Command and Control Automation – MIP and MSC2 FOSC

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Abstract

The Multilateral Interoperability Program's work has been the a great leap forward in the coalition arena just as the Multi-Service Command And Control Flag Officer Steering Committee's work has been instrumental in bringing the Services together to discuss tactical interoperability and work to solve the hard problems. One of the most interesting aspects of these two undertakings has been the method of defining C2 requirements. The service tradition of working Service requirements first, then joint requirements, and finally multinational requirements is a long-standing sequential process that mimics the implementation process. Through these two efforts it is clear that this long practiced sequence is a questionable method for producing true interoperability.

Multilateral Interoperability Program

Background

The Multilateral Interoperability Program or MIP was created in April 1998. It is a multilateral initiative to automate C2 in such a way that it facilitates the ground commander and his staff's accomplishment of the execution of their combined mission. MIP is more than just a set of slides but rather a maturing automation solution on the verge of implementation. The goal is to deliver an automated mission essential C2 capability into the hands of the warfighters as soon as possible.

There are six full MIP member nations (Canada, France, Germany, Italy, United Kingdom, United States) that signed the MIP Tactical C2IS Interoperability Requirement on 25 October 1999, and agreed to a C2 interoperability requirement. The fact that we can get six countries to agree to a single automated C2 requirement is no small achievement. It indicates that as we peeled back the basic C2 requirement, we realized

we had much in common as partners and could agree to a common way ahead in implementing requirements. In fact, the more we interact, the more we gain in a common doctrinal understanding, which is the basis for a successful implementation.

MIP's Aim

MIP's fundamental aim is to automate C2 at the multinational tactical level with the intent of improving situational awareness (and subsequently situational understanding) by the commander and staff by achieving international interoperability of Command and Control Information Systems (C2IS) at all levels from corps to battalion, or lowest appropriate level. This is done in order to support multinational, combined and joint operations and the advancement of digitization in the international arena, including NATO. The concept of operations, or process by which this is done is called the MIP Solution.

It is important to remember that the MIP Solution does not stand alone. In fact, unless the MIP Solution is integrated into the operational user's National Command and Control Information System (C2IS) and has national communications connectivity, the MIP Solution is a worthless study in standardization.

The MIP Solution is scoped to information flow in a command, support, or proximity relationship. If we get this solution right, MIP coupled with the national C2IS will allow both vertical and horizontal SA flow. For example, a Canadian Battle Group C2 system may plug directly into a US Brigade C2 system (MCS) and automatically exchange routine, structured C2 information. Likewise, an Italian Battle Group could exchange SA information laterally with a Canadian Battle Group, these units share a flank. The MIP Solution essentially automates selected parts of the Operations Order

(OPORD) to enable situational awareness (SA) and sets forth operational rules to automate routine SA information within the context of multilateral operations.

The MIP is not a NATO program. It is a multilateral one that seeks a near term implementation. However, MIP has leveraged NATO Land Group 1 (LG/1) documents, as our baseline. MIP paid particular attention to the LG/1 Framework Paper annexes A&B where horizontal and vertical flows were tailored to their automation suitability. This is of significant importance because normal routine numeric-based information (overlays, SA, control measures, etc.) is more appropriately sent through structured channels (level 4&5) as opposed to unstructured exchanges (intent based information in face to face meetings, LO, VTC, FTP, e-mail, etc). These annexes validated our own MIP conclusions as to what information to automate through the level 4&5 mediums. Additionally, we are submitting change proposals to NATO organizations. The MIP Solution must not become another stovepipe solution if it is to be effective.

Liaison

Automation is well suited to handle routine structured information, and when correctly implemented, permits the operator to return their focus to those tasks the computer does not handle well - intent or the art of war. The MIP requirements development process, from the identification of the operator's routine SA functions through conceptual data and information definitions, identified and isolated the routine tasks that lend themselves to automation.

The capture and validation of multinational requirements in support of liaison and defined in the automated process of the national C2IS is therefore vital as a first step in gaining interoperability among multinational coalitions. The second step of the process,

separating requirements into what can be automated and what can not, ensures that the computational power of the C2IS can be appropriately leveraged.

