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Exploratory Evaluation of Intelligence-Operations Collaborative Systems

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**EXPLORATORY EVALUATION OF INTELLIGENCE-OPERATIONS
COLLABORATIVE SYSTEMS**

Spring 2010

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1.0 INTRODUCTION

1.1. Background

The Collaborative Battlespace Reasoning Awareness (COBRA) project was developed out of the need to provide a closer alignment between the intelligence analyst and the operations officer. As a result several technological initiatives are underdevelopment to support collaboration and synchronization of intelligence, operations, and geospatial information and activities. The goal is to increase battle command unification through shared decision-making in an effort to support the commander's mission objectives.

1.2 Purpose of Research Initiative

The USMA and CERDEC have formed a partnership for the purpose of developing useful collaborative tools for enabling warfighters at the brigade and higher echelons to support intelligence driven operations. The expertise and research program at the USMA's Engineering Psychology Lab enhances the efforts currently being conducted at CERDEC's Intelligence and Information Warfare Directorate by providing system design guidelines based on human performance and human-system interaction principles. Furthermore, the increase in technology and distributed team work has increased the information demand on the warfighter, thus warranting research efforts that focus on the human performance implications of collaborative work in heterogeneous collocated and dislocated teams

2.0 OBJECTIVE

The software application, IMPULSE, was designed to support the tasks of both intelligence and operations warfighters. This report outlines the efforts, and the information gleaned from the initial usability workshop held at West Point.

In the series of usability workshops to come, the overall objective is to examine how well IMPULSE allows the users (i.e., intelligence (S2) and operation (S3) warfighters) to complete their tasks, in the way that they expect them to be completed. In other words, how well does IMPULSE align with the user's workflow and mental model of their tasks. Specific emphasis is placed on ensuring that IMPULSE's features have operational relevance.

3.0 COMPLETED WORK

For the first workshop we used an informal exploratory assessment with the primary goal being an exploration of the users' initial reactions to the software application. Four main tasks were completed:

1. Interviews with military experts
2. Preliminary user workflow and operational relevance evaluation
3. Identification of potential operational scenarios
3. Preliminary usability testing

Twelve military experts from the USMA, who had combat experience in either the Iraq or Afghanistan operational environments and a range of experience across communities and echelons, participated in the initial workshop. Each task is presented below.

3.1 Task 1: Interviews with military experts

The goal of Task 1 was to lead guided discussions between the military experts and developers of IMPULSE. The goal was to elicit process and task descriptions from the experts. These descriptions were obtained from the roles of the S2, S3, Battalion Commander, and Brigade Commander. A brief summary of the main processes and tasks that occur during a mission are provided below. As a note, the goal of this report is to highlight and capture those areas relevant to the design and of IMPULSE features; therefore, comprehensive descriptions of the processes, tasks, and expert interviews are not detailed in this report.

3.1.1 Military Decision Making Process (MDMP)

All personnel, at every level, work within the constraints of the MDMP which helps with examining the situation and reaching logical decisions. The major steps involved in MDMP include receipt of the mission, mission analysis, courses of action (COA) development, COA analysis, COA comparison, COA approval, and orders production. Due to the high operational tempo, in practice, the full MDMP may occur once on a deployment typically in the beginning of a deployment. During the MDMP the Intelligence Preparation of the Battlefield process occurs.

3.1.2 Intelligence Preparation of the Battlefield (IPB).

The IPB process is an integrated staff function driven by the commander. The process supports staff estimates and military decision making. The products and methodology of the IPB process keep the commander informed of the situation and provide a mental visualization of how an operation will unfold. Products from the IPB process include Modified Combined Obstacle Overlay (MCOO), Situation Templates, and Event Templates. Critical components of the IPB process involve updating and creating threat models that identify potential high value targets (HVTs). The HVTs are ranked regarding their relative worth to the threat's operation, and then recorded as part of the threat model. The IPB process also involves determining where to place assets to detect and track targets so they can be engaged. The IPB process would therefore be facilitated with a tool that can rank data and support 'what if' planning thru visualization.

3.1.3 The Role of the S2.

The S2's responsibilities include IPB, Intelligence Surveillance and Reconnaissance planning (ISR), and Targeting. The S2 is the key player in the IPB process described above.

