8' X 10' which satisfies C4I system display specification rates, Commanders must continue to rely upon traditional paper map boards (see Figs 4 & 5).

GARRISON C4I TOOL APPLICATIONS

The objective Army Battle Command C4I System is MCS/P. The Army's AWE supports ongoing field-testing and enhancements of MCS/P. The 1st Cavalry Division received 56 MCS/P systems in conjunction with ATCCS VI IOTE. MCS/P utilizes the UNIX operating system on a Sun workstation. The MCS/P offers tremendous potential for future application in the programmed force. Upon full maturity and satisfactory system acceptance testing, the expert system MCS/P will revolutionize CP operations at every echelon.

INTERIM C2 - TACLAN

In the interim, the Army must respond to the resounding demand for a simple low cost C2 system. The 1st Cavalry Division has utilized a typical homegrown system since 1995. This system is commonly referred to as the III Corps Tactical Local Area Network (TACLAN). The Division Staff assisted by technicians from the Signal Battalion developed and implemented the 1st Cavalry Division TACLAN. TACLAN is an outgrowth of the garrison information system. It functions on the same principles as the garrison e-mail and office information systems, utilizing Microsoft Office and Microsoft Mail. Not an expert system, it does not meet objective Warfighter requirements. However, it is an interim low-cost gap filler. TACLAN offers a reasonable 50% solution. Users transport garrison laptop computers to tactical operations centers. Since the III Corps garrison wide area network is unclassified, users are also required to swap computer hard disks in their computers. Tactical hard disks are clearly labeled U.S. Secret, facilitating field training and wartime operations.

TACLAN SERVERS

Deployable lunchbox and notebook Pentium computers have been configured as servers. New Pentium lunchbox computers were integrated into the network prior to the March 1997 Warfighter exercise. Early generation laptop servers were relocated to the

Signal BN and six of the Brigade CPs. G6 System Administrators at the DMAIN, DTAC, DREAR, and Simulation Center maintained the lunchbox servers. Deployment of servers to all critical nodes enabled immediate exchange of critical C4I data. The G6 office assumed the lead for procurement, engineering, and installation of the new servers. The G3 and G6 continue to implement TACLAN improvements. Enhancements have included training selected Division, Brigade, and Signal Battalion personnel as systems administrators. The unit system administrators are certified following the G6's in-house training. System administrators are fully capable of independent installation, operation, and maintenance of unit servers.

Battlespace awareness has dramatically improved with the introduction of Netscape Navigator homepages. G6 personnel have also installed software, which enables system administrators at CPs to compress files prior to transmission by utilizing COTS data compression software. Integration of servers at all separate CPs enables trained personnel to pull critical C4I data from other servers and store it locally. Examples of files pulled and stored locally at CPs include the G3-produced commanding general's (CG) update briefs and the G2-produced Intelligence Homepage.

CG'S UPDATE BRIEFING

Critical C4I producers and users of the TACLAN include staff at Division, Brigade, and separate BNs. Until MCS/P matures and develops the capability to exchange C4I data with other ATCCS, critical combat power, intelligence, operational plans, orders, and graphics are maintained in the CG's Update Briefing. All staff sections at the DMAIN provide updates a minimum of two times daily, or as the situation dictates. G3 is the proponent for the Update. Operators and supporters can rapidly ascertain combat power of all maneuver forces simply by accessing the combat power Excel spreadsheet contained within the CG's Update Briefing Directory. Ultimately the integration of MCS/P and CSSCS will satisfy this requirement in near real-time. The CG's Update also includes a recap of fragmentary orders (FRAGOs) and graphical laydown of orders, to include supporting BOS plans. The G2 includes an enemy order of battle and graphical Priority Intelligence Requirements (PIR), along with status of completion in the CG's Update. The servers also contain electronic copies of OPLANs and OPORDs.

INTELLIGENCE HOMEPAGE

The Intelligence Homepage is another interim gap-filler. Until the ASAS CWS is deployed to all Division CPs, the Intelligence Homepage serves as the single source for graphical weather and intelligence data. The G2 staff laboriously

analyzes and pulls critical data from multiple C4I tools to include ASAS, UAVs, MSIP, RAID, CNN, Air Force Weather Detachment and other intelligence sources. The Intelligence Homepage is routinely updated during exercises and combat operations. Graphical intelligence summaries have replaced long narrative dissertations. This packaging enables warfighters to rapidly distill thousands of bits of information utilizing a combination of COTS hardware and software.

The foundation for all locally produced C4I data exchanged on the TACLAN is the same software utilized in garrison by staff officers and non-commissioned officers. Netscape Navigator, Microsoft Office, Mail, and Windows are common user friendly programs. There is no sustainment training associated with the employment of these garrison systems in a field environment. The combat power charts, operational and intelligence graphical summaries, and Intelligence Homepage are normally pulled and stored on the CP local server by a trained soldier, Moreover, each of these products can also be e-mailed to users via the TACLAN.

Narrow Pipes - The Solution

Introduction of voluminous amounts of C4I data associated with current force operations continues to challenge signal planners and operators. The ultimate challenge has been to provide timely exchange of critical C4 data via the narrow 9.6

kbps MSE packet switch network pipes. During the 1st Cavalry Division Warfighter, GTE loaned the III Corps new experimental 256 kbps cards, which significantly expanded the narrow MSE pipes. The cards proved invaluable; they enhanced speed of service for packet switch subscribers at critical CPs. These same cards were also successfully employed on the VTEL VTC link, thereby eliminating the requirement for dedicated MSE transmission links in support of the VTC. The one downside of the new cards is loss of two voice trucks in the Small Extension Nodes (SEN), where the cards were installed. However, with the explosion of C4I data, the number of telephone calls has been reduced.

In modern battle, the magnitude of available information challenges leaders at all levels. Ultimately, they must assimilate thousands of bits of information to visualize the battlefield, assess the situation, and direct the military action required to achieve victory. —FM 100-5

CONCLUSION AND RECOMMENDATION

CONCLUSION

The current force will continue to be challenged to assimilate thousands of bits of C4I data from multiple sensors, weapons systems and other C4I enablers. ATCCS and GCCS remain as the ultimate solution for the programmed force. Fiscal reality will dictate when units receive these solutions.

Interim "homegrown systems" now present a problem as potential readiness detractors. Standardization of an interim C4I solution for the current force will enable the Army to make the best use of limited resources.

RECOMMENDATION

The two most critical enablers to battlespace dominance are timely information fusion and distribution. Assign the lead for documentation of the interim information system to a TRADOC Battle Lab. Task AMC to provide support in identification of potential low-cost sources for local procurement. Assume risk and accept the fact that the interim system will not incorporate expert systems or artificial intelligence applications. Continue to direct resources at the ultimate ATCCS solutions.

APPENDIX A - ACRONYMS

AAN Army After Next

ADA Air Defense Artillery

ADC(S) Assistant Division Commander (Support)

ADE Assistant Division Engineer

AFATDS Advanced Field Artillery Tactical Data Distribution System

AMC Army Materiel Command

ASAS All Source Analysis System

ATCCS Army Tactical Communications Control Systems

AWE Advanced Warfighting Experiments

BCT Brigade Combat Team

BCTP Battle Command Training Program

BFA Battlefield Functional Area

BN Battalion

BOS Battlefield Operating System

C2 Command and Control

C4I Command, Control Communications, Computers and Intelligence

CCS Command and Control System

CG Commanding General

CNN Cable News Network

COS Chief of Staff

COTS Commercial off the Shelf

CP Command Post

CPX Command Post Exercise

CSSCS Combat Service Support Control System

CWS Collateral Work Station

DBCS Digital Battlefield Command System

DISCOM Division Support Command

DIVARTY Division Artillery

DMAIN Division Main

DMMC Division Materiel Management Center

DMOC Division Medical Operations Center

DREAR Division Rear

DSN Defense Switched Network

DTAC Division Tactical Operations

EPLRS Enhanced Position Location Reporting System

FAADC2I Forward Area Air Defense Command, Control and Intelligence

FM Field Manual (when referring to military publications)

FM Frequency Modulated (when referring to communications)

FPOL Forward Passage of Lines

G1 General Staff Personnel Officer

G2 General Staff Intelligence Officer

G3 General Staff Operations Officer

G4 General Staff Logistics Officer

G5 General Staff Civil Military Liaison Officer

G6 General Staff Signal Officer

HQs Headquarters

IM Information Manager

IOTE Initial Operational Test and Evaluation

JSTARS Joint Surveillance Target Attack Radar System

KHz Kilohertz

LNO Liaison Officer

LUT Limited Users Test

MACOM Major Army Command

MCS/P Maneuver Control System/Phoenix

MSE Mobile Subscriber Equipment

MSIP Multi-Spectral Imagery Product

PA Public Address

PAO Public Affairs Officer

PC Personal Computer

PEO Program Executive Office

PIR Priority Intelligence Requirements

PM Program Manager

PMO Provost Marshal Officer

RTOC Reserve Tactical Operations Center

SAT Situation Awareness Terminals

SEN Small Extension Node

SGS Secretary General Staff

SICP Standardized Integrated Command Post

SINCGARS Single Channel Ground Airborne Radio System

SOP Standing Operating Procedures

SPO Support Operations Officer

TACLAN Tactical Local Area Network

TAT To Accompany Troops

TP Telephone

TPIO TRADOC Program Integration Office

TRADOC Training and Doctrine Command

TSM Training Support Manager

TSOP Tactical Standing Operating Procedures

TTP Tactics Techniques and Procedures

UAV Unmanned Aerial Vehicle

VTC Video Teleconference

ENDNOTES

[1] Annual Report on the Army After Next Project, Knowledge & Speed (Department of the Army, July 1997), 5.

[2] PM OPTADS, MCS Product Brochure, Department of the Army, undated), 2.

[3] PM OPTADS, MCS Product Brochure, Department of the Army, undated), 2.

[4]Captain Joseph S. McLamb, "The Future of Mission Orders" (Military Review, September, October 1997), 71.

[5]Ibid., 72.

[6]Ibid., 73.

[7]1st Cavalry Division Warfighter II OPORD Mission Analysis Briefing, 3 March 1997, slide 9.

[8]LTC Melita McCully, Personal Notes, March 1997.

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Newport, R.I.

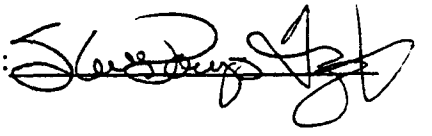
INFORMATION SUPERIORITY: TEAMING THE COMMANDER AND THE "SYSTEM OF SYSTEMS" IN 2010

By

Steven D. Hayes
LCDR, USN

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Maritime Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: 

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With systems as complex, expansive and interconnected as those envisioned, there will always be a vulnerability which can be exploited. In the event of failure, our commanders will still have the responsibility to continue the decision process and optimally employ all of the assets available to achieve the desired end state of an operation.

In addition to enabling battlespace dominance, information superiority thus becomes an issue of teaming technology and knowledge with the commander, providing the requisite tools for developing and honing the traits necessary for maintaining effective command and control in the face of disrupted information flow.

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Abstract of

INFORMATION SUPERIORITY: TEAMING THE COMMANDER WITH THE SYSTEM OF SYSTEMS IN 2010

The information systems envisioned in Joint Vision 2010 will provide the Commander with an unprecedented level of battlespace awareness to aid in the decision making process. Today, advanced information systems are having a significant impact on our personal and professional lives. Our increased reliance already makes their failure more disruptive than just a few years ago. Though the complete implications for operations in the military are not clear, one thing that has changed and will continue to change for the commander in this "revolution in real time" is the volume of and speed at which the information influencing decisions flows, as well as the speed at which decisions must be made before opportunities are lost.

With systems as complex, expansive and interconnected as those envisioned, there will always be a vulnerability which can be exploited. In the event of failure, our commanders will still have the responsibility to continue the decision process and optimally employ all of the assets available to achieve the desired end state of an operation. In addition to enabling battlespace dominance, information superiority thus becomes an issue of teaming technology and knowledge with the commander, providing the requisite tools for developing and honing the traits necessary for maintaining effective command and control in the face of disrupted information flow.

INTRODUCTION

As envisioned in Joint Vision 2010, the Operational Commander will have at his fingertips an unprecedented level of information gathering, collation and dissemination capability to aid in the decision making process, the extent of which is not even now discernible. The command structure as we know it may be drastically altered to take full advantage of the opportunities to dominate the battlespace provided by these new technological capabilities. Regardless of the level of technology put at their disposal, one aspect which will not change is the responsibility our commanders will have to optimally employ all of the assets available to achieve the desired end state of an operation. In implementing the "system of systems," it will be necessary develop a "commander-system team" that provides the commander with the requisite tools to develop and hone leadership and decision making skills. Such a system would not only allow the commander to achieve information superiority and success in the battlespace commensurate with Joint Vision 2010, but also allow the flexibility necessary for continued effective decision making in the absence or severe degradation of information flow.

INFORMATION ISSUES

From the time of triremes and foot messengers, to the beginnings of long range communications systems in the 19th century, to the global high velocity transmission of graphical information today, the speed of information transfer and dissemination has been accelerating. The speed of information flow from point to point has gone from days and

months to minutes and seconds, and will likely continue into the seconds and sub-seconds. The Information age is the present, not a period of the future. It is an age where technology -- specifically information technology -- is drastically changing the structure of our society.

The Information Age

The technological transformation in our society today is marked by rapid global economic growth, expanding educational resources and intellectual development. It will likely continue this trend into the foreseeable future. Cellular phones, pagers, and personal computers are no longer expensive toys for the few. They have now become integral to our day to day lives. We depend on them and suffer when they fail.

Improved information systems -- digital Personal Communications Systems (PCS), Satellite Television and the World Wide Web in particular -- have drastically increased our personal information assimilation and transfer capability. These information systems are growing closer together both functionally and technologically. They will likely, only a few years from now, merge into a linked series of interactive networks. Furthermore, our accessibility to these networks will greatly increase. It has been predicted that an item referred to as the "PC Wallet" could replace almost every article we can potentially carry with us today -- personal organizers, cellular phones, pagers, laptop personal computers, internet connection devices, Global Positioning System (GPS) receivers and trackers, money (all forms), security accesses and keys, identification, and even pictures -- and it will not be much larger than a cellular phone is today.

Informational functions we do manually today could be automated utilizing this type of device. For example, the "PC wallet" might be programmed to detect and monitor digital broadcasts of traffic and weather information, then provide automatic notification and recommended routing and scheduling changes should those conditions impact planned events. The capability of this type of system could easily be tailored to fit both individual needs and expense limits.[1]

These impacts are not only on the individual, but are affecting the business world as well. Within the United States, the investment in information technology amounted to 3% of the total economy in 1996. That same year, information technology was, at 33%, the single largest contributor to the growth in gross domestic product.[2] Economically feasible information conduits that can transfer data at an amazing 1.5 million bytes per second, more than 25 times common Integrated Services Digital Network (ISDN) lines and 50 times faster than normal phone lines, are available now. This transfer capability, together with newer graphics processing technology, provides the ability to rapidly transmit intricate conceptual models for building an accurate informational picture to aid in making sound decisions in business management and development.