The primary functions of the liaison officer are to relay the commander's intent which are non-routine in nature and not easily adapted for either message or transaction processing. However, routine tasks handled through automation will complement the execution of duties of the liaison officer. Routine SA tasks, such as control measures identification, position location reporting, and organizational status handled through liaison channels are suitable to automatic processing. Therefore, automation of routine liaison tasks will significantly reduce the burden on the liaison officer (LNO) and improve accurate command and control (C2) SA data exchange. This is especially true when the spoken language among the LNOs is not common and the introduction of errors is likely.

MIP's Solution

MIP remains focused on the essentials because automated data transfer technology does not support the full range of C2 well - we only selected those routine, structured, non-intent processes to automate. Our data elements number about 100 … nothing close to the 17,000 data elements in the DoD Data Dictionary System (DDDS). A characteristic of the MIP Solution is to keep the requirement essential and simple. We want to ensure that our MIP Solution is effective and efficient. We have identified 14 common functions in our C2 requirement, from maneuver, key terrain, … to weather and civil military operations. We want to produce a solution that can be operated by the soldier in the field. The initialization of the MIP Solution and movement of SA data, for example, is meant to be fully automatic when mature. Ultimately, we need a solution that

soldiers can easily train to and is consistent with our doctrinal guidelines and user requirements.

There are issues that remain. Security is a concern. MIP has established a sub-group under a separate working group to investigate possible solutions. Communications has been isolated from the MIP Solution and is a national responsibility. When applicable, the MIP Solution uses STANAG 2101 principles to govern the logical flow of information. These principles are also consistent with US doctrine (higher to lower; left to right; supporting to supported), and are implemented when a command, support, or proximity relationship exists.

MIP has two, closely interrelated phases. Phase 1 objectives are to develop an improved, fieldable formatted message capability supporting vertical and horizontal interoperability by 2002. Phase 2 objectives are to define and develop a fieldable, automated data exchange capability supporting vertical and horizontal interoperability by 2005.

The MIP schedule is ambitious but achievable. We do expect difficulties as, in essence, we are evaluating both the art and science of command and control, i.e., does situational awareness as automated by the MIP Solution lead to situational understanding. At this time, our main effort to ensure that we get the technology or science part right (data, structures, & rules). The operational tests will evaluate whether we‘ve been successful in conveying “understanding“ to the operational user.

The goal is to concurrently demonstrate both the Phase 1 (Messaging) and the Phase 2 (Data Exchange) functionality by the end of 2001. The purpose of the Phase 1 operational test is to make a fielding decision. The Phase 2 demonstration will be a

feasibility or proof of concept demonstration to prototype database replication. The MIP Phase 2 proof of concept will be conducted during a combined field test & demonstration.

The common glue that makes the MIP Solution successful to date is the adoption of common data and operational rules. In addition to the data mappings from the MIP Solution into national C2ISs, MIP operational working group members are concerned with the rendering of a consistent common picture across the multinational domain. The MIP requirement also includes operational rules that have been agreed to by the six MIP nations. These operational rules include data ownership rules for passing information and aggregation; a minimum display requirement (1 up, 2 down, and to the flanks), acknowledgement, incremental updating, and information permissions. In the final analysis, the success of the MIP Solution does not depend on whether the data is shipped by message or data base transaction or XML; the data requirement is independent of the medium.

MIP's Test Objectives

Nothing drives implementation like a mark on the wall. The MIP community feels the schedule is ambitious but achievable. Our aim is to deliver a product to the user sooner than later … so here are our initial measures of success.

The specific MIP Test Objectives are to demonstrate that the Solution meets the operational requirement, demonstrate the initialisation of the order of battle, transfer situational awareness, modify the task organization (add/delete units) and demonstrate deployability (warfighting - MOOTW).

These test objectives are also our measures of success. MIP initially focused on the execution of the mission, automating routine SA data and applying operational rules to national C2ISs for a consistent understanding of the common picture. The operational test will evaluate the size of the delta in applying automation to the stated MIP requirement (MIP Mission Essential Capability (MEC)).

An important part of the MIP Solution is to initialize the order of battle electronically. The commander needs to know the forces assigned, and while this is information in the OPORD and well understood by the analog human process, it is not a trivial process for C2 nodes to understand their position in the command hierarchy. In Phase 1 the test will initialize the Order of Battle from pre-loaded software. An automatic initialization may be attempted in Phase 2.