ISR Planning. The ISR planning involves determining what the requirements are from the IPB process and the identification of assets which can best gather this information.

During ISR planning the S2 must

- Identify requirements
- Develop specific order of requests for the collector (e.g. cross out articles of interest in newspapers),
- Collect against intelligence gaps (5 W's: Who, What, Where, When Why, & How)
- Prepare and execute (e.g., build good relationships with sources and gather information on exploitation such as cultural knowledge)
- Assess and exploit (e.g., having a dedicated interrogator, developing lines of questions to start interrogation and Assessment Collection and Exploitation (ACE)).

The following provides an example of the S2's role during ISR planning:

There was a report of a Wahabist cell in Sadr City.

S2 is required to confirm or deny the presence of anyone living in this house and any activity. The S2 needs to identify sources that could provide more information. In this instance, two collection assets were tasked. One was a patrol (CAV Troop); they were tasked with identifying a presence at this location. However, they came back with nothing to report. Secondly HUMINT were tasked with identifying if there were any Saudi Arabians in location by talking to neighbors, etc. These activities resulted with a more detailed report of an activity at that location answering the intelligence gap of whether the report was legitimate by confirming or denying the information.

Targeting. Targeting occurs at the end of ISR planning, the goal of targeting is to answer the 5 W's. If these are not answered completely, then commanders assume even more risk in executing against a target. The S2 continually refines the five W's to gather more information and may have to return to the IPB process to rethink targeting to ensure the effects are truly what is needed to be accomplished. Lastly, updated information may result in rethinking actions.

S2s cycle through the following 2 mnemonics to complete the targeting process. D3A – Decide, Detect, Deliver, Assess. F3EA – Find, Fix, Finish, Exploit, Assess. Additionally, intelligence gaps, those things that are unknown, need to be continually updated. Elaborating on the example above; beyond trying to understand if there was a Wahabist cell, it is important to understand the situation in the city more. For instance, are there any non Shia living in Sadr City? Where do they go to Mosque? Where do they live? Where do they send their kids to school? This could be tasked to HUMINT and / or Civil Affairs. Once HUMINT identifies there is a Wahabist cell, then we must re-task other collectors to answer the gaps which could include understanding more of the demographics and atmospherics of a location. This information would continually be rerouted through the IPB Process.

3.1.4 The role of the S3

Brigade Level S3: Brigade drives all operations: plans and decides priorities for the main effort and supporting efforts. Maintaining situation awareness is critical. The main tasks of the S3 at the brigade level include managing assets, deconflicting assets and requests, and integrating reports between the intelligence and operations communities. Examples of each are provided below.

- Managing assets - Users will request assets, S3 will prioritize and send up the request. The S3 will task the asset and the battalion to monitor for a set period of time at (x) location.
- Deconfliction of assets and requests – S3 prioritizes who can use assets with the support of the S2 recommendations. For example, feed can be used for (x) amount of time but will be needed back during (x) specific threat window. Collaboration between S2 and S3 occurs such that S3 needs an asset to answer Priority Information Request (PIR) and S2 provides the recommendation. Priority is given based upon areas that are considered “hot.”
- Integration of Reports – the fusion cell contributes to the integration of intelligence. In a “targeting” meeting the S2 and S3 decide which company/forces will act.
- Battle Tracking – Operators are required to map the battlespace which involves logging onto different systems as well as calling down to different units.
- Fusion Cell – The commanders priorities are brought together involving many different stakeholders: intelligence, operations, military transition teams (MIT), local national advisors, Foreign Service Officers (FSOs), etc. In this process the S3 provides the plan of action and the S2 provides the rationale.
- Crisis Management

3.1.5 The role of the Battalion Commander

A battalion commander’s duties and responsibilities mainly include maintaining situation awareness and targeting. Maintaining SA includes receiving updates from all companies, both ops and intel. Targeting involves maintaining a targeting cycle (e.g. old targets, new targets, and updates to Priority Intelligence Requirements (PIR). Battalion commanders establish PIRs in three stages: (1) PDSS pre-deployment site survey; (2) Relief In Place Transfer Of Authority (RIPTOA) where many PIR’s are inherited from the previous unit, and (3) the targeting process.