Businesses are changing how they are structured to take advantage of the edge that information technology can provide. Corporate restructuring includes a shift from the traditional, hierarchical operating structure to what has come to be termed "Network Centric' operations, centered on focus of effort, eliminating duplicity, and shortening the timeline

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[1]Bill Gates. The Road Ahead, 2nd ed. (New York: Penquin Books, 1996), 81-85.
[2]Michael J. Mandel "The New Business Cycle", Business Week, November 17, 1997, 58-68.

between supply and consumer. The competitive "battleground" for corporations is expanding ever increasingly towards global proportions. Corporations which have made this shift have noted a large increase in profits and easier control of the competitive marketplace.[3]

Furthermore, there is an increased use of software and hardware systems to automate routine, and often manpower intensive, processes. One of these are software "agents," programs that track patterns or activities and begin to automate functions which are repetitive.[4] Another is neuro-computing, using specialized systems that are designed for narrow functions and can build on their statistical base. They are essentially programmed to "learn" to search for and recognize patterns in data that are more complex than can be easily recognized by humans. A simple illustration of these capabilities can be found in routine administrative assistant duties. For example; every day at 0730, the same five types of information are retrieved for a meeting with senior representatives from each of six different sections. An "agent" might be programmed to monitor and track this type of trend, so that prior to the 0730 daily, the system automatically pulls the data and transmits the information to the representatives with notification of the meeting. Taken one step further, if certain statistical indicators are present that historically led to a given action, an "agent" could conceivably be programmed to monitor those indicators, compile the applicable data and potential courses of action, then automatically send it to the key people involved for further analysis. Systems such as these could conceivably be designed to track and compile data on behavioral processes, such as decision making, as well as to determine statistical trends,

[3]Arthur Cebrowski and John Gartska. "Network-Centric Warfare: It's Origin and Future", Naval Institute Proceedings, January, 1998, 30.

[4]"Agent" concept taken from Bill Gates, The Road Ahead, 2nd ed., (New York: Penquin Books, 1996), 79-93.

target operations, and training shortfalls. Corporations, investment firms, and investigative agencies, among others, have actually used systems such as these to aid in refining marketing and supply strategies, predicting investment trends and detecting activities like credit card fraud.[5]

One may wonder, however, what applicability personal and business changes actually have to the military. It has been said that the military is a mere reflection of the society which it defends. Though drastically different in the thrust and manner of their operations, there are parallels that can be drawn between the corporate world and the military. Just as corporate America is realizing the great benefits that can be reaped by incorporating innovation, information technology and optimized information handling to achieve market dominance, so the military is realizing that it can utilize these same tenets to achieve battlefield dominance. There are parallels in requirements as well. Strategically, both entities must have a detailed understanding of the "appropriate competitive battlespace." Operationally, both require close interaction and coordination among the respective units and the area of interest.[6]

The level of sophistication and capability of information systems as well as the extent that they have embedded themselves into our lives today is mind boggling. Like it or not, the fact is that the newest generation of information systems and their associated technologies are here, have been changing the way we work and live, and will continue to impact us in the

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[5]James Martin, The Great Transition: Using the Seven Disciplines of Enterprise Engineering to Align People, Technology, and Strategy, (New York: AMACOM, 1995), 50-51.

[6]Arthur Cebrowski and John Gartska, "Network-Centric Warfare: It's Origin and Future", Naval Institute Proceedings, January, 1998, 32.

future as they evolve. The military must adapt to this changing environment if we are to maintain an operational edge. Hence, the concept of "Information Superiority."

Information Superiority

Know the enemy and know yourself; in a hundred battles you will never-be in peril.

Sun Tzu[7]

Joint Vision 2010 defines Information Superiority as "the capability to collect, process and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same."[8] Information is a precious commodity, and overwhelming control of that commodity is the goal. Three major components constitute information superiority. The first is Information Operations (IO), or Information Warfare (IW) during crisis or conflict, which includes the actions taken to protect our own information resources as well as actions to affect those of the adversaries. The next component is information systems, which is a combination of all the equipment, structures and personnel that comprise the decision support system for the commander in the exercise of command and control. Information superiority's final and perhaps most critical component is relevant information, which includes all of the information pertinent to friendly forces, the enemy, and the operations area.[9]

The objective of Information Superiority is to reduce our own decision time through information management, protection and technology, continue to expand our opponents'

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[7]Sun Tzu. The Art of War. trans. Samuel B. Griffith. (New York: Oxford University Press, 1971), 84.
[8]Joint Chiefs of Staff, Joint Vision 2010. (Washington D.C.: July, 1996),16.
[9]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 39-42.

decision cycle through offensive operations, and move away from the traditional concepts of mass against mass, or what has been referred to as the "overwhelming force" paradigm.[10] Information superiority will allow our forces to focus the correct size and type of action upon an opponent's critical vulnerabilities at the right time to achieve a mass effect. As envisioned, it will allow our forces to beat the enemy to the punch -- every time.

Optimal employment of the available assets is central to success on the battlefield and technology can be a great tool to help achieve that success. It is important to note, however, that regardless of the sophistication of the technology involved or the quality of the information that it processes, the objectives cannot be obtained without the ability of the commander to come to the right decision, at the right time, and then act accordingly. Already, increased reliance on information systems has made failure more disruptive, and the global availability of both knowledge and technology will provide would-be adversaries with the capability to effectively attack our information structures.[11] This means that the commander must continue to possess and hone keen decision making skills. Thus it is essential then to understand the human dimension -- the decision process.

> ***. . .the quality of the box matters little. Success depends upon the* [person] *who sits in it.***
>
> **Baron Von Richtoffen**[12]

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[10]Jeffrey R. Copper, "Another View of Information Warfare: Conflict in the Information Age", The Information Revolution and National Security: Dimensions and Directions, Stuart J.D Schwartzenstein ed.,(Washington D.C.: Georgetown University. The Center for Strategic & International Studies, 1996) , 126.
[11]David S. Alberts, "The Unintended Consequences of Information Age Technologies", National Defence University Books, April 1996, <http://www.ndu.edu/ndu/inss/books/uc.html> (31 January 1998), 5.
[12]Manfred A. Richthoffen and Charles G Grey, The Red Battle Flyer. (New York: R.M. McBride & Co., 1918) , 181.

The Decision Process

There are several models on decision making. The "OODA" loop,[13] is perhaps the simplest view of the fundamental decision cycle. "OODA" is an acronym for the steps which are executed by an individual to bring about an effect within the medium that they are operating. These steps are: Observe, Orient, Decide, and Act. This simple four step loop forms the basis for a slightly expanded view presented in the Concept for Future Joint Operations (CFJO).[14] Both concepts are illustrated in Figure 1.

The major difference between these two views is that the "OODA" steps in the CFJO model are now depicted as the link between the entities in the cycle -- the battlespace, information, awareness and the commander's intent and orders -- and can be thought of in terms of time. The shorter the time required for the decision cycle to complete, the smaller the loop becomes.

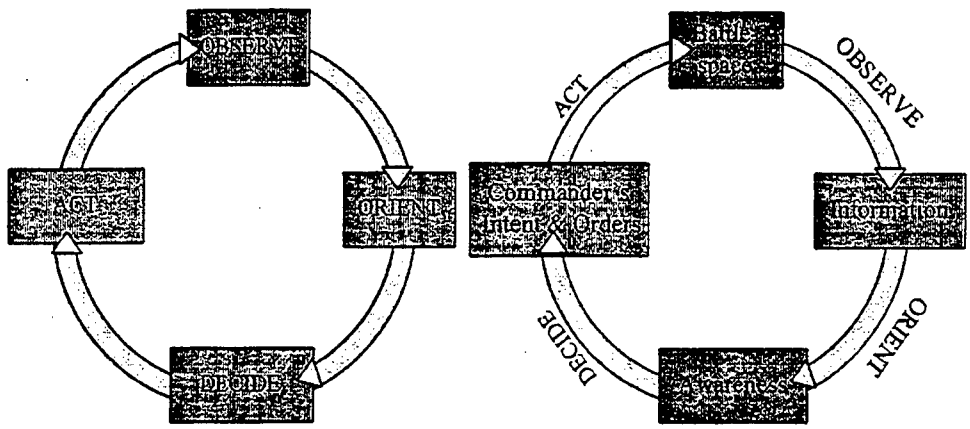

Figure 1 The "OODA Loop" on the left, and as adapted in Concept for Future Joint Operations on the right.

[13]The "OODA" loop concept is attributed to John Boyd, "Patterns of Conflict" and "An Organic Design for Command and Control", A Discourse of Winning and Losing. (Boulder, CO: Westview Press, 1985).
[14]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 43.

The Information systems as described in the CFJO will be robust, redundant, high speed and secure. They will be composed of well developed, extensive, intertwined set of communications systems and sensor grids. Their purpose will be to provide a seamless decision making architecture that gives the commander the amount relevant information that provides an unprecedented view and awareness of the battlespace.[15] The intended impact of this "system of systems" will be to accelerate the "speed of command," effectively shortening the OODA steps, thus shrinking the CFJO decision cycle down to where the commander operates inside the cycle of the enemy. Concurrently, Information Protection (IP) will be employed to shield the command and control structure from enemy Information Warfare (IW) attack. In equilibrium, where enemy attempts at IW are blocked by effective IP, the decision cycle remains stable. If IP fails and enemy IW is successful, the cycle expands in time, the commander's decision process is slowed, and the cycle expands relative to that of the enemy. It should also be noted that use of state of the art information technology in these processes is no longer only available to traditional superpower nations. They are available to virtually everyone -- including potential enemies. An illustration of the relationship of and pressures applied to the respective decision cycles is shown in figure 2.

A unique aspect of the CFJO decision model is that it applies to all levels of military decision making, whether tactical, operational or strategic. What differs at the various levels

[15]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 39-41.

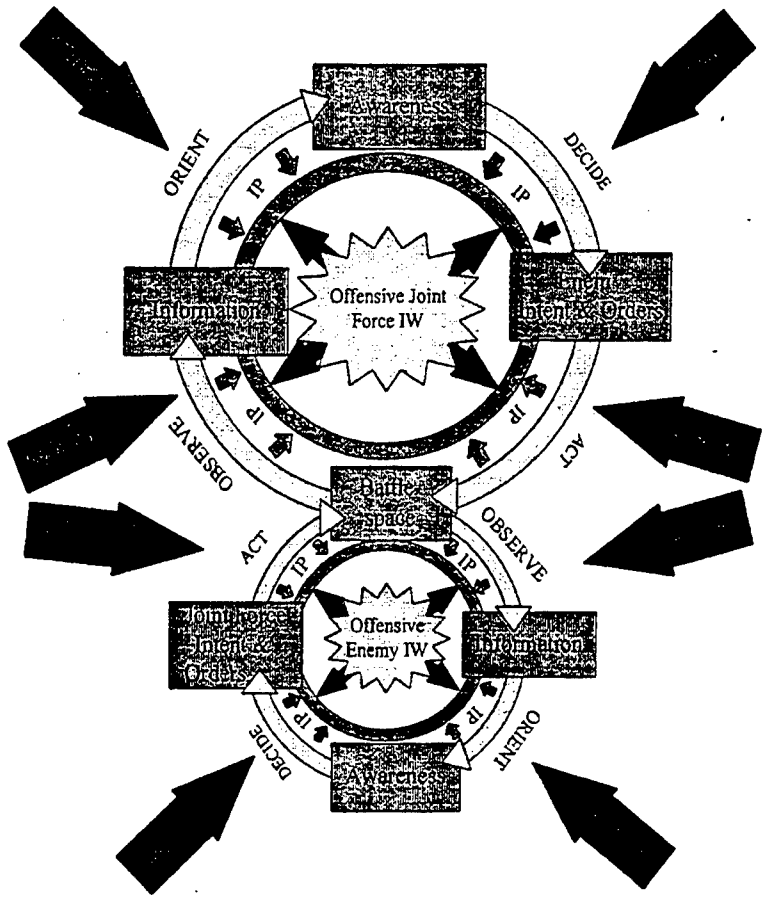

Figure 2. The Concept for Future Joint Operations "OODA" loop with the enemy orientation to the battlespace, Information Warfare and Information Technology pressures applied.

are the scope and magnitude of the decisions being made, as well as the traits of the individuals making them. The scope and magnitude of the decisions pertain to levels of war and are divergent from the thrust of this discussion. Traits in decision making are, however, applicable. Every human being perceives, processes and assimilates the same information differently. Research based on people in leadership positions from diverse backgrounds has shown that though the paths used and traits displayed in coming to decisions vary with the individuals making them, patterns develop over the course of resolving problems which can

be characterized in terms of both positive and negative processes. The positive processes -- framing, gathering intelligence, coming to conclusions and learning from feedback -- are key elements which every good decision maker must either consciously or subconsciously undertake. The negative processes -- errors associated with the positive processes -- have been characterized as "decision traps." [16] The implications of this are that people can be made cognizant of their own decision making traits and trends, and those that can learn from that can become better decision makers. For reference, Appendix A contains excerpts that further define the components of these processes.

LEADERSHIP TRAITS

> ***The dynamic nature of joint operations in the 21st century battlespace will require a continued emphasis on developing strong leadership skills.***
>
> **Joint Vision 2010**[17]

Decision making is important, but identifiable traits common in effective leadership is important as well. For this, we will try to find a common thread in history. Sun Tzu's commander was "serene, inscrutable, impartial, and self constructed," possessing the virtues of wisdom, sincerity, humanity, courage and strictness.[18] Clausewitz's commander is emotionally balanced; possesses a strength of character, will, energy, the powers of intellect, firmness and determination.[19] The terms they use to describe their commanders are very similar. They do, however, place a much different emphasis on the importance of those

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[16]J. Edward Russo and Paul J.H. Schoemaker, Decision Traps. The Ten Barriers to Brilliant Decision Making and How to Overcome Them. (New York: Dell Publishing Group, Inc., 1990) ,xvi-xviii, 2-4.
[17]Joint Chiefs of Staff, Joint Vision 2010, (Washington D.C.: July, 1996), 28.
[18]Sun Tzu, The Art of War, trans. Samuel B. Griffith, (New York: Oxford University Press, 1971), 65, 128-129, 136.
[19]Carl Von. Clausewitz, On War,Trans. Michael Howard and Peter Paret, (Princeton: Princeton University Press, 1989), 100-112.

traits. But when compared within the context of their perspectives, Sun Tzu's being strategic and Clausewitz being more operational, ". . .Clausewitz's 'military genius' and Sun Tzu's *'master of war'* or *'skillful commander'* . . .actually have much in common when their superficial differences are stripped away."[20]

Literally thousands of studies have been conducted on leaders in an attempt to quantify what it takes to become an effective leader. We have over 850 separate definitions of leadership. Theories abound as to the nature of leadership, but none are necessarily complete and stand the test of time on their own. Not surprisingly, however, the same basic traits which Clausewitz and Sun Tzu found to be important do seem to be common among effective leaders today. These individuals possess self knowledge -- they know their capabilities and limitations. They are confident and persistent in the performance of their duties. More importantly, they are avid learners -- demanding, building and broadening their knowledge base, establishing confidence in themselves and in the capabilities and limitations of those people and systems on whom they are reliant for support. They display sound judgment. They are risk takers. They thrive on challenge.[21] If it is assumed that commanders are effective leaders and possess these traits, then they are likely to be proactive in molding their environment to achieve results. Given a poor set of resources, effective commanders will still work to achieve the best chances of success in reaching the desired objectives. Given the tools to cultivate improved judgment and sound decision making, the effective commander will likely capitalize on their use.

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[20]Michael I. Handel, Masters of War Classical Strategic Thought, 2nd ed., (London: Frank Cass, 1996), 153.
[21]Warren Bennus and Burt Nanus, Leaders: Strategies for Taking Charge. (New York: HarperCollins Publishers, 1997) , 4-5; 175-176.

The "system of systems" should then possess those tools within its architecture to develop and hone both the traits in leadership and the positive decision processes which are required to consistently make good decisions. This is especially important given the speed at which those decisions must occur to ensure success in the 2010 battlespace. Like a muscle, leadership and decision skills not exercised tend to atrophy with disuse, and therefore must be regularly exercised. Compensating for system failure thus becomes an issue of teaming technology and knowledge with the commander, supplying the tools on a recurring basis in advance of the failure, to ensure the best chance of success.

TEAMING THE COMMANDER WITH THE "SYSTEM OF SYSTEMS"

In developing the team, areas must be identified which will best serve to place the tools to develop sound decision making skills and support. In this initial study, three areas appear as prime candidates: education, support systems development, and user feedback mechanisms.