With respect to targeting, battalion commanders are interested in the following questions:

- What is a target?
- What is the effect we want to achieve?
- What resources can make this happen?
- What task needs to be assigned to each resource?

The battalion commander’s has many types of resources including economics (e.g. microfunds for projects like a drainage system), Stryker companies (e.g. soldiers on the ground, aerial assets), Iraqi Army and police (e.g. checkpoints), and communications (e.g. leaflets and posters, radio, situational reports, face to face, and going outside the wire).

3.1.6 The Role of the Brigade Commander

The roles and responsibilities of the brigade commander include:

- Developing the local government (politics)
- Training local forces
- Protecting the local people
- Collecting information
- Protecting VIPs
- Running the war (brigade brings together S1 - S6 vs. division plans tomorrow)
- Tasking battalions to do the fighting

Three threads of needs were identified from the brigade commander's interview: (a) the need to provide a collaboration medium that will prevent groupthink (e.g. prior to collaboration know what ideas are on the table). This should result in many more solutions during collaboration, (b) the need to do 'what if' scenarios within the current operational picture to support SA development and planning, and (c) when working with Iraqi intelligence the need to mask the data source, additionally it is necessary to provide a sanitized map to coalition forces.

3.1.7 Intelligence/Operations Integration Barriers

From the interviews it was concluded that intelligence and operations integration barriers are largely due to the lack of predictive models for complex and interdependent systems. These barriers include:

- Visualization of network interdependencies
- Understanding of command intent at multiple echelons (while everyone is operating on the same campaign plan, different situations occur at different levels requiring different information needs)
- Sharing data with coalition partners
- Creation of multiple views of the same data according to the commander's intent
- The inability to synchronize the rates of technology insertion and technology creation

Lastly, there is a paradigm shift in the Army. A shift from the focus of securing information to moving towards ways to increase the sharing of information e.g. enabling of sharing of humanitarian assistance/disaster recovery information with coalition partners and non-governmental agencies.

3.2 Task 2: Preliminary user workflow and operational relevance evaluation

This section provides a brief description of several features of IMPULSE followed by data collected by end users to include: community specificity (which community intelligence or operations could find benefit from a specific component), operational relevance/task (how would operators use this in the field), and lastly comments from the experts are included.

3.2.1 Forum

Brief Description A forum is developed to be a persistent collaboration space similar to a chat room. It could be initiated either for a specific task or it could be for a group that works together regularly.

Community Specificity This feature could be useful to both the intelligence and operations communities.

Operational Relevance / Task A forum could be used to transfer information to both communities by selecting users.

Expert Comments There would need to be a way for data to be classified according to security level. Additionally, operators would need the ability to have specific information hidden and the ability to exclude certain users.

3.2.2 Search Capability

Brief Description The search capability enables users to search names, videos, and documents. Basically any type of data that can be tagged can be searched.

Community Specificity While both communities would find this feature beneficial, it may need to be customized differently for each community (e.g. need to customize columns by community).

Operational Relevance / Task

Operations: I have x individuals, do they need to be detained? Can I find other alias for these individuals? Did I mishear how their names are pronounced? Or were the names misspelled? Does there a connection with any other alias?

Intelligence: This feature would be beneficial in assisting to eliminate redundancy or cleaning the data.

Expert Comments Users would necessitate an advance search capability. For instance, they would be interested in searching by time; location (latitude and longitude coordinates), etc.

3.2.3 Search Wiki

Brief Description The Wiki component would act as a data repository. Data / information may be updated by other users.

Community Specificity This feature could facilitate collaboration between and amongst the communities.

Operational Relevance / Task Intelligence and operations could potentially conduct concurrent planning using the Wiki feature. For instance they could use a shared map and provide updates.

Expert Comments By providing the username that either initiated or edited the information, community trust/distrust is developed in the fidelity of the information and initiator.

3.2.4 Contact Search

Brief Description The contact search feature enables users to identify degrees of separation between contacts.

Community Specificity Intelligence community

Operational Relevance / Task This feature is necessary for users to be able to identify known relationships and/or suspected relationships.