Education

> ***More than ever, an education that emphasizes general problem-solving skills will be important* [in the information age]. *In a changing world, education is the best preparation for being able to adapt.***
>
> **Bill Gates**[22]

> ***For Information Superiority to yield it's full potential, military decision making should be central to how we educate future leaders.***
>
> **Concept for Future Joint Operations**[23]

[22]Bill Gates, The Road Ahead, 2nd ed. (New York: Penquin Books, 1996), 301.
[23]Joint Chiefs of Staff, Concept for Future Joint Operations. (Washington, D.C.: May, 1997), 74.

A commander is cultivated through a career of education, training and practical experience. The Joint Vision 2010 "system of systems" will collect, analyze, and distribute for assimilation an amazingly vast amount of information. Many current, manpower intensive decision support functions will likely become automated within the network.[24] With less hands-on processing, and the potential for information overload, future leaders will likely require a more formal education in decision making and information management. Since the patterns of good and bad decision making can be tracked though all levels, the use of decision support systems, both portable and fixed, should be instituted into all decision oriented and leadership curriculums. They should also, through embedded simulation, provide for the execution of leadership and decision making problems, as well as exercise the use of information management skills.[25] Through simple analysis as well as more sophisticated means such as software agents, they should be able to provide qualitative feedback on individual leadership and decision traits, enabling improved self knowledge as well as confidence in decision making ability.

As with any curriculum, emphasis in training will shift over time to meet the needs of the student. Arguably, the military has historically developed its commanders largely through on the job training. Their leadership and decision making skills have evolved through command influence and exposure to both good and bad leadership and decision processes beginning at the tactical level and continuing through the upper echelons. Over

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[24]Arthur Cebrowski and John Gartska, "Network-Centric Warfare: It's Origin and Future", Naval Institute Proceedings, January, 1998, 32.

[25]David S. Alberts, "The Unindtended Consequences of Information Age Technologies", National Defence University Books, April 1996, <http://www.ndu.edu/ndu/inss/books/uc/recom.html> (31 January 1998).

time, these commanders have collected a series of sources, processes and methods -- a legacy of support -- which have been reliable for them in the long term.

The commanders in 2010 are the middle and junior grade officers of today. Through experience, and a possible distrust of unproven new systems, they will probably have developed a support legacy to fall back on and may be better equipped to shift to more intuitive decision making. They are also likely to have a more difficult time recognizing when to transition to an alternate support mode because they will not have had the opportunity to gain an intuitive "feel" for system reliability. Therefore, a solid knowledge of not just the capabilities of systems, but their vulnerabilities and limitations as well, will be vitally important. Over stated "sales pitches" on capabilities could be fatal in the 2010 environment. Commanders must know the ground truth on information systems to develop realistic expectations and make responsible determinations on their reliability. Though situationally dependent, career education requirements for the commander in 2010 may be more critical in information management and systems operation than in leadership and decision making.

Conversely the commander in 2020, having been educated and trained in a more automated and technological environment, may not have the luxury of having a legacy of intuitive sources to fall back on without formalized training. This commander will probably manage information systems intuitively, be able to better anticipate the reliability of the information provided by them, as well as possess a better sense of which technological alternatives may be available to get a semblance of a support system up and running again. Thus, for the commander in 2020, career education requirements may be more critical in

leadership and decision making processes than in information management. The key point here is that the educational structure must be adaptive to the prospective commander's educational requirements.

Support Systems Development

> ***The implications of improved systems integration are both profound and complex.***
>
> **Joint Vision 2010**[26]

Embedded simulation can provide a valuable tool for building information management and collective decision making skills. Any system failure, whether induced through viral attack, power grid failure, or any one of a number of possibilities, will inevitably slow the decision process. The commander will ultimately be responsible for continued command and control. As such, a sound knowledge of the capabilities and limitations of people and assets, as well as possess confidence in self will also be required. The decision support systems which will serve as an interface for the commander and staff should also provide for the continued honing of decision making and information management skills. One possibility for meeting this need would be to include an embedded network and stand alone exercise simulation capability that also provides qualitative feedback on both individual and collective performance. With such a system, exercise problems could be run simulating varying levels of degradation, thus exercising that intuitive muscle in decision making, developing confidence and awareness on the part of the staff and the commander, as well as identifying problem areas which need further attention.

[26]Joint Chiefs of Staff, Joint Vision 2010. (Washington D.C.: July, 1996), 15.

A decision support interface and displays isolated from information fill could help minimize the variables in a rapidly changing environment. The volume of information available and the technology that provides it under normal operation will likely make the staff the limiting or inhibiting factor in developing a solid picture of the battlespace. When a system failure occurs, however, a massive shift in workload, from information management tasks to information seeking and analysis, will occur. Whenever a large shift in tasking such as this takes place, it is best to minimize the variables that the human operator has to contend with. Thus, the user interface and basic functionality of decision support systems should be separated from fill, effectively isolated by design from the information they process. The look and feel of the interface should be the same whether the "system of systems" is at full capacity or operating on a very degraded basis. With this sort of design, a system invaded by viral attack, for example, could be secured, then archived drives containing the functional system as well as baseline intelligence information installed, and a stand alone support system up and running in minimum time. Though inevitably hindered by a degradation in information flow, decisions could still be made in a familiar environment based on the best, if time late, information available. An architecture such as this would also allow for easier transition to operations in classification sensitive environments, such as coalition warfare, Military Operations Other Than War (MOOTW), or Peace Keeping Operations (PKO).

The commander and staff should have indicators to assess the status of the grids they are operating within. This might be accomplished through designing a central status display in the decision support system, textually and/or graphically providing the "pulse" of the network in terms of factors critical to that particular command center, aiding the staff much

like a vital statistics monitor aids the physician when working with a patient. Properly designed, the commander could anticipate degradation or failures based on "pulse" cues and compensate accordingly.

User Feedback Mechanisms

Instituting newer, faster and more complex information systems will make constructive user feedback and lessons learned, both positive as well as negative, vital to achieving success. Establishing the "system of systems" will, out of necessity, be an iterative process, where problems encountered as well as solutions and lessons learned provided by the warfighters themselves will ultimately drive the direction of growth. For this to be effective, the users of these growing systems need to be proactive in their design.

The absolute best time to get feedback from the users is when issues are at the forefront of their mind. Information and decision support systems should provide the user with easy "one click" or "one word" access to process save functions and standardized, on screen lessons learned, system change request, and request for information forms. Data compiled in this manner would likely be much more complete and accurate than is produced by the present, almost afterthought type of processing. Additionally, by automating and standardizing these electronic forms, statistically significant trends in problem reporting and change requests could provide valuable insight into and justification for true upgrade and acquisition requirements, better supporting the needs of the warfighter.

CONCLUSIONS

The information age is not a period in the future, it is here today. We are already beginning to experience the impact that technology will have on the manner and speed at which we operate and are developing a reliance on information systems in the performance of our day to day tasks. Continual, accurate, rapid assessment of the validity of the battlespace picture, information management and rapid adaptation to changing levels of information flow will greatly increase in importance to the decision process as we progress further towards the Joint Vision 2010 concept of information superiority. To provide for success, it will become imperative in the cultivation of future commanders that all levels of their career professional education include the development of sound leadership, decision making and information management skills. Various measures, such as embedding simulation and exercise tools into the decision support architecture, should be taken to ensure that the leadership and decision making skills required for a commander to be effective are continually challenged and well honed. Lastly, the users of these information and decision support systems must be proactive in providing continual, accurate, and timely feedback on problems, solutions and lessons learned to ensure that our transition to information superiority is done in a smart and effective manner.

APPENDIX A

The Decision Making Process[27]

The Key Elements

The decision making process can be broken down into four main elements. Every good decision maker must, consciously or unconsciously, go through each of them.

They are:

1. **Framing:** Structuring the question. This means defining what must be decided and determining in a preliminary way what criteria would cause you to prefer one option over another. In framing, good decision-makers think about the viewpoint from which they and others will look at the issue and decide which aspects they consider important and which they do not. Thus the inevitably simplify the world.

For example, in deciding whom to promote, you may simply define the problem as: "Selecting the person whose leadership is likely to produce the best performance in the work group." Note that this viewpoint pushes other aspects of the issue into the background, such as ability to connect with other parts of the organization, rapport with external clients, or rewarding the employee who has worked hardest or who has most seniority.

2. **Gathering Intelligence:** Seeking both the knowable facts and the reasonable estimates of "unknowables" that you will need to make the decision. Good decision-makers manage intelligence-gathering with deliberate effort to avoid such failings as overconfidence in what they currently believe and the tendency to seek information that confirms their biases. As Will Rogers said, "It's not what we don't know that causes trouble. It's what we know that ain't so."

3. **Coming to Conclusions:** Sound framing and good intelligence don't guarantee a wise decision. People cannot consistently make good decisions using seat-of-the-pants judgment alone, even with excellent data in front of them. A systematic approach forces you to examine many aspects and often leads to better decisions than hours of unorganized thinking would.

For example, numerous studies have shown that novices as well as professionals make more accurate judgments when they follow systematic rules than when they rely on their intuitive judgment alone.

4. **Learning (or failing to learn) from feedback:** Everyone needs to establish a system for learning from the results of past decisions. This usually means keeping track of what you expected would happen, systematically guarding against self-serving explanations, then making sure you review the lessons your feedback has produced the next time a similar decision comes along.

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[27]Excerpt from J. Edward Russo and Paul J.H. Schoemaker, Decision Traps. The Ten Barriers to Brilliant Decision Making and How to Overcome Them. (New York: Dell Publishing Group, Inc., 1990), 2-4.

Decision Traps[28]

The decision research of the last two decades has shown that people in numerous fields tend to make the same kinds of decision-making mistakes. So whatever kind of decision you have to make, you can probably use the insights a small group of researchers have developed to prevent those mistakes.

We have highlighted the most common errors in the following ten "decision traps." You'll find that these errors plague different parts...of your decision-making process.

1. **Plunging in:** Beginning to gather information and reach conclusions without first taking a few minutes to think about the crux of the issue you're facing or to think through how you believe decisions like this one should be made.

2. **Frame Blindness:** Setting out to solve the wrong problem because you have created a mental framework for your decision, with little thought, that causes you to overlook the best options or lose sight of important objectives.

3. **Lack of Frame Control:** Failing to consciously define the problem in more ways than one or being unduly influenced by the frames of others.

4. **Overconfidence in Your Judgment:** Failing to collect key factual information because you are too sure of your assumptions and opinions.

5. **Shortsighted Shortcuts:** Relying inappropriately on "Rules of Thumb" such as implicitly trusting the most readily available information or anchoring too much on convenient facts.

6. **Shooting from the Hip:** Believing you can keep straight in your head all the information you've discovered, and therefore failing to manage the group decision-making process.

7. **Group Failure:** Assuming that with many smart people involved, good choices will follow automatically, and therefore failing to manage the group decision-making process.

8. **Fooling Yourself About Feedback:** Failing to interpret the evidence from past outcomes for what it really says, either because you are protecting your ego or because you are tricked by hindsight.

9. **Not Keeping Track:** Assuming that experience will make its lessons available automatically, and therefore failing to keep systematic records to track the results of your decisions and failing to analyze these results in ways that reveal their key lessons.

10. **Failure to Audit Your Decision Process:** Failing to create an organized approach to understanding your own decision-making, so you remain constantly exposed to all the above mistakes.

In simple decisions -- say, whether to return a phone call -- you probably do not need to worry about these decision traps. . .But in big decisions -- the decisions that determine the success of your life and that of those around you -- The decision traps frequently cause havoc.

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[28]Excerpt from J. Edward Russo and Paul J.H. Schoemaker, Decision Traps. The Ten Barriers to Brilliant Decision Making and How to Overcome Them. (New York: Dell Publishing Group, Inc., 1990), xvi-xvii.

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Note: The following URLs are current as of the date of publication.

Military Intelligence
http://www.loyola.edu/dept/politics/milintel.html#C4I
This site is a connection hub for both government and military intelligence sites.

Advanced Information Technology (AIT) Branch of the Naval Research Lab (NRL)
http://www.ait.nrl.navy.mil/

Information Operations Army Field Manual No. 100-6
http://cryptome.org/fm100/fm100-6.htm

"Forward...From The Sea": Intelligence Support to Naval Expeditionary Forces
http://www.fas.org/irp/eprint/baus.htm
Master's thesis from the Marine Corps Command and Staff College.

FAS Intelligence Resource Program – Commander's Tactical Terminal (CTT)
http://www.fas.org/irp/program/disseminate/ctt.htm
This site describes the Commander's Tactical Terminals (CTT). The site provides a description of seamless, near-real-time intelligence and targeting information as well as links to related web sites.

FAS Intelligence Resource Program – Defense Dissemination System (DDS)
http://www.fas.org/irp/program/disseminate/dds.htm

ANNEX C
The Broadcast/Receive Example Architecture Study
http://www.fas.org/irp/doddir/dod/c4isr/annex_c.htm
The site reviews system architecture requirements for advanced intelligence systems.

F-117 testers evaluate real-time information capability
http://www.fas.org/man/dod-101/sys/ac/docs/n19980804_981147.html
Air Force News Release, 4 August 1998.

USAF Fact Sheet 96-04 F-117 Nighthawk
http://www.af.mil/news/factsheets/F_117A_Nighthawk.html

Federation of American Scientists – Counter-Imagery Intelligence
http://www.fas.org/eye/tracking.htm
Tracking space reconnaissance satellites in real-time with links to specific satellites as well as other related programs.

IC21: The Intelligence Community in the 21st Century
http://www.fas.org/irp/congress/1996_rpt/ic21/ic21014.htm
Staff Study from the 104th Congress.

Air Force Information Warfare Center
http://www.fas.org/irp/agency/aia/cyberspokesman/97aug/afiwc.htm
The mission of AFIWC is to explore, apply and migrate offensive and defensive information warfare capabilities for operations, acquisition and testing; and provide advanced IW training for the Air Force.

USAF Fact Sheet: E8-C Joint Stars
http://usmilitary.about.com/careers/usmilitary/library/milinfo/affacts/ble-8cjointstars.htm

HORIZON - A Jointly Focused Vision Charting the Course for the 21st Century Air Force
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Lt. Gen. John S. Fairfield, deputy chief of staff for C4 (Command, Control, Communications and Computer Systems)
Excerpt from an article published in Armed Forces Journal International, January 1996.

Additional References

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AD-A382931

BOSTON UNIV MA
OFFICE OF SPONSORED PROGRAMS

Real-Time Control for Advanced Material Processing Applications

07 Jul 2000 28 PAGES

PERSONAL AUTHORS: Gevelber, Michael; Wroblewski, Donald; Basu, Soumendra

UNCLASSIFIED REPORT

ABSTRACT: (U) Improving materials processing capabilities is of fundamental importance to enable DOD and the Air Force to meet their future materials requirements for advanced applications. However, processing problems are increasingly more difficult as we seek to manufacture new materials with greater control over material microstructure, meet more stringent performance requirements while significantly reducing cost and time to market. To meet these challenges, we have been developing a controls based approach utilizing real-time sensors. The DURIP grant provided funds to implement three advanced materials process control applications: crystal growth for advanced opto-electronic semiconductors for high-bandwidth communications and detection, plasma deposition for protective coatings critical for engines, turbines, and space propulsion systems, and CVD, an enabling technology for many critical applications in aerospace, engines, manufacturing, and micro and opto-electronics.

DESCRIPTORS: *CONTROL SYSTEMS, *REAL TIME, *COMPOSITE MATERIALS, MICROSTRUCTURE, ELECTROOPTICS, AIRCRAFT ENGINES, PRODUCTION ENGINEERING, CHEMICAL VAPOR DEPOSITION, PROTECTIVE COATINGS, SPACE PROPULSION.

AD-A378151

NAVAL POSTGRADUATE SCHOOL
MONTEREY CA

Real-Time Intrusion Detection for Windows NT Based on Navy IT-21 Audit Policy

01 Sep 1999 61 PAGES

PERSONAL AUTHORS: Kremer, H. S.

UNCLASSIFIED REPORT

ABSTRACT: (U) A Navy directive orders the migration of Navy computer systems to an Internet-connected network of Windows NT workstations and servers. Windows NT possesses the security features of a class C2 computer system but does not offer a standard real-time host-based tool to process the security-event audit data to detect intrusions or misuse. We discuss what would entail in general. We also report on experiments with a sensor program, which resides on each workstation and server in the network and provides some real-time processing of NT host-based events. It passes information to an Agent that communicates to other Agents in the network, in an effort to identify and respond to an intrusion into the network. The Navy audit policy and the methods of implementing the policy are also investigated in this thesis.

DESCRIPTORS:
*COMPUTER PROGRAMS, *DATA PROCESSING SECURITY, *REAL TIME, *INTRUSION DETECTION, POLICIES, THESES, ARTIFICIAL INTELLIGENCE, DIRECTIVES, NAVAL EQUIPMENT, AUDITING.

AD-A375849

NAVAL POSTGRADUATE SCHOOL
MONTEREY CA

Virtual Reality Transfer Protocol (VRTP): Implementing a Monitor Application for the Real-Time Transport Protocol (RTP) Using the JAVA Media Framework (JMF)

01 Sep 1999 232 PAGES

PERSONAL AUTHORS: Afonso, Francisco C.

UNCLASSIFIED REPORT

ABSTRACT: (U) The Real-time Transport Protocol (RTP) supports the transmission of time-based media, such as audio and video, over wide-area networks (WANs), by adding synchronization and quality-of-service (QoS) feedback capabilities to the existing transport protocol. RTP has been widely used in the Multicast Backbone (MBone), a virtual network that has become a shared worldwide medium for Internet multicast communications. This work presents the design patterns, architecture and implementation of an RTP monitor application using the Java Media Framework (JMF), a new Java Application Programming Interface (API) for multimedia support. An RTP monitor is an application that receives packets from all participants in a multicast session in order to estimate the quality of service for distribution monitoring, fault diagnosis and both short and long-term statistics. This new RTP monitor is available as a component of the Virtual Reality Transfer Protocol (VRTP), a protocol being developed to support large-scale virtual environments (LSVEs) over the Internet. Initial test results are satisfactory for audio and video streams, as well as prototype RTP-compliant Distributed Interactive Simulation (DIS) protocol streams.

DESCRIPTORS: *VIRTUAL REALITY, *COMMUNICATIONS PROTOCOLS, DATA BASES, AUTOMATION, DISTRIBUTED DATA PROCESSING, REAL TIME, THESES, DATA DISPLAYS, VIDEO SIGNALS, INTERNET, MULTIPLE ACCESS, DISTRIBUTED INTERACTIVE SIMULATION, GRAPHICAL USER INTERFACE.

AD-A375827

ELECTRONICS RESEARCH LAB SALISBURY (AUSTRALIA)

Representing Uncertainties Using Bayesian Networks

DEC 1999 66 PAGES

PERSONAL AUTHORS: Das, Balaram

UNCLASSIFIED REPORT

ABSTRACT: (U) This report demonstrates the application of Bayesian networks for modeling and reasoning about uncertainties. A scenario for naval anti-surface warfare is constructed and Bayesian networks are used to represent and update uncertainties encountered in the process of situation assessment. Concepts from information theory are used to provide a measure of uncertainty and understand its flow in a Bayesian network. This in turn yields analytical methods to formulate various effectiveness measures.

DESCRIPTORS: *COMMAND CONTROL COMMUNICATIONS, *BAYES THEOREM, *INFORMATION THEORY, MILITARY INTELLIGENCE, UNCERTAINTY, NEURAL NETS, NAVAL WARFARE, AUSTRALIA, DECISION AIDS, FLEET EXERCISES, MEASURES OF EFFECTIVENESS, SITUATIONAL AWARENESS.

AD-A374040

NAVAL POSTGRADUATE SCHOOL
MONTEREY CA

Implementation of Real-Time MSHN Using Ace and TAO

01 Sep 1999 140 PAGES

PERSONAL AUTHORS: Papadatos, Panagiotis

UNCLASSIFIED REPORT

ABSTRACT: (U) The Management System for Heterogeneous Networks (MSHN) project is a part of the DARPA/ITO QUORUM program. MSHN targets the execution of multiple, disparate tasks that use a set of shared, heterogeneous resources in a way that maximizes a collection of application specific quality of service (QoS) measures. This thesis examines some of the architectural requirements demanded of MSHN for it to be able to operate in a real time environment, and presents an implementation of a MSHN communication schema using components designed for supporting real time applications. This implementation is built over the Adaptive Communication Environment(ACE), a freely available, open source, Object Oriented (OO) framework for building concurrent communication. To support the communication between MSHN components, we used the Common Object Request Broker Architecture (CORBA), particularly The ACE ORB (TAO), a standards based, CORBA middleware framework. Both ACE and TAO are being developed at the Washington University in St. Louis, MO. In our experiments, we define and measure the latency (communication time required to start an application) and agility(communication time required to migrate an application given a platform failure). We find that MSHN has the potential for supporting certain types of real time systems, such as vehicle control.

DESCRIPTORS: *COMMUNICATIONS NETWORKS, *ADAPTIVE COMMUNICATIONS, *COMMUNICATIONS PROTOCOLS, COMPUTER GATEWAYS, REAL TIME, THESES, RESOURCE MANAGEMENT, CONFIGURATION MANAGEMENT, CLIENT SERVER SYSTEMS, NETWORK ARCHITECTURE, MSHN(MANAGEMENT SYSTEM FOR HETEROGENEOUS NETWORKS.

AD-A373934

ELECTRONICS RESEARCH LAB SALISBURY (AUSTRALIA)

Military Information Operations Analysis Using Influence Diagrams and Coloured Petri Nets

DEC 1999 78 PAGES

PERSONAL AUTHORS: Staker, R. J.

UNCLASSIFIED REPORT

ABSTRACT: (U) This report describes how influence diagrams, coloured petri net models and related techniques may be used to analyze certain aspects of military information operations. An example is employed to demonstrate these techniques. The example used is a very simplified representation of a military command organization dealing with a decision problem. The objective of the report is to provide theory, methods and techniques to support the assessment of the effect of military information operations on such organizations. The simplicity of the example permits the basic concepts to be clearly conveyed. They may readily be extended to the analysis of more complex examples as required. The most fundamental and significant concept developed in this report is that of a common quantitative measure of effectiveness that encompasses all types of information operations relevant to information warfare. This permits the direct comparison of the effectiveness of alternative information operation options with one another and also with conventional operations options. This latter ability is essential if information operations are to be employed appropriately as part of a broader range of military options.

DESCRIPTORS: *MILITARY OPERATIONS, *INFORMATION WARFARE, MILITARY INTELLIGENCE, QUEUEING THEORY, DECISION MAKING, MONTE CARLO METHOD, MILITARY APPLICATIONS, INFORMATION THEORY, AUSTRALIA, MEASURES OF EFFECTIVENESS.

AD-A373117

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY ARLINGTON VA

Advances in Enterprise Control. AEC Proceedings, November 15-16, 1999/San Diego, California

16 NOV 1999 299PAGES

UNCLASSIFIED REPORT

ABSTRACT: (U) This document contains copies of 33 papers prepared for and presented at the November 1999 DARPA JFACC Symposium on Advances in Enterprise Control. The purpose of the symposium was to bring together researchers and practitioners from industry, government and academia to present and discuss the latest developments in all aspects of enterprise control. The symposium presented papers that (a) describe the results of original research on the topics of interest, (b) provide broad reviews of the state-of-the-art, and (c) propose and advocate new research directions. Also presented were papers that describe significant practical experiences with current enterprise control systems: complex dynamic phenomena, non-obvious successes and failures, requirements and unmet needs. The modern enterprise is a large-scale dynamic system with broadly distributed and potentially conflicting goals, resources and constraints, with multiple semi-autonomous participants of both human and artificial nature (e.g., large military operations, financial/trading institutions, logistics systems, manufacturing plants, power grids). The increasing capabilities of technology to collect, automatically generate, and disseminate information offer the possibility for large-scale enterprises to be more responsive to change.

DESCRIPTORS: *HUMAN FACTORS ENGINEERING, *ARTIFICIAL INTELLIGENCE, *GAME THEORY, SYMPOSIA, ADAPTIVE CONTROL SYSTEMS, DISTRIBUTED DATA PROCESSING, REAL TIME, COMMAND AND CONTROL SYSTEMS, CONTROL THEORY, DYNAMIC PROGRAMMING, DECISION SUPPORT SYSTEMS.

AD-A373004

WAGNER (DANIEL H.) ASSOCIATES INC HAMPTON VA

Optimal Response Decision Aid (ORDA) for Time Critical Targets: Demonstration Scenario Results

31 JAN 2000 26 PAGES

PERSONAL AUTHORS: Discenza, Joseph H.

UNCLASSIFIED REPORT

ABSTRACT: (U) Report developed under SBIR contract for topic AF99-117. U.S. forces need to use intelligence in a timely and efficient manner to protect against mobile ballistic missile launchers and other time-critical threats. This research, using off-the-shelf software developed for other services, showed how the Air Force could use a scientific search planning decision aid to allocate surveillance assets optimally.

DESCRIPTORS: (U) *COMPUTER PROGRAMS, *GUIDED MISSILE LAUNCHERS, *OFF THE SHELF EQUIPMENT, *DECISION AIDS, SOFTWARE ENGINEERING, MILITARY INTELLIGENCE, SCENARIOS, AIR FORCE, OPTIMIZATION, ANTIMISSILE DEFENSE SYSTEMS, MONTE CARLO METHOD, BALLISTIC MISSILE INTERCEPT SYSTEMS, SURVEILLANCE.

AD-A371754

ELECTRONICS RESEARCH LAB SALISBURY (AUSTRALIA)

Achieving Systemic Information Operations for Australian Defence

OCT 1999 28 PAGES

PERSONAL AUTHORS: Staker, R. J.

UNCLASSIFIED REPORT

ABSTRACT: (U) This document describes a proposed program of research into theories, methodologies and techniques appropriate to achieving a systemic military information operations capability for the Australian Defence Force. The major expected outcomes of this research are decision support aids relevant to information operations, contributions to the theory of information operations and contributions to IO policy and doctrine. The doctrine would include matters relating to the design of organizations that are capable of operating effectively in an information operations environment.

DESCRIPTORS: *MILITARY INTELLIGENCE, *COMMAND AND CONTROL SYSTEMS, *AUSTRALIA, *INFORMATION WARFARE, MILITARY FORCES (FOREIGN), MILITARY DOCTRINE, HUMAN FACTORS ENGINEERING, MILITARY CAPABILITIES, DECISION AIDS, DECISION SUPPORT SYSTEMS.

AD-A370593

CARNEGIE-MELLON UNIV PITTSBURGH PA SOFTWARE ENGINEERING INST

Architectural Evaluation of Collaborative Agent-Based Systems

OCT 1999 43 PAGES

PERSONAL AUTHORS: Woods, Steve G.; Barbacci, Mario R.

UNCLASSIFIED REPORT

ABSTRACT: (U) The Architecture Tradeoff Analysis Method (Service Marks) (ATAM Service Marks) is an architecture evaluation technique currently evolving at the Software Engineering Institute (SEI). ATAM has been applied to a number of command and control, real time, and information systems. As collaborative, autonomous agents become a significant software technology, the demand for evaluating the quality attributes of the architectures of agent based systems will increase. Very broadly, agents may be thought of as software entities that have the ability to undertake action autonomously in their particular embedded environment, according to a typically general set of requests or desired goals, and that are able to communicate with other agents as determined by their own initiative. Given an agent system architecture, we need scenarios that could be applicable for conducting ATAM evaluations on instances of that agent architecture. This report identifies a few features in agent based systems that could be used to classify agent system architectures and to guide the generation of scenarios applicable to these architectures.

DESCRIPTORS: *SOFTWARE ENGINEERING, *INFORMATION SYSTEMS, *COMPUTER ARCHITECTURE, REAL TIME, COMMAND AND CONTROL SYSTEMS, COMMUNICATIONS NETWORKS, ARTIFICIAL INTELLIGENCE, COMPUTER NETWORKS, CLIENT SERVER SYSTEMS.

AD-A370517

BDM INTERNATIONAL INC SIERRA VISTA AZ

Modeling Intelligence Production Performance

SEP 1999 132 PAGES

PERSONAL AUTHORS: Mclean, Marsha B.; Knapp, Beverly G.

UNCLASSIFIED REPORT

ABSTRACT: (U) The objective of this effort was to develop an analysis framework and computer-based tool for simulating and evaluating the impacts of materiel, organizational, and personnel changes in the Military Intelligence (MI) production system. This tool was designed to assist the MI community in assessing new concepts for meeting commander's intelligence requirements of the future. A series of representational models was built first: conceptual, performance, and information quality. The conceptual model represented intelligence production as a simple input-process-output model, with nodes representing the functions required to produce intelligence and links representing the information flow. The performance model specified the behavioral tasks required to produce intelligence, taxonomy of human performance errors associated with the tasks, and the operational, scenario, and environmental variables that affect task performance. Finally, the Intelligence Quality Model quantified the results of information flow activity and linked the impact of task performance variables when operating on the information. A team of experts in behavioral science, modeling and simulation, and military intelligence built the Intelligence Production Model (IPM).

DESCRIPTORS: *INFORMATION PROCESSING, COMPUTER PROGRAMS, COMPUTERIZED SIMULATION, MILITARY INTELLIGENCE, INTELLIGENCE, MODELS, PERFORMANCE (HUMAN), INTERFACES, RULE BASED SYSTEMS, INFORMATION THEORY.

AD-A370463

ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES

Stealth, the End of Dedicated Electronic Attack Aircraft

27 MAY 1999 62 PAGES

PERSONAL AUTHORS: Hake, Michael F.

UNCLASSIFIED REPORT

ABSTRACT: (U) The importance of protecting limited aircraft assets cannot be overstated. The loss of a modern aircraft entails the probable loss of highly trained and experienced crews that took years to develop. Furthermore, if a target is missed because of defensive reactions to radar-guided weapons, the sortie is lost and the target will have to be attacked again, draining valuable resources from the war effort and risking the attack package all over again. Therefore, the jamming of early warning, ground-control intercept, and acquisition radars maximizes the success of strike packages by creating significant confusion and friction inside the command and control system of an adversary by denying critical intelligence on aircraft routes, altitudes, and timing. This friction slows an adversary's ability to respond to aerial attacks and therefore contributes directly to the preservation of combat power - experienced combat crews and aircraft. Joint publication 3-01.4 defines Electronic Warfare (EW) as "any military action involving the use of electromagnetic energy and directed energy to control the electromagnetic spectrum or to attack the enemy." EW is further divided into three subcategories: Electronic Attack (EA), Electronic Protect (EP), and Electronic Warfare Support (ES).

DESCRIPTORS: *ATTACK AIRCRAFT, *ELECTRONIC AIRCRAFT, MILITARY OPERATIONS, ELECTRONIC WARFARE, COMBAT EFFECTIVENESS, INTELLIGENCE, DECISION MAKING, DEFENSE SYSTEMS, BATTLEFIELDS, PROBABILITY, AIRBORNE, INTERCEPTION, COMMAND AND CONTROL SYSTEMS.

♦ **AD-A**370318

ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES

Intelligence Training for Stability and Support Operations -- Can the Military Intelligence Officers Advance Course Do Better

27 MAY 1999 77 PAGES

PERSONAL AUTHORS: Rotkoff, Steven W.