Expert Comments Users would be able to perform link analysis; when a new character comes into play users can perform a query to better understand the individual's affiliations and relationships to other data. Other important issues to be mindful of include: the data may become overwhelming therefore a filter would be necessary. A history of the data needs to be available to users. Free form versus drag drop results in the need for a customizable model. Lastly there is a need for visualization of this data.

3.2.5 Additional Media

Brief Description Additional media is a repository of a collection of artifacts, pictures, videos, sound bites, word documents, and power point slides.

Community Specificity Intelligence

Operational Relevance / Task Users use a variety of data to build a picture of the operational environment.

Expert Comments Users need the ability to export all media for later use or use by different individuals. Additionally completing a batch download would be helpful and time effective.

3.2.6 Image Tool

Brief Description This feature allows individuals to zoom into an image and tag specific portions of the image.

Community Specificity Intelligence and Operations. This feature in fact would serve to build trust between the communities by intelligence having the ability to share a picture striped of data.

Operational Relevance / Task At the division level it could be used to perform image analysis. At the tactical level it is important to tag a location, person, etc. This can be a useful way to tie in national level imagery.

Expert Comments Ability for free draw should be incorporated.

3.2.7 Video Annotation

Brief Description This feature allows users to select a time in a video clip and add an annotation.

Community Specificity

Intelligence - users can look for specific annotations for their unit.

Operations - folks can annotate or self correct based on eyes on the ground: ground truth.

Operational Relevance / Task This feature would serve two functions: It would serve as instant SA and secondly would facilitate planning.

Expert Comments Users have an interest in seeing updates since they were last logged in; including the author of the updates. Users would also like the ability to rate clips / the use of a weighting schema.

3.2.8 Map

Brief Description This feature allows users to lock on a map so that they can have a shared view with others, but they can still look at their own space. The toolkit includes the typical drawing tools as well as military symbology.

Community Specificity Intelligence & Operations.

Operational Relevance / Task

Intelligence – Users need to be able to distinguish between different events i.e. Ability to identify a car bomb versus an IED vs. a suicide bomb. The toolkit should allow the ability to customize or develop new symbology as the operational threat changes.

Operations – Users would need the ability to export the map that they created e.g. print and go. The map feature could be useful for planning and for situation awareness e.g.

Crisis Management or which route to take based on timestamp of previous IEDs.

Expert Comments Terrain lines and elevation data are critical. Overlay features (e.g. grid overlay) are important so that some information can be hidden or revealed. This feature could be helpful if there was a way to filter a version for Iraqi and Afghan collaboration.

3.2.9 Chat

Brief Description Typical chat interface, can be used as an additional communications channel. Instant communication all users have the same access.

Community Specificity Intelligence

Operational Relevance / Task Generic tasks include getting access to data and requesting information. Additionally, analysts can perform distance collaboration.

Expert Comments Users would need customizability e.g. including or excluding users (selectivity).

3.2.10 Storyboard

Brief Description This feature is designed to be a briefing package.

Community Specificity Operations.

Operational Relevance / Task It could be used to show the commander where an Explosively Formed Penetrator (EFP) strike occurred. This feature could potentially be used in the fusion cell. Additionally, both battalion and company level could get on impulse to update information. The platoon leader would need a mobile device and the FSO could be able to print and take the information digitally. Lastly, if insurgency units move, other users could update the information; more real time.

Expert Comments A handheld version would be beneficial depending on how quickly the tool can update information.

3.2.11 File Manager

Brief Description This feature allows users to manipulate data e.g. move data, share within system, & export.

Community Specificity Relevant to both the intelligence and operations users.

Operational Relevance / Task Information sharing.

Expert Comments

3.2.12 ISR Synchronization matrix

Brief Description *At the time of the workshop, this tool was still under concept and software development.*

Community Specificity Intelligence and Operations collaborating in managing and re-routing assets to support ground forces.

Operational Relevance / Task Supports the asset collection manager in determining which assets are available.

Expert Comment Users would need to be able to export the plan similar to an operational order.

3.2.13 PIR Manager

Brief Description *At the time of the workshop, this tool was still under concept development.*

3.3 Task 3: Operational Scenarios

Following interviews with experts, and demonstration of the features of Impulse, we were able to identify two potential scenarios that could be used to stress the system. They are briefly documented below and would need to be further refined to be used in collaborative data collection.

3.3.1 Operational Scenario 1: 24 hours in advance a change of route needs to occur for a VIP.

Currently operators use the following tools to perform missions. They use Adobe Breeze to share docs and do sense-making. This tool allows commanders from anywhere to work together and interactively mark up a map. They can recognize which user is editing the map

based on which computer they are logged into. They would normally use ppt to draw; use breeze to talk; use Command Post of the Future (cpof) or Tactical Ground Reporting Tool (TIGR) to get IED information.

3.3.2 Operational Scenario 2: Using snap shot of feed.

VIP left the group and went thru a checkpoint, but did not have an interpreter. Impulse could be used to complete battle space zoning, issue a task, and view routes. Because Blue Force Tracker is too delayed, incorporating a feed could make the data used for planning and SA more real time.

3.4 Task 4: Exploratory Usability Testing

The tool was demonstrated to five end users (four intelligence officers and 1 operations officer). Three software developers were present as well as two human factors professionals. This exploratory usability session served three main goals.

1. To identify potential tasks end users could potentially complete in future formal usability testing.
2. To expose end users to the tool
3. To expose to software developers potential mismatches between the mental model of the user and the conceptual design of Impulse.

Following a brief show and tell, users were asked to complete the following tasks:

1. Create a forum
2. Perform a search for an individual of interest
3. Perform a contact search
4. Add icons to a map
5. Add a map to a story board
6. Develop a wiki
7. Delete an image
8. Add a new slide and remove a slide
9. Icon recognition
10. Import and export files from desktop machine
11. Share a file
12. Lock the map

This exploratory evaluation simply allowed end users and developers to talk one on one regarding what the end users wanted to do and how they wanted to do it. Using a talk aloud methodology developers were able to see potential gaps in the mental model of the end users and the conceptual model of the system. Additionally various items were noted that required several clicks, particularly on high level important tasks. Thus reducing end user clicking for critical tasks is an important design need. Formal error rates and response times will not be reported here because this exploratory evaluation served more as a demonstration than actual usability

testing.

4.0 NEXT STEPS

Lastly, this report serves to outline the next steps involved in raising the technology readiness level. This begs the question what does technology readiness look like? First and foremost, Impulse will support the lack of interoperability between tools by being a real time collaborative tool. An additional goal is to support the disadvantaged user thereby running on a handheld. The tool should be able to resynchronize when users are back in the net. With respect to cross echelon functionality, the levels envisioned to be supported include brigade, battalion, company, and squad, e.g., a reduced set of capabilities that would support a user in their patrol area i.e. at squad level. Serious consideration and ultimately research needs to be conducted to support the requirement of a common look and feel across echelons and communities given different classifications of end users are responsible for completing different tasks in different ways. It may not be the case that a reduced set of capabilities well supports an operator at x echelon. Lastly, a major security issue in collaboration is what information and how much information is too much. Therefore the tool needs to address the possibility of developing a cut line e.g. information may be shared by publishing to a public forum, but data will be ripped at a specific level of classification.

Technical Approach

Specifically, military user assessments are needed as well as an evaluation of how the tool may be used operationally. This will be accomplished by the following tasks

1. The following tools will be provided to USMA for usability testing starting in August:
 - a. IMPULSE
 - b. ISR Enterprise
 - c. Planning tool (potentially)
 - d. Stripes (potentially)
2. USMA will visit software developers and software developers will kickoff the usability testing by presenting their tools to the class in September.
3. Elicitation of operational relevance will be conducted by the use of 1-2 minute voice video scripts provided by software developers and used by USMA with military experts at various levels.

4. A Cooperative Agreement between USMA and CERDEC will be completed by the end of the calendar year to outline future work and funding requirements.

These activities may help to answer questions regarding:

1. Ease of use: does this match user workflow? Are there too many windows? Clicks?
2. Enhancements to various features or modules: Based on shop or echelon what tasks do operators need to do? Specifically the ISR module.