UNCLASSIFIED REPORT

ABSTRACT: (U) Futurists depict a world dominated by increased ethnically based transnational threats using asymmetric tactics to engage U.S. forces. These type operations are categorized under the rubric of Stability and Support Operations (SASO). Currently our training strategy is to remain ready for Major Regional Conflict (MRC) and prepare for SASO on a case by case basis. This monograph examines the intelligence skills required to operate in a SASO environment and then evaluates how well the Military Intelligence Advanced Course (MIOAC) prepares students for SASO challenges. The monograph methodology is to define the intelligence skills required for SASO and validate the proposed skill set against doctrine and mission essential task lists for army intelligence XXI. Following definition of the skills a review of recent SASO operations to include; Haiti, Somalia, and Bosnia document the quality of intelligence officer performance in SASO operational environments. MIOAC is then reviewed for how well it addresses operational shortfalls based on standards correlated to the intelligence skill set identified earlier. Finally the monograph concludes with recommendations for improving MIOAC within the constraints of the current TRADOC system as well as recommendations on a new paradigm for officer training.

DESCRIPTORS: *MILITARY INTELLIGENCE, *MILITARY TRAINING, MILITARY OPERATIONS, MILITARY PERSONNEL, MILITARY STRATEGY, THREATS, COURSES (EDUCATION), OFFICER PERSONNEL.

AD-A369488

GEORGIA INST OF TECH ATLANTA COLL OF COMPUTING

Distributed Simulation of Synthetic Environments and Wireless Networks

3 SEP 1999 148 PAGES

PERSONAL AUTHORS: Fujimoto, Richard M.

UNCLASSIFIED REPORT

ABSTRACT: (U) The goal of this research is to provide a decision aid that allows engineers, scientists and battle managers to simulate complex situations and facilitate rapid and informed planning. Specifically, we are developing mechanisms to facilitate the decision process in battle management. Often, very large systems may need to be modeled such as an entire combat theater or a large airspace. The problem with large systems is that a single simulation run may take hours to complete. In order to reduce execution time, one can decompose a sequential simulation into a collection of many interacting programs distributed over multiple processors. This approach is called parallel simulation. To ensure correctness, we require that parallel execution generates the same result as a sequential execution. This technology enables off-line decision aid simulations to be transformed into real time decision aids for time critical situations without loss of model accuracy.

DESCRIPTORS: *BATTLE MANAGEMENT, *DISTRIBUTED INTERACTIVE SIMULATION, *COMBAT SIMULATION, THEATER LEVEL OPERATIONS, REAL TIME, PARALLEL PROCESSING, WIDE AREA NETWORKS, DECISION AIDS, VIRTUAL REALITY.

♦ Included in *The DTIC Review*, December 2000

AD-A368081

ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS

Core Competency of the United States Army Reserve Military Intelligence Force

4 JUN 1999 118 PAGES

PERSONAL AUTHORS: Kennard, Cathy D.

UNCLASSIFIED REPORT

ABSTRACT: (U) The thesis examines the organization, roles, capabilities, and contributions of the U.S. Army Reserve Military Intelligence Force. It investigates the perception that the individual military intelligence soldier--not military intelligence units--forms the core competency of the U.S. Army Reserve Military Intelligence Force. It examines the U.S. Army Reserve Military Intelligence Force in terms of size and composition, skills and training, and participation in contingency deployments and intelligence contributory support missions. It also examines the evolution of the U.S. Army Reserve Military Intelligence Force and explains why the modification table of organization and equipment force dominates and ultimately affects the fate of the total U.S. Army Reserve Military Intelligence Force. The thesis concludes that the individual Military Intelligence soldier does form the core competency of the U.S. Army Reserve Military Intelligence Force, but attributes that competency to associated unit structure. The study proposes that the U.S. Army Reserve Military Intelligence Modification Table of Organization and Equipment structure be realigned with the active component military intelligence structure or be eliminated in lieu of a more specialized table of distribution and allowance structure.

DESCRIPTORS: *MILITARY INTELLIGENCE, *MILITARY RESERVES, *ARMY PERSONNEL, DEPLOYMENT, ORGANIZATIONS, SKILLS, THESES, MISSIONS, MILITARY TRAINING, PERCEPTION.

AD-A367095

MICRO ANALYSIS AND DESIGN BOULDER CO

Real Time Intelligent Coaching for Command and Control Systems: Phase 1 Final Report

28 MAY 1999 141 PAGES

PERSONAL AUTHORS: Evans, Debra C.

UNCLASSIFIED REPORT

ABSTRACT: (U) A study was undertaken to determine the feasibility of using Bayesian network technology to inform guidance supplied by an automated intelligent coach for command and control operations. To do so, and expert model, a method for comparing expert behavior and operator behavior, a Bayesian network, assessor, and feedback report were constructed. The automated tool was examined for functionality. It was determined that the approach was promising and that further extension of it is probably warranted.

DESCRIPTORS: *REAL TIME, *COMMAND AND CONTROL SYSTEMS, *BAYES THEOREM, AUTOMATION, MODELS, TRAINING, NETWORKS, TOOLS, BEHAVIOR, OPERATORS (PERSONNEL), DECISION AIDS.

AD-A366320

ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES

Does the U. S. Army Still Need a Military Intelligence Battalion Commander and a G2 in a Heavy Division?

16 DEC 1998 64 PAGES

PERSONAL AUTHORS: Ward, David L.

UNCLASSIFIED REPORT

ABSTRACT: (U) The formation of the MI battalion in a U.S. Army heavy division brought a military intelligence commander of the same rank as the G2 into existence. The existence of two military intelligence lieutenant colonels in a heavy division has caused a number of problems that have not been adequately addressed by doctrine. None of the other battlefield operating systems have a battalion commander and staff officer of the same rank whose responsibilities are so intertwined. This paper examines whether a heavy division still requires a G2 and a MI battalion commander. Doctrinal guidance concerning the roles and functions of the (G2 and MI battalion commander is vague and contradictory. This paper shows the disconnects and often confusing definitions used. The terms intelligence system and intelligence architecture which are often used synonymously and incorrectly in Military Intelligence Field Manuals are discussed and defined. This paper examines four options in structure and roles for the G2 and MI battalion commander.

DESCRIPTORS: *MILITARY INTELLIGENCE, *BATTALION LEVEL ORGANIZATIONS, *MILITARY COMMANDERS, BATTLEFIELDS, BRIGADE LEVEL ORGANIZATIONS, DIVISION LEVEL ORGANIZATIONS, MILITARY TRAINING, ARMY, INSTRUCTION MANUALS.

AD-A366257

ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES

Prowler Integration into USAF Strategic Attack and Air Interdiction Missions

17 DEC 1998 56 PAGES

PERSONAL AUTHORS: Hake, Michael F.

UNCLASSIFIED REPORT

ABSTRACT: (U) The importance of protecting limited aircraft assets cannot be overstated. The loss of a modern aircraft entails the probable loss of highly trained and experienced crews that took years to develop. Furthermore, if a target is missed because of defensive reactions to radar-guided weapons, the sortie is lost and the target will have to be attacked again, draining valuable resources from the war effort and risking the attack package all over again. Therefore, the jamming of early warning, ground-control intercept, and acquisition radars maximizes the success of strike packages by creating significant confusion and friction inside the command and control system of an adversary by denying critical intelligence on aircraft routes, altitudes, and timing. This friction slows an adversary's ability to respond to aerial attacks and therefore contributes directly to the preservation of experienced combat crews and aircraft. Joint Publication 3-01.4 defines Electronic Warfare (EW) as "any military action involving the use of electromagnetic energy and directed energy to control the electromagnetic spectrum or to attack the enemy." EW is further divided into three subcategories: Electronic Attack (EA), Electronic Protect (EP), and Electronic Warfare Support (ES).

DESCRIPTORS: *AIR DEFENSE, *ELECTRONIC WARFARE, *INTERDICTION, *MISSIONS, *AIR FORCE PLANNING, MILITARY OPERATIONS, ELECTRONICS, WARFARE, MILITARY FACILITIES, INTELLIGENCE, AIRCRAFT, DECISION MAKING, DEFENSE SYSTEMS, FLIGHT CREWS, THREATS, BATTLEFIELDS, ENERGY, ELECTROMAGNETIC RADIATION, ANTIAIRCRAFT WEAPONS, COMMAND AND CONTROL SYSTEMS, JAMMING, STRATEGIC WARFARE, RADAR HOMING.

AD-A366203

CARNEGIE-MELLON UNIV
PITTSBURGH PA DEPT OF COMPUTER SCIENCE

A Real-Time Push-Pull Communications Model for Distributed Real-Time and Multimedia Systems

01 Jan 1999 25 PAGES

PERSONAL AUTHORS: Juvva, Kanaka; Rajkumar, Raj

UNCLASSIFIED REPORT

ABSTRACT: (U) Real time and multimedia applications like multi-party collaboration, internet telephony and distributed command control systems require the exchange of information over distributed and heterogeneous nodes. Multiple data types including voice, video, sensor data, real time intelligence data and text are being transported widely across today's information, control and surveillance networks. All such applications can benefit enormously from middleware, operating system and networking services that can support QOS guarantees, high availability, dynamic reconfigurability and scalability. In this paper, we propose a middleware layer called the real time push pull communications service to easily and quickly disseminate information across heterogeneous nodes with flexible communication patterns. In particular, unlike the real time publisher/subscriber model, different information sources and sinks can operate at different frequencies and also can choose another (intermediate) node to act as their proxy and deliver data at the desired frequency. In addition to the synchronous communications of the publisher subscriber model, information sinks can also choose to obtain data asynchronously. This paper presents an overview of the design, implementation and a performance evaluation of the model.

DESCRIPTORS: *INFORMATION EXCHANGE, *DISTRIBUTED DATA PROCESSING, *COMPUTER COMMUNICATIONS, COMMAND CONTROL COMMUNICATIONS, INFORMATION SYSTEMS, REAL TIME, INTERNET, CLIENT SERVER SYSTEMS, NETWORK ARCHITECTURE.

AD-A366193

ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES

Air Force and Army Digitization and the Joint Targeting Process for Time-Critical Targets

17 DEC 1998 65 PAGES

PERSONAL AUTHORS: Angle, David W.

UNCLASSIFIED REPORT

ABSTRACT: (U) The application of new technology towards the digitization of command and control systems has the potential to provide near real-time situational awareness to commanders and increase the timeliness and accuracy of the processes involved in targeting time-critical targets throughout the battlefield. This paper narrowly focuses on the digitization of Air Force and Army command and control systems and the implications of that digitization for the joint targeting of time-critical targets. The Air Force is fielding the Theater Battle Management Core Systems (TBMCS) and the Army is fielding the Army Battle Command System (ABCS). Both the TBMCS and the ABCS comprise a system of systems with modular hardware and software packages that provide command, control, communications, computers, and intelligence capabilities for the warfighters. These systems are migrating towards joint interoperability by adhering to the architecture and protocols of the Defense Information Infrastructure/Common Operating Environment (DII/COE) mandated by the Joint Chiefs of Staff time-critical targets, such as theater ballistic missiles or surface to air missiles, are fleeting in nature with typically only a short window of opportunity in which to acquire and attack them.

DESCRIPTORS: *COMMAND AND CONTROL SYSTEMS, *ARMY PLANNING, *AIR FORCE PLANNING, *BATTLE MANAGEMENT, GUIDED MISSILES, DIGITAL SYSTEMS, THEATER LEVEL OPERATIONS, DEFENSE SYSTEMS, REAL TIME.

AD-A364671

WASHINGTON UNIV SEATTLE

The Specification, Analysis, and Execution of Requirements and Designs for Real-Time Systems

26 Feb 1999 5 PAGES

PERSONAL AUTHORS: Shaw, Alan C.

UNCLASSIFIED REPORT

ABSTRACT: (U) The goal was to further develop a methodology, language, and tools, based on state machines, for describing, analyzing, and executing requirements and designs for concurrent and distributed real time systems. Using our Communicating Real Time State Machine (CRSM) notation , we showed how specifications in the large could be obtained with simple mechanisms for composing CRSMs into subsystems and larger systems, and how assertion checking can be employed to monitor systems changes. Events and data messages that are communicated among distributed components are often times stamped as a way to handle timing constraints, ordering, and causality; the idea of time stamped event histories, i.e., sequences of time stamped events ordered by time, was developed as a new real time programming object and supported by an implementation extension of our CRSM simulator. Our current work is focused on real time communication models that fit naturally into a state machine framework and that can be applied to the many and diverse forms of distributed communication that exist.

DESCRIPTORS: *DISTRIBUTED DATA PROCESSING, *COMPUTER COMMUNICATIONS, *REAL TIME, COMPUTERIZED SIMULATION, SOFTWARE ENGINEERING, MESSAGE PROCESSING.

AD-A364418

SPACE AND NAVAL WARFARE SYSTEMS COMMAND SAN DIEGO CA

Complementary Processing and its Impact on Software Performance

JAN 1999 9 PAGES

PERSONAL AUTHORS: Ceruti, Marion G.; Trout, Ray C.; Lee, Tse

UNCLASSIFIED REPORT

ABSTRACT: (U) Complementary processing (CP) is a software scheduling methodology and architecture, the code for which is installed on top of operating systems to increase processing speed. CP has direct application to real time systems by enhancing performance. This article describes the background, concept and rationale of CP. Advantages and limitations of using CP are delineated. CP is discussed with a view toward the utility of applications to military command and control systems, which increasingly rely on object oriented software. Directions for future research are explored.

DESCRIPTORS: *DATA MANAGEMENT, *DISTRIBUTED DATA PROCESSING, *COMMAND AND CONTROL SYSTEMS, SOFTWARE ENGINEERING, COMPUTER COMMUNICATIONS, REAL TIME, OBJECT ORIENTED PROGRAMMING.

AD-A364412

ARMY WAR COLL
CARLISLE BARRACKS PA

The Battle of the Bulge Intelligence
Lessons for the Army After Next

1 APR 1999 45 PAGES

PERSONAL AUTHORS: Rosenbaum, Michael D.

UNCLASSIFIED REPORT

ABSTRACT: (U) Some argue that military intelligence can no longer be a doctrinally-based organization. Technological changes occur so fast that "technology will drive and doctrine will spin, our intelligence operations." This paper examines Third Army intelligence operations, primarily from September through December 1944, leading up to the battle of the bulge, for lessons learned. The paper identifies ten historic lessons that provide the basis for some of our intelligence doctrine today and that can serve as cornerstones for intelligence doctrine and operations in the Army After Next. It then argues that technology should not drive intelligence operations. Rather, well-trained intelligence professionals, who have studied history and understand doctrine and the intelligence battlefield operating system, will deliver intelligence that commanders can use.

DESCRIPTORS: *MILITARY INTELLIGENCE, *MILITARY DOCTRINE, LESSONS LEARNED, BATTLEFIELDS, BULGING, HISTORY, ARMY OPERATIONS, ARMY INTELLIGENCE.

♦ **AD-A**363102

NAVAL WAR COLL NEWPORT RI

E Pluribus Unum: Enhancing Intelligence
Support in the Network Centric Environment

5 FEB 1999 23 PAGES

PERSONAL AUTHORS: Greenwood, Michael D.

UNCLASSIFIED REPORT

ABSTRACT: (U) Network centric warfare's emphasis on timeliness and targeting challenges the intelligence community to concurrently support tactical combat operations and operational planning and execution while maintaining strategic situational awareness. To successfully accomplish each requirement obligates the intelligence community to make fundamental changes in the authority of the supported theater intelligence officer relative to the other members of the intelligence community. Additionally, a renewed emphasis must be placed on the collection of human intelligence, the development of regional expertise, and utilization of imagery analysts. Lastly, the network centric warfare's requirement to concurrently support the strategic, operational, and tactical levels places a premium on accessing archived intelligence via the information grid. As a consequence, the intelligence community must use available technology to filter information and better allocate analytical resources to achieve real time intelligence support.

DESCRIPTORS: *JOINT MILITARY ACTIVITIES, *MILITARY PLANNING, *COMMUNICATIONS INTELLIGENCE, COMMAND CONTROL COMMUNICATIONS, MILITARY STRATEGY, THEATER LEVEL OPERATIONS, MILITARY DOCTRINE, MILITARY TACTICS, MILITARY ART.

♦ Included in *The DTIC Review*, December 2000

AD-A363075

UNIVERSITY OF CENTRAL FLORIDA ORLANDO

The S2 Automated Agent (S2A2): A Training Aid for Commanders and Intelligence Officers

1999 191 PAGES

PERSONAL AUTHORS: Janiszewski, John T.

UNCLASSIFIED REPORT

ABSTRACT: (U) Although most leaders have a very solid background on the decision making process, training is still required to maintain and perfect their skills. While decision makers and their staff can collectively train using computer simulations, there currently is no tool that allows the decision maker to train in isolation on the decision making process. If a decision maker is to train in complete isolation without involving any of his staff then there is a requirement to use artificial intelligence and its techniques to model the functions of the decision maker's staff. This research models some of the functions of one of the most critical staff officers in the United States Army, the military intelligence officer (S2). There have been many uses of artificial intelligence to support military operations, but there have been none to date that are proven to replicate the functions of an S2 during the processing phase of the intelligence cycle. This research begins the creation of an S2 Automated Agent (S2A2) that allows the commander to implement war plans and see the results of those plans. Systems model for both the learning environment and the S2A2 are developed. The fundamental principle of the S2A2 is the decomposing of a complex problem, such as determining an enemy course of action, into smaller, more manageable situational indicators.

DESCRIPTORS: *MILITARY INTELLIGENCE, *ARTIFICIAL INTELLIGENCE, *MILITARY TRAINING, *COMBAT SIMULATION, MILITARY REQUIREMENTS, DECISION MAKING, THESES, WAR GAMES.

AD-A361839

LOCKHEED MARTIN CORP SYRACUSE NY OCEANRADAR AND SENSOR SYSTEMS

Embedded and Real-Time Application of High-Performance Scalable Computing

01 Feb 1999 55 PAGES

PERSONAL AUTHORS: Hamlet, Ronald E.

UNCLASSIFIED REPORT

ABSTRACT: (U) Pre and Post Doppler Space-Time Adaptive Processing (STAP) architectures were considered for target implementations based on embedded High Performance Scalable Computing (HPSC) architectures leveraging commercially available processing technology from Analog Devices Super Harvard Architecture (SHARC) Digital Signal Processor (DSP). Algorithm partitioning and mapping was performed that demonstrated initial feasibility and then a sizing study was performed for a theoretical implementation. Further utilized a discrete event simulator to perform detailed timing analysis and three different mappings of the Recursive Modified Gram Schmidt with Error Feedback (RMGSEF) algorithm in order to obtain insight into processor communication utilization and data latency. This effort culminated in a real time RADAR demonstration of the RMGSEF algorithm that was implemented using parallel SHARC processors based on the High Performance Scalable Computer (HPSC) to perform the QR Decomposition (QRD). The demonstration RADAR System incorporated 18 antenna elements over three pulse repetition intervals resulting in 34 degrees of freedom with performance of less than 15 ms of latency and a 42KHz sample rate. Further studies concentrated on alternative STAP solutions based on evolving Motorola PowerPC's and Field Programmable Gate Arrays (FPGAs).

DESCRIPTORS: *DOPPLER RADAR, *PARALLEL PROCESSING, *EARLY WARNING SYSTEMS, SIGNAL PROCESSING, SOFTWARE ENGINEERING, DATA MANAGEMENT, COMPUTER COMMUNICATIONS, REAL TIME, BEAM FORMING, RADAR PULSES, PULSE COMPRESSION, STAP(SPACE TIME ADAPTIVE PROCESSING).

AD-A361675

SCHAFER (W J) ASSOCIATES INC
ARLINGTON VA

Support to the Smart Munitions Test Suite
White Sands Missile Range

FEB 1999 18 PAGES

UNCLASSIFIED REPORT

ABSTRACT: (U) Schafer Corporation is providing support to the White Sands Missile Range (WSMR) National Range Development Directorate. This activity is directly in support of the Smart Munitions Test Suite (SMTS) which is a unique asset developed by WSMR to enhance the test and evaluation community's ability to evaluate weapons systems by combining test with modeling and simulation. Reduced test budgets have lead to fewer field tests resulting in both a greater reliance in simulation to fill in the test matrix and enhancing the value of those tests performed. With fewer tests being performed each test must have its success maximized and this too enhances the value of simulation especially for mission rehearsal. SMTS performs all of the necessary functions to maximize the weapons system evaluation process. Developed at WSMR the SMTS is designed to meet the specific challenges of today's test environment. Using a modular command and control architecture, the SMTS, which is completely mobile, can be rapidly configured to support a broad range of missions. Specialized SMTS capabilities include a powerful, transportable modeling and simulation capability that emphasizes pre-mission planning and rehearsal. The heart of SMTS is real-time acquisition and tracking capability based on an optimal real-time fusion of radar, optics, Global Positioning System (GPS), and other sensors all of which can handle up to 80 objects simultaneously.

DESCRIPTORS: *COMMAND AND CONTROL SYSTEMS, *AMMUNITION, *RANGES (FACILITIES), TEST AND EVALUATION, SIMULATION, OPTICS, DETECTORS, REAL TIME, WEAPON SYSTEMS.

AD-A361634

DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION CANBERRA (AUSTRALIA)

The Virtual Ship - A New Capability in Support of Maritime Forces

JAN 1999 45 PAGES

PERSONAL AUTHORS: Best, John P.

UNCLASSIFIED REPORT

ABSTRACT: (U) A key challenge in modern surface warfare is the integration of many different systems. These include on-board and off-board sensors, data fusion systems, command decision aids, Command and Control (C2) systems, weapons and the platform itself. There is currently a gap in the capability to rigorously study these integration requirements in a laboratory environment additionally, the capability is lacking to comprehensively investigate the operational efficiency of new systems prior to their introduction to service. The virtual ship will provide a facility through which these issues may be addressed. It will exploit modern computing capability, particularly distributed simulation technology, to bring together simulations of ship systems in order that warship operations may be simulated. The virtual ship will provide a human-in-the-loop capability in that human operators may interact in real time with the simulations just as they would interact with the real system. The virtual ship will find application in support of a number of DSTO and ADF objectives. It will provide an environment within which the operational utility of sensors, signal processing techniques, data fusion techniques, command decision aids and weapon systems may be demonstrated and refined. It will enable the operational perspective to be accounted for in the laboratory, prior to expensive sea trials. It also provides a means by which system user requirements may be elicited in a controlled and cost effective manner.

DESCRIPTORS: *SIMULATION, *INFORMATION SYSTEMS, *MILITARY CAPABILITIES, *NAVAL WARFARE, *NAVAL VESSELS (COMBATANT), *VIRTUAL REALITY, *SEA TESTING.

AD-A361632

AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH

A Validation Assessment of Thunder 6.5's Intelligence, Surveillance, and Reconnaissance Module

MAR 1999 174 PAGES

PERSONAL AUTHORS: Nelson, Francine N.

UNCLASSIFIED REPORT

ABSTRACT: (U) A validation assessment of THUNDER 6.5's Intelligence, Surveillance, and Reconnaissance (ISR) module is accomplished using formulational and experimental validation techniques. A comparison of ISR purposes and processes according to military doctrine is made with the purposes and processes of ISR implemented within THUNDER 6.5. This comparison provides an overview of the process, an understanding of the level of aggregation within THUNDER, insight into possible problem areas in THUNDER, and a basis for improving THUNDER ISR processes. Sensitivity analysis of the ISR parameters as they relate to the quality, quantity, and timeliness of ISR is also presented to provide insight into the responsiveness of THUNDER to changes in ISR capability for selected battle outcomes.

DESCRIPTORS: *MILITARY INTELLIGENCE, *DECISION MAKING, *MODELS, *SURVEILLANCE, *TOOL KITS, EXPERIMENTAL DATA, VALIDATION, MILITARY DOCTRINE, TEST METHODS, MODULAR CONSTRUCTION, MEAN, TIMELINESS, LINEAR REGRESSION ANALYSIS, RECONNAISSANCE.

AD-A361334

NAVAL POSTGRADUATE SCHOOL MONTEREY CA

The Global Transportation Network: The Heart of In-Transit Visibility

MAR 1999 108 PAGES

PERSONAL AUTHORS: Geis, Susan R.

UNCLASSIFIED REPORT

ABSTRACT: (U) The Persian Gulf War highlighted problems concerning In-Transit Visibility (ITV). The lack of in-transit visibility resulted in over 20,000 of 40,000 containers entering the theater of operations being opened, inventoried, resealed, and shipped back into the transportation system because the troops did not know what the contents were. There was also a lack of ITV coverage over troop movements throughout area of operations. As a result of the Persian Gulf fiasco, the United States Transportation Command, was given the responsibility for designing and providing a DoD-wide ITV system using the Global Transportation Network (GTN). GTN is an integrated database system that provides users with real-time in-transit visibility information, and C2 capabilities to facilitate transportation planning and decision making. This thesis examines how well GTN is performing in the area of in-transit visibility since becoming operational in August of 1997, especially compared with commercial tracking systems. The results of this research will provide valuable insights into the actual in-transit visibility capabilities of the GTN system. It will also enable future and current transportation managers in DoD to become more aware of the ITV capabilities of GTN as well as commercial systems that can further improve the Global Transportation Network's capabilities.

DESCRIPTORS: *TRANSPORTATION, *TRACKING, *VISIBILITY, *PERSIAN GULF WAR, DATA BASES, GLOBAL, THEATER LEVEL OPERATIONS, INTEGRATED SYSTEMS, DECISION MAKING, NETWORKS, REAL TIME.

AD-A361075

BDM INTERNATIONAL INC SIERRA VISTA AZ

Intelligence Production Model Version 6.00 For Windows: User's Manual

JAN 1999 97 PAGES

PERSONAL AUTHORS: Mclean, Marsha B.; Roe, Angela S.; Christian, Jamieson

UNCLASSIFIED REPORT

ABSTRACT: (U) This is the user manual for the Intelligence Production Model (IPM) version 6.00. The manual provides step-by-step instructions for setting up and running the IPM, viewing and processing output, and maintaining files generated during model runs. The manual includes a section to aid the user in model design, as well as a dictionary of terms. The IPM is a software application that simulates how the quality of information and information processing performance in a Military Intelligence (MI) production system affect the quality of military intelligence required to meet the commander's needs. By simulating the functions and processes in developing a collection plan, conducting data analysis and fusion, and disseminating intelligence products, the model enables users to simulate the entire intelligence collection and production system from a human perspective. Also, the model can simulate information operations against the intelligence battlefield functional areas and can identify how "defective" information degrades the quality of intelligence.

DESCRIPTORS: *MILITARY INTELLIGENCE, *USER MANUALS, *TACTICAL DATA SYSTEMS, *INFORMATION PROCESSING, COMPUTER PROGRAMS, DATA PROCESSING, OUTPUT, ARMY PERSONNEL, BATTLEFIELDS, PARAMETERS, ERRORS, DATA ACQUISITION, INFORMATION THEORY, MILITARY COMMANDERS, COLLECTING METHODS, PRODUCTION MODELS.

AD-A359897

ARMY RESEARCH INST FOR THE BEHAVIORAL AND SOCIAL SCIENCES ALEXANDRIA VA

Assessing Battle Command Information Requirements and the Military Decision Making Process in a Concept Experimentation Program

DEC 1998 78 PAGES

PERSONAL AUTHORS: Lickteig, Carl W.; Sterling, Bruce S.; Elliott, Gary S.; Burns, Joe E.; Langenderfer, Joe E.

UNCLASSIFIED REPORT

ABSTRACT: (U) This report describes a concept experimentation assessment of battle command information requirements and military decision making in the 2010-2015 timeframe. This research was the first in a series of Concept Experimentation Programs (CEPS) planned by the Mounted Battlespace Battle Lab (MBBL) at Fort Knox, KY, to re-engineer command and staff operations. This report focuses on research methods, exploratory results, and recommendations on method improvements for assessing battle command information requirements and the Military Decision Making Process (MDMP). The exploratory results provide a benchmark for future efforts and suggestions for improving information systems and future evaluations. Limitations and lessons learned on research methods are considered. Method recommendations address measurement approach issues, such as Mission, Enemy, Terrain, Troops, and Time (METT-T) structure for determining information requirements, and the applicability of the MDMP in a real-time information environment. Recommendations on manual measures address the timing and scope of assessment and respondent workload.

DESCRIPTORS: *REQUIREMENTS, *DECISION MAKING, SIMULATION, MEASUREMENT, LESSONS LEARNED, INFORMATION SYSTEMS, REAL TIME, MILITARY APPLICATIONS, MANUAL OPERATION, MILITARY TRAINING, BATTLES, INFORMATION PROCESSING.

AD-A359416

JOINT ADVANCED DISTRIBUTION SIMULATION/JOINT TEST AND EVALUATION ALBUQUERQUE NM

Lessons Learned from Executing an ADS Air-to-Air Missile Test in Near Real Time

01 Mar 1998 20 PAGES

PERSONAL AUTHORS: Sturgeon, Steven; Duffany, James P.

UNCLASSIFIED REPORT

ABSTRACT: (U) The Live Fly Phase (LFP) of the Systems Integration Test (SIT) was executed by the Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) and the 46th Test Wing at Eglin AFB, FL during 1997. The purpose of the SIT is to evaluate the utility of using Advanced Distributed Simulations (ADS) to support cost-effective testing of an integrated missile weapon/launch aircraft system in an operationally realistic scenario. The SIT missions simulate a single shooter aircraft launching an air-to-air missile against a single target aircraft. In the LFP, the shooter and target were represented by live aircraft and the missile by a simulator. ADS techniques were used to link two live F-16 fighter aircraft flying over the Eglin Gulf Test Range to the AMRAAM AIM-120 Hardware-In-The-Loop (HWIL) simulation facility at Eglin. In order to successfully integrate these assets for a near real-time test, the JADS team learned several lessons during the risk reduction and test execution phases. The lessons highlighted here concern test control aspects, computer processing, and telemetry issues. Control of a distributed test dealt with tactical aircraft control, scenario and data collection decisions, collocation of critical project personnel, and voice communications.

DESCRIPTORS: *FIGHTER AIRCRAFT, *AIR TO AIR MISSILES, *FLIGHT SIMULATION, *ADVANCED DISTRIBUTED SIMULATIONS, TEST AND EVALUATION, LESSONS LEARNED, REAL TIME, AIR LAUNCHED, GUIDED MISSILE SIMULATORS, DISTRIBUTED INTERACTIVE SIMULATION, F-16 AIRCRAFT, AMRAAM MISSILES.

AD-A356510

VIRGINIA UNIV CHARLOTTESVILLE SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Timeliness and Predictability in Real-Time Database Systems

01 Oct 1998 12 PAGES

PERSONAL AUTHORS: Son, Sang H.

UNCLASSIFIED REPORT

ABSTRACT: (U) The confluence of computers, communications, and databases is quickly creating a globally distributed database where many applications require real time access to both temporally accurate and multimedia data. This is particularly true in military and intelligence applications, but these required features are needed in many commercial applications as well. Major applications are military command and control, avionics and weapon systems, and monitoring and decision support systems. Those applications have at their core requirements for managing and analyzing massive amounts of data residing in many data repositories. Much of this data has timing attributes such as a particular satellite image being valid for no more than 5 minutes. Audio, video and images are key types of data which provide increased value to applications, but also increased challenges. Driving such systems are significant real time requirements for managing thousands of objects and tracking them by using a global, intelligent, and responsive multimedia database system. The objective of this project was to develop new database system technology for distributed real time systems and to evaluate them in the experimental real time database servers. Our focus has been to discover a set of design principles for building dependable and responsive database systems for time critical applications and to develop algorithms to improve timeliness and predictability of such systems.

DESCRIPTORS: *DATA BASES, *DATA MANAGEMENT, *DISTRIBUTED DATA PROCESSING, ALGORITHMS, COMPUTER COMMUNICATIONS, REAL TIME, ARTIFICIAL SATELLITES, ACCESS TIME, DECISION SUPPORT SYSTEMS.

AD-A355741

MITRE CORP HUNTSVILLE AL

Application of BMDO IS&T Distributed Computing and Simulation Research to BM/C3 Systems

1998 7 PAGES

PERSONAL AUTHORS: Smith, Stan M.; Mcfee, John K., Jr.; Hayes, James C.; Weise, Maura Young

UNCLASSIFIED REPORT

ABSTRACT: (U) The Ballistic Missile Defense Organization (BMDO) Innovative Science and Technology (IS&T) program sponsors research which is advancing the current state of the art in Parallel Discrete Event Simulation (PDES), high speed communications, distributed computing architectures and automated decision support. This paper examines the application of these technologies to Theater Missile Defense (TMD) and National Missile Defense (NMD) Battle Management/Command Control and Communications (BM/C3) applications including real time battle planning and faster than real time defense evaluation. the requirement for performing faster than real time defense evaluation in future BM/C3 systems is derived from the understanding that a real time defense planning capability will require a faster than real time defense evaluation capability. This capability will require a mechanism for executing potentially hundreds of full scale system simulations with various threats, configurations, and resources in a sufficiently short amount of time that results can be evaluated and provided to the decision maker enabling more effective decision making on the battlefield.

DESCRIPTORS: *COMMAND AND CONTROL SYSTEMS, *DECISION SUPPORT SYSTEMS, *THEATER MISSILE DEFENSE, COMPUTERIZED SIMULATION, GUIDED MISSILES, DISTRIBUTED DATA PROCESSING, REAL TIME, COMPUTER ARCHITECTURE, PARALLEL PROCESSING, BATTLE MANAGEMENT.

AD-A355156

DEFENCE RESEARCH ESTABLISHMENT VALCARTIER (QUEBEC)

Results of an Investigation of Concepts for Developing Computer-Based Decision Support for a Modern Frigate

OCT 1998 88 PAGES

PERSONAL AUTHORS: Chalmers, Bruce A.

UNCLASSIFIED REPORT

ABSTRACT: (U) DREV is investigating concepts for the development of a computer based, real time decision support system that can provide combat system operators with advanced support capabilities for countering the current and anticipated threat to the Canadian Patrol Frigate. Among its principal roles, this system will continuously take in data from the ship's sensors and other information sources; support the formulation, maintenance and display of an accurate tactical picture derived by fusing all available data, leading to enhanced situation awareness; and assist in determining and selecting a response to anticipated or actual threats. This document examines a range of concepts for the design of the system, focusing on automation, cognitive and methodological issues. It also exposes preliminary ideas of a novel model based framework that is being developed to support design.

DESCRIPTORS: *COMMAND AND CONTROL SYSTEMS, *FRIGATES, *DECISION SUPPORT SYSTEMS, COMPUTERIZED SIMULATION, REAL TIME, COMBAT SURVEILLANCE, CANADA, THREAT EVALUATION, DATA FUSION.

AD-A354768

ARMY RESEARCH LAB ABERDEEN PROVING GROUND MD

Development and Testing of an Interface for Real-Time Visualization of Resin Flow in Composites

01 Sep 1998 44 PAGES

PERSONAL AUTHORS: Green, William; Shires, Dale; Walsh, Shawn

UNCLASSIFIED REPORT

ABSTRACT: (U) The manufacture of polymer composite materials has benefited greatly from the development of computer-based simulation tools and sensor-based instrumentation. The present research offers a unique and powerful interface for collecting, integrating, analyzing, and rendering critical data related to a dynamic composite manufacturing process. These operations are executed in real time over the internet, permitting unprecedented flexibility and speed in deploying and using the manufacturing "tools." These tools include, but are not limited to, resin flow sensors, a model-based resin-flow reconstruction procedure, and a user friendly display for remotely manipulating and monitoring composite process events. The interface developed herein is critical not only in improving the fundamental visualization of a process but also as a means of practically communicating process information between geographically distinct locations. Thus, manufacturing concerns with only modest computer infrastructure can remotely leverage these tools to improve the quality, performance, and cost of their products without the need for significant investment in high performance computing infrastructure.

DESCRIPTORS: *COMPUTERIZED SIMULATION, *MATRIX MATERIALS, *COMPUTER AIDED MANUFACTURING, REAL TIME, LAMINATES, COMPOSITE STRUCTURES, FLOW VISUALIZATION, PRODUCTION CONTROL, DATA ACQUISITION, COMPUTER GRAPHICS, MOLDING TECHNIQUES.

AD-A351761

NAVAL WAR COLL NEWPORT RI JOINT MILITARY OPERATIONS DEPT

Advanced C4I and Operational Decision Making: Panacea or Pandora's Box?

18 MAY 1998 25 PAGES

PERSONAL AUTHORS: Eagen, Michael M.

UNCLASSIFIED REPORT

ABSTRACT: (U) The much vaunted Revolution in Military Affairs (RMA) as it relates to advanced Command and Control, Communications, Computers and Intelligence (C4I) is upon us. The notion that advanced C4I, fueled by rapid fire advancements in information technology, will be the ultimate answer to the fog and friction of war permeates the C4I for the warrior concept. Such views are short sighted and fail to take into account the psychological factors that contribute to fog and friction. This paper explores the promise of this "system of systems" as well as its week points. Specifically, the paper examines the interface between the joint warrior of the future and the advanced C4I systems that will empower-the various service-specific and joint warfighting models being developed in support of Joint Vision 2010. Included is a discussion of how advanced C4I may or may not change decision making processes, particularly at the operational level of war. Finally, the paper examines methods which the military of the future might employ to meet the challenges these new technologies will create.

DESCRIPTORS: *MILITARY INTELLIGENCE, *COMMAND CONTROL COMMUNICATIONS, *DECISION MAKING, *COMPUTER COMMUNICATIONS, *OPERATIONAL EFFECTIVENESS, WARFARE, HIGH RATE, MODELS, COMPUTERS, PSYCHOLOGY, FRICTION, GUNFIRE.

AD-A351751

NAVAL WAR COLL NEWPORT RI JOINT MILITARY OPERATIONS DEPT

Operational Intelligence at the Battle of Midway

18 MAY 1998 22 PAGES

PERSONAL AUTHORS: Jaeger, Paul J.

UNCLASSIFIED REPORT

ABSTRACT: (U) The Battle of Midway showcased the application of operational intelligence as a function of operational art. Planning and execution for the Midway operation required fusion of strategic, operational and tactical intelligence by the commanders involved; most notably Admiral Chester Nimitz. Having fully integrated operational intelligence into his decision making with emphasis on enemy intent derived from code breaking Nimitz designed an operation that was truly the turning point of war in the pacific. Four main lessons about operational intelligence emerge as a function of operational art: 1) To be effective, operational intelligence requires the existence, in peacetime, of a theater-wide system for collecting, processing, evaluating and disseminating intelligence information to the operational commander; 2) Integration of strategic/operational/tactical level intelligence is key to victory; 3) Operational planning based on enemy intent rather than enemy capability treads on dangerous ground rely on enemy intentions only when you possess absolutely reliable information; and 4) The operational commander must have vision to see where intelligence can help his decision making. The proper, insightful and confident use of fused, finished operational intelligence allowed Admiral Nimitz to extract unambiguous indications of enemy intent and develop an operational plan that capitalized on own force strength and critical enemy weaknesses.

DESCRIPTORS: *MILITARY INTELLIGENCE, *MILITARY OPERATIONS, DECISION MAKING, MILITARY COMMANDERS, MILITARY PLANNING, MILITARY TACTICS.

AD-A351664

NAVAL WAR COLL NEWPORT RI JOINT MILITARY OPERATIONS DEPT

Orchestrating Dominant Battlespace Awareness

25 MAY 1998 29 PAGES

PERSONAL AUTHORS: Sherman, Kevin B.

UNCLASSIFIED REPORT

ABSTRACT: (U) Joint Vision 2010 expresses the vision of a revolution in military affairs through the transformation of maneuver, mass, logistics, and operational protection into four new operational concepts. Although technology is forecast to improve these concepts, JV 2010 shows the prism of information superiority to be the catalyst for dramatic improvement. This paper will focus on the real time awareness piece of information superiority that is called Dominant Battlespace Awareness (DBA). Specifically, the paper examines achieving DBA through the perspective of intelligence, surveillance, and reconnaissance collection. The organization of the early air defense organizations is used as a historical template for creating assured awareness from disparate pieces of information, an expectation of achieving DBA is naive without organizing to achieve it. Although complete awareness is unrealistic, an early and well developed ISR plan can achieve the pockets of battlespace awareness that are sufficient for the "new operational concepts". Real-time DBA requires the orchestration the ISR collection sensor at the operational level of war.

DESCRIPTORS: *MILITARY OPERATIONS, *INFORMATION SYSTEMS, *SITUATIONAL AWARENESS, MILITARY INTELLIGENCE, REAL TIME, COMBAT SURVEILLANCE, JOINT MILITARY ACTIVITIES, LOGISTICS, MANEUVERS, RECONNAISSANCE, ELECTRONIC INTELLIGENCE.

AD-A350132

ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS

The Implications of Video Datalink on the AC-130

5 JUN 1998 95 PAGES

PERSONAL AUTHORS: Hicks, John M.

UNCLASSIFIED REPORT

ABSTRACT: (U) This study considers the implications of Video Datalink (VDL) on the AC-130. Gunships use infrared and low-light television sensors, and synthetic aperture radar to search for and to identify target for close air support and interdiction missions. The addition of VDL offers gunship crews the ability to employ Real-Time Information to the Cockpit/Offboard Targeting (RTIC/OT) technology to improve situational awareness, survivability, and operational flexibility. Also, VDL offers the Joint Force Air Component Commander (JFACC) inflight tasking capability, increased reconnaissance capability, operational flexibility and situation awareness. Ultimately, VDL allows command and control elements to exercise direct control of gunship operations. These capabilities are beneficial when they provide information to the crew or to the JFACC. However, VDL used to provide direct control of gunship operations may violate the Air Force doctrinal tenet of centralized control and decentralized execution.

DESCRIPTORS: *INFORMATION TRANSFER, *INFRARED DETECTORS, *DATA LINKS, *VIDEO SIGNALS, *LOW LIGHT LEVELS, *GUNSHIPS, *TELEVISION TRACKING, AIR FORCE, LESSONS LEARNED, SURVIVABILITY, FLIGHT CREWS, REAL TIME, MILITARY DOCTRINE, CLOSE SUPPORT, INTERDICTION, MORALE, SYNTHETIC APERTURE RADAR, COMMAND AND CONTROL SYSTEMS, INFRARED RADIATION, TACTICAL WARFARE, RECONNAISSANCE, TELEVISION EQUIPMENT.

AD-A349582

NAVAL POSTGRADUATE SCHOOL MONTEREY CA

An Analysis of Bandwidth Requirements for Collaborative Planning

JUN 1998 142 PAGES

PERSONAL AUTHORS: Duncan, Michele A.

UNCLASSIFIED REPORT

ABSTRACT: (U) Any military operation, no matter how large or small requires some level of planning. Planning has become more complicated, requiring interactions across geographical, functional, and organizational boundaries in a more compressed command and control decision cycle. For ships at sea, planning with other units, at sea or on shore, is constrained by the availability of communications bandwidth and limitations of the tools used for real-time interactions. Emerging tools such as audio and video conferencing and shared whiteboard, enable real-time collaboration among dispersed forces. However, these tools are bandwidth "greedy" requiring more than is currently available on many ships. In an effort to determine what amount of bandwidth a ship needs, this thesis used simulation and modeling to experiment with combinations of bandwidth, collaboration tools, number of planners, and network delivery methods. In general, a bandwidth of 128 kbps enables two ships to conduct a video and audio session.

DESCRIPTORS: *SHIPBOARD, *SYSTEMS ANALYSIS, *BANDWIDTH, COMPRESSION, MILITARY OPERATIONS, REQUIREMENTS, SIMULATION, SHIPS, DECISION MAKING, MODELS, NETWORKS, REAL TIME, INTERACTIONS, TOOLS, THESES.

♦ **AD-A**349111

NAVAL WAR COLL NEWPORT RI JOINT MILITARY OPERATIONS DEPT

Information Superiority: Teaming the Commander and the "System of Systems" in 2010

13 FEB 1998 27 PAGES

PERSONAL AUTHORS: Hayes, Steven D.

UNCLASSIFIED REPORT

ABSTRACT: (U) The information systems envisioned in Joint Vision 2010 will provide the commander with an unprecedented level of battlespace awareness to aid in the decision making process. Today, advanced information systems are having a significant impact on our personal and professional lives. Our increased reliance already makes their failure more disruptive than just a few years ago. Though the complete implications for operations in the military are not clear, one thing that has changed and will continue to change for the commander in this "revolution in real time" is the volume of and speed at which the information influencing decisions flows, as well as the speed at which decisions must be made before opportunities are lost. With systems as complex, expansive and interconnected as those envisioned, there will always be a vulnerability which can be exploited. In the event of failure, our commanders will still have the responsibility to continue the decision process and optimally employ all of the assets available to achieve the desired end state of an operation.

DESCRIPTORS: *DECISION MAKING, *INFORMATION SYSTEMS, *MILITARY COMMANDERS, *NAVAL TRAINING, *LEADERSHIP TRAINING, INFORMATION EXCHANGE, REAL TIME, VULNERABILITY, COMMAND AND CONTROL SYSTEMS.

AD-A348564

NAVAL WAR COLL NEWPORT RI JOINT MILITARY OPERATIONS DEPT

Joint Vision 2010: Information Superiority and its Effect on the Command and Control Process

13 FEB 1998 20 PAGES

PERSONAL AUTHORS: Ellis, Jeffrey A.

UNCLASSIFIED REPORT

ABSTRACT: (U) With the implementation of Joint Vision 2010, information superiority will impact every aspect of operational art, but none will be so great as the impact on operational command and control. Through information superiority, the operational commander theoretically gains a clearer picture of the battlespace, thus mitigating the fog of war. This study examines some of the potential command and control issues facing the operational commander as he attempts to conduct major operations and campaigns. Given the diverse threat, it is doubtful that U.S. forces can gain and maintain information superiority over our enemies. The need for information superiority will hamper our ability to operate in a combined environment. Information superiority may lead to operational command and control that is too rigid and too centralized to maintain friendly freedom of action. Operational commanders may become transfixed by increasing levels of information focusing on data instead of the application of forces in space and time. In the end, information superiority will provide a clearer picture of the battlespace but it will not mitigate the fog of war.

DESCRIPTORS: *MILITARY INTELLIGENCE, *DECISION MAKING, *COMMAND AND CONTROL SYSTEMS, *BATTLE MANAGEMENT, *INFORMATION WARFARE, THREATS, MILITARY COMMANDERS.

♦ Included in *The DTIC Review*, December 2000

AD-A348153

GENERAL ACCOUNTING OFFICE WASHINGTON DC NATIONAL SECURITY AND INTERNATIONAL AFFAIRS DIV

Quadrennial Defense Review: Opportunities to Improve the Next Review

25 JUN 1998 59 PAGES

UNCLASSIFIED REPORT

ABSTRACT: (U) In its May 1995 report, the Commission on Roles and Missions of the Armed Forces recommended that DoD lead a comprehensive strategy and force review at the start of each new administration. In August 1995, the Secretary of Defense endorsed performing a quadrennial review of the defense program. Congress, noting the Secretary's intent to complete the first such review in 1997, required in the National Defense Authorization Act for Fiscal Year 1997 that DoD report on a number of topics, including the defense strategy; the force structure best suited to implement the strategy; the effect of new technologies anticipated by 2005 on force structure, doctrine, and operational concepts; and key assumptions used in the review. It also authorized a National Defense Panel, comprising national security experts from the private sector, to review the results of the QDR and conduct a subsequent study to identify and assess force alternatives. DoD completed the QDR in May 1997 and the Panel issued its report in December 1997.

DESCRIPTORS: *MILITARY INTELLIGENCE, *MANAGEMENT PLANNING AND CONTROL, *STRATEGIC ANALYSIS, *OPERATIONAL READINESS, *DEFENSE PLANNING, THEATER LEVEL OPERATIONS, DECISION MAKING, MILITARY DOCTRINE, JOINT MILITARY ACTIVITIES, NATIONAL DEFENSE, MILITARY DOWNSIZING, SITUATIONAL AWARENESS.

AD-A346978

NAVAL POSTGRADUATE SCHOOL MONTEREY CA DEPT OF SYSTEMS MANAGEMENT

Decision Support for Reconnaissance Using Intelligent Software Agents

MAR 1998 144 PAGES

PERSONAL AUTHORS: Edmiston, Marcia R.; Gregg, Darrell R., Jr.; Wirth, David G.

UNCLASSIFIED REPORT

ABSTRACT: (U) Research in reconnaissance traditionally focuses on data detection and discrimination methods. Less emphasis is placed on transforming the collected data into useful information and presenting it to key command and control nodes. Information not presented in a timely manner is excluded from the decision process. This thesis proposes a conceptual model of intelligent software agents to support the human decision process and reconnaissance-related tasks. The Mobile Agent Reconnaissance Kit (MARK) suggests a hierarchy of software agents to facilitate data integration and coordination in a network-centric multisensor environment. The model uses static and mobile agents to collect data from dispersed, heterogeneous data sources, process and fuse the data, and present the resultant information to the user in an HTML file. The authors explore applications of mark in terms of the military Intelligence Cycle, the Joint Director of Laboratories (JDL) Technical Panel for C3I Data Fusion Model, and the Joint Operations Planning and Evaluation System (JOPES) crisis action planning.

DESCRIPTORS: *COMPUTER PROGRAMS, *MILITARY INTELLIGENCE, *RECONNAISSANCE, CRISIS MANAGEMENT, DETECTION, DECISION MAKING, DATA MANAGEMENT, MODELS, PANELS, THESES, INTEGRATION, PLANNING, MOBILE, COMMAND AND CONTROL SYSTEMS, USER NEEDS, HETEROGENEITY, DECISION SUPPORT SYSTEMS.

♦ **AD-A**346387

ARMY WAR COLL CARLISLE BARRACKS PA

Information Fusion - Battlespace Dominance

25 JAN 1998 50 PAGES

PERSONAL AUTHORS: McCully, Meelita

UNCLASSIFIED REPORT

ABSTRACT: (U) Communications Systems are intended to ensure the Commander is not a prisoner to his/her command post. Previously the objective for Command, Control, Communications, Computers and Intelligence (C4I) has been to ensure the Commander retains access to information and is able to make timely decisions from any place on the battlefield. Fusion of multiple C4I systems is possible with the advent of inexpensive Commercial Off The Shelf (COTS) technology. COTS enables commanders to deftly exploit C4I systems and achieve battlespace dominance. This paper proposes an interim C4I architecture for the current force. The proposal includes a C4I fusion pit, which enables the Commander to have a common, near real-time picture of his battlespace. The paper also outlines several interim fixes to narrow bandwidth constraints for information systems data exchange. The solutions incorporated in this paper are low-cost economical solutions.

DESCRIPTORS: *COMMAND CONTROL COMMUNICATIONS, *INFORMATION EXCHANGE, *COMPUTER COMMUNICATIONS, *DATA FUSION, DECISION MAKING, INFORMATION SYSTEMS, REAL TIME, BATTLEFIELDS, COMPUTERS, SOLUTIONS (GENERAL), RESOURCES, TIMELINESS.

AD-A346009

ARMY WAR COLL CARLISLE BARRACKS PA

Educating Junior Military Officers for the Information Age

1 APR 1998 44 PAGES

PERSONAL AUTHORS: Sayles, Andre H.

UNCLASSIFIED REPORT

ABSTRACT: (U) As pointed out in Joint Vision 2010, improvements in information and systems integration technologies will have a significant impact on future military operations. The phrase dominant battlefield awareness is used to describe an environment in which the commander will be able to monitor friendly and enemy operations in real time. Improved situational awareness is expected to be a product of the information revolution in which telecommunications, sensors, all sources of intelligence, and global positioning are integrated into a single system for the individual warrior. Decentralized operations will require leaders at the lowest level to understand information age technologies. Current senior military officers began active service before the personal computer became popular in the early 1980s. Military leaders entering the service in the year 2000 will be key staff officers in 2010 and the senior commanders in 2025. This report addresses the extent to which military leaders will need to be technologically literate in the information age and how we can get to where we need to be.

DESCRIPTORS: *MILITARY OPERATIONS, *MILITARY STRATEGY, *INFORMATION SYSTEMS, INTEGRATED SYSTEMS, INTELLIGENCE, DECISION MAKING, REAL TIME, GLOBAL POSITIONING SYSTEM, MILITARY COMMANDERS, MILITARY PLANNING, DECENTRALIZATION, MILITARY CRITICAL TECHNOLOGY.

♦ Included in *The DTIC Review*, December 2000

AD-A341295

CALSPAN SRL CORP BUFFALO NY

Advanced Intelligence Information System Hyper Toolkit

FEB 1998 68 PAGES

PERSONAL AUTHORS: Guewa, John R.; Gallo, Steven M.; Neal, Jeannette G.; Stringer, Matt S.

UNCLASSIFIED REPORT

ABSTRACT: (U) In this rapidly changing world, intelligence analysts analyze the latest information on foreign systems and trends and produce assessments of the present and anticipated future capabilities of particular countries. For these assessments to be of maximum utility to operational planners and national decision makers, it is necessary to: (1) reduce the time it takes to produce and disseminate intelligence products and information, and; (2) provide better and more effective ways of packaging and presenting the information to facilitate its access and understanding. To help address these problems, this effort focused on the development of the Hyper Toolkit to provide efficient means for creating and maintaining electronic linked multimedia documents and information spaces, particularly in World Wide Web (WWW) formats (e.g., HTML), to provide fast dissemination and online viewing by the intelligence community via electronic means such as intelink and other networks, dial-up facilities, CDROM, etc.

DESCRIPTORS: *MILITARY INTELLIGENCE, *INTERNET, *HYPERTEXT, NATIONAL SECURITY, DECISION MAKING, DATA MANAGEMENT, COMPUTER COMMUNICATIONS, RULE BASED SYSTEMS, THREAT EVALUATION, DIGITAL COMMUNICATIONS, TACTICAL DATA SYSTEMS, GRAPHICAL USER INTERFACE.

AD-A341290

PRC INC MCLEAN VA

Task Analyses of Military Intelligence Critical Combat Functions

JAN 1998 350 PAGES

PERSONAL AUTHORS: Bartkoski, Terry P.; Harrison, Kent E.; Finley, Dorothy L.

UNCLASSIFIED REPORT

ABSTRACT: (U) This preface provides the user with necessary and relevant information concerning the development of Critical Combat Functions (CCF): CCF 1, Conduct Intelligence Planning, CCF 2, Collect Information, CCF 3, Process Information, and CCF 4, Disseminate Intelligence, as performed by a brigade. A CCF is defined as "an integration (i.e., interrelationship) among participants and tasks that represents a force multiplier with a definable outcome." Participants and organizational structure identified in this analysis are based on Table of Organization and Equipment (TOE) 870421100, dated 10/05/95. Field Manual (FM) 71-3. The Armored and Mechanized Infantry Brigade, January 1996, was used to identify special staff positions. These analyses of a brigade's performance of the CCFs, which compose the Intelligence Battlefield Operating System (BOS), are a product of the process of developing a training strategy for the brigade. The analyses describe tasks, participants, products, processes, and relationships necessary for providing intelligence to the heavy brigade commander and staff, higher and lower units, supporting units, and adjacent units.

DESCRIPTORS: *MILITARY INTELLIGENCE, *BRIGADE LEVEL ORGANIZATIONS, WARFARE, COMBAT EFFECTIVENESS, STRATEGY, TRAINING, INFANTRY, MILITARY COMMANDERS, MILITARY PLANNING.

AD-A322818

VIRGINIA UNIV CHARLOTTESVILLE SCHOOL OF ENGINEERING AND APPLIED SCIENCE

Timeliness and Predictability in Real-Time Database Systems

FEB 1997 82 PAGES

PERSONAL AUTHORS: Son, Sang H.

UNCLASSIFIED REPORT

ABSTRACT: (U) The confluence of computers, communications, and databases is quickly creating a globally distributed database where many applications require real time access to both temporally accurate and multimedia data. This is particularly true in military and intelligence applications, but these required features are needed in many commercial applications as well. Major applications are military command and control, avionics and weapon systems (e.g., missile guidance system), and monitoring and decision support systems. Those applications have at their core requirements for managing and analyzing massive amounts of data residing in many data repositories. Much of this data has timing attributes such as a particular satellite image being valid for no more than 5 minutes. Audio, video and images are key types of data which provide increased value to applications, but also increased challenges. Driving such systems are significant real time requirements for managing thousands of objects and tracking them by using a global, intelligent, and responsive multimedia database system.

DESCRIPTORS: *DATA BASES, *REAL TIME, *TIMELINESS, *RELIABILITY (ELECTRONICS), AVIONICS, GUIDED MISSILES, INTELLIGENCE, DISTRIBUTED DATA PROCESSING, COMPUTER COMMUNICATIONS, PREDICTIONS, WEAPON SYSTEMS, COMPUTERS, TRACKING, COMMAND AND CONTROL SYSTEMS, ARTIFICIAL SATELLITES, MILITARY APPLICATIONS, ACCESS TIME, DECISION SUPPORT SYSTEMS.

AD-A307630

NAVAL WAR COLL NEWPORT RI

Exploiting the Utility of Space-Based Environmental Surveillance Systems at the Operational Level of War

7 MAR 1996 22 PAGES

PERSONAL AUTHORS: Barron, John

UNCLASSIFIED REPORT

ABSTRACT: (U) The ability to assess the physical environment of the battlefield and understand its implications on the outcome of military operations is an integral part of the operational commander's planning and decision making processes. Today, accurate environmental intelligence, particularly in the areas of weather observation and terrain characterization, is almost exclusively accomplished through the use of space-based surveillance systems. The analysis of near real-time, satellite data in the form of digital, Multispectral Imagery (MSI) can be utilized to provide precise information on weather systems, atmospheric profiles, nearshore beach surveys, bathymetry, land classification schemes, terrain contouring and topography, hydrological evaluations, and much more. For today's Joint Task Force Commanders (CJTFs), the exploitation of this environmental intelligence in support of operations at the theater level of war has a direct bearing on mobility, maneuver, deception, operational fires and reconnaissance. Specific military applications of MSI include; disaster assessment; Land Lines of Communication (LOCs) identification and interdiction; Camouflage, Concealment and Deception (CC&D) detection; flight planning; and strike targeting.

DESCRIPTORS: *MILITARY OPERATIONS, *DECISION MAKING, *BATTLEFIELDS, *SURVEILLANCE, *SATELLITE METEOROLOGY, TEST AND EVALUATION, MOBILITY, THEATER LEVEL OPERATIONS, INTELLIGENCE, DISASTERS, ENVIRONMENTS, DETECTION, WEATHER, REAL TIME, CAMOUFLAGE, INTERDICTION, AMPHIBIOUS OPERATIONS, INSHORE AREAS, HYDROLOGY.

AD-A289134

NAVAL POSTGRADUATE SCHOOL MONTEREY CA

Design and Synthesis of a Real-Time Controller for an Unmanned Air Vehicle

SEP 1994 121 PAGES

PERSONAL AUTHORS: Hoffman, Peter M.

UNCLASSIFIED REPORT

ABSTRACT: (U) The Naval Postgraduate School is developing a Vertical Take-Off and Landing (VTOL) Unmanned Air Vehicle (UAV) that can transition to horizontal flight, once airborne, in order to take advantage of the improvements in speed, range, and loiter time that horizontal, fixed-wing flight provides. This research investigates the design requirements of the central controlling device for that UAV, including the specific problems of defining the necessary hardware components and developing software for executive control. First, hardware requirements needed to be determined. By exploring the general operational requirements of the UAV and taking into account space and weight limitations, a hardware suite was selected which could provide adequate functionality to replace the human traits of a pilot. Its order to provide awareness' of the operational environment, motion sensors, navigation equipment, and communication equipment was required. Controllable servo motors were necessary to move control surfaces appropriately. Computer hardware, necessary to provide system intelligence, was selected in order to interoperate with the other hardware. Next, a Real-Time Executive (RTE) software program was designed to provide the functionality and coordination of all hardware components.

DESCRIPTORS: *FLIGHT CONTROL SYSTEMS, *AIR NAVIGATION, *UNMANNED, *COMPUTER APPLICATIONS, *REMOTELY PILOTED VEHICLES, *REMOTE CONTROL, *TRANSITION FLIGHT, COMPUTER PROGRAMS, INTELLIGENCE, REAL TIME, COMMUNICATION EQUIPMENT.

AD-A279553

NAVAL WAR COLL NEWPORT RI DEPT OF OPERATIONS

National-Level Intelligence and the Operational Commander: Improving Support to the Theater

8 FEB 1994 36 PAGES

PERSONAL AUTHORS: Hecker, Steven

UNCLASSIFIED REPORT

ABSTRACT: (U) The relationship between operational commanders and the national level intelligence community is examined by suggesting the nature of support that should be provided to the theaters. Proper support from the national agencies is necessary if a theater commander is to have the best possible intelligence needed for planning and executing campaigns and operations. Problems which developed between theater commanders and the national agencies during Desert Storm and other operations are examined. These cases demonstrated that a unified intelligence effort is needed between the theater and national levels. Also, near-real time dissemination of national-level intelligence products to the operational commanders should be ensured. These products should provide the theater commander with the clearest possible assessments on enemy capabilities and intentions.

DESCRIPTORS: *INTELLIGENCE, *NATIONAL DEFENSE, *MILITARY OPERATIONS, DESERTS, ENEMY, OPERATION, ANTISHIP MISSILES, PLANNING, REAL TIME, STORMS, TIME, THEATER LEVEL OPERATIONS, STRATEGIC INTELLIGENCE, BATTLES, DAMAGE ASSESSMENT, JOINT MILITARY ACTIVITIES.

AD-A273701

WRIGHT LAB WRIGHT-PATTERSON AFB OH

Expert System Rule-Base Evaluation Using Real-Time Parallel Processing

SEP 1993 35 PAGES

PERSONAL AUTHORS: Noyes, James L.

UNCLASSIFIED REPORT

ABSTRACT: (U) A large rule-based expert system with each rule involving perhaps 10 out of 100,000 possible boolean criteria, can require a significant amount of processing time to evaluate. This time can be reduced if all rules have a single consequent and have antecedents that contain only conjunctions of the boolean criteria or their complements. If the consequences do not insert new facts into the rule-base, then parallel processing can be used with great efficiency. The value of a rule-based expert system to help solve a variety of diagnostic and advisory needs has been well-demonstrated over the last two decades. Parallel processing has become increasingly important for embedded systems in order to accelerate a variety of computations. This report discusses research connected to the development of a data structure and algorithm to perform parallel inferencing in rule-based systems. It also discusses a simulation technique for estimating the number of processors needed to evaluate a given number of rules and criteria within the required time.

DESCRIPTORS: *EXPERT SYSTEMS, *PARALLEL PROCESSING, *REAL TIME, *RULE BASED SYSTEMS, ALGORITHMS, ALLOCATIONS, ARTIFICIAL INTELLIGENCE, AUTOMATION, COCKPITS, COMPUTATIONS, EFFICIENCY, INTELLIGENCE, KNOWLEDGE BASED SYSTEMS, TIME, COMPUTERIZED SIMULATION.

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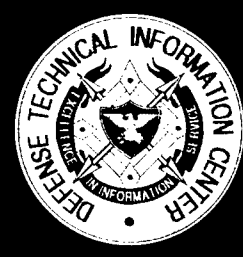

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