The operational test for MIP Phase 1 will take place in Munster, Germany. The German host will be the 9th German Panzer Regiment. The aim of the test as stated earlier is to measure the attainment of MIP goals. In certain respects, the operational test will be limited. The test will not be in a field environment. The execution will not, in all circumstances, employ liaison - but only render the MIP Solution under a communications watch. However, the essence of the first operational test is to focus on the data exchanges and understand how the operational rules are applied by national C2ISs to create a consistent common picture across the scenario domain. The test then will acknowledge that we're off to a fast start if we get over the first three hurdles of initialization, situational awareness, and task organization. From that standpoint, the MIP scenario is more a technical driver than a realistic operational scenario. That is exactly the point we want to make: to get the data, data flow, and rules right. As we gain

confidence that the MIP Solution is maturing, we will make the scenarios more realistic. Today, the scenario is aimed at proving out initialization, SA, and task organization in the execution phase of the mission. More will come later in Phase 2.

The MIP Solution by itself (a data interface standard) is not sufficient. The MIP Solution (data standards & operational rules) must be integrated in each nation's C2IS. The MIP operational test results are an important indication of the maturity of the MIP Solution as well as the national C2ISs to handle the MIP Solution's interoperability interface standard and operational rules.

Multi-Service Command And Control Flag Officer Steering Committee

Background

Each US Service has "stovepipe" systems that do not pass information in a Joint environment. These systems were developed for certain, specific missions, not originally intended for interoperability. Consequently, many of these systems do not readily communicate or share information with other systems. Information that is exchanged often does not meet the real-time information requirements of commanders.

The Multi-Service Command And Control Flag Officer Steering Committee (MSC2 FOSC) was formed to consider issues concerning these impediments to multi-service C2 interoperability. The MSC2 FOSC will also review Joint operational concepts, inter-service requirements, and other pertinent issues that may be part of the solution and agree upon a solution leading to seamless, Joint, command and control systems. The forum provides an opportunity for open, frank discussions and information exchange on "operator-to-operator" C2 issues affecting the joint Services in order to

collectively eliminate duplicative systems and move toward a compatible C2 arena. The MSC2 FOSC is completely un-funded and is a voluntary effort between the Services.

As chartered, the MSC2 FOSC membership is composed of the senior Flag Officer responsible for Combat Developments for each Service. It is their responsibility to provide input to the other FOSC members on their Service's point of view and assist by directing resources to solve joint interoperability problems. Members voting members of the MSC2 FOSC are:

- US Air Force: Commander, Aerospace Command and Control & Intelligence, Reconnaissance, Surveillance Center Commander (AC2ISRC/CC);
- US Army: Deputy Chief of Staff for Combat Development (DCSCD, TRADOC);
- US Navy: Director, Space, Information Warfare, Command and Control, N6;
- US Marine Corps: Commanding General, Marine Corps Combat Development Command (CG, MCCDC)

In addition to these members, key participants from the Joint community provide input to the FOSC members and other participants on their point of view and assist by directing resources to solve joint interoperability problems. They include:

- Director, Intelligence and Information Operations Center, SOCOM;
- Director J-6, Joint Forces Command;
- Director J-7, Joint Forces Command;
- Director J-8, Joint Forces Command;
- Director, Joint Theater Air and Missile Defense Organization (JTAMDO);
- Flag-level Joint Staff Representatives from J3, J6, J8;
- DISA

It is not the intent of the MSC2 FOSC Flag Officers to exclude any organization with an interest in deliberations. Any DoD organization is welcome to participate in the FOSC activities.

Each Service's responsibility is to articulate Joint interoperability issues in preparation of the FOSC deliberations. These issues are then screened by an appropriate

O-6 level review board (OAC) prior to being forwarded to the Flag Officers for consideration as an MSC2 FOSC project. Once a project is selected, the Flag Officers designate a Service lead and directs that an Operational Working Group (OWG) convene to develop warfighter requirements and proposed solutions to the problem.

To date, the FOSC has been very successful. They directed the formation of a Close Air Support (CAS) OWG which developed 35 information requirements and 168 information exchange requirements for CAS Execution. Additionally, this OWG developed as initial high-level Operational Architecture, initial draft of the Interim Joint CONOPS for CAS Data Link and the shell for a Tactical Data Link Gateway ORD. This ORD was further developed and is currently at the Air Force Requirements Oversight Committee (AFROC) for review.

FOSC Focus

It is recognized that making individual systems interoperable may not necessarily increase their individual performance; however, that is not the goal. Rather, the goal is to increase the aggregate effectiveness of all C2 systems acting in concert . The foundation for such improved effectiveness lies in the ability of systems to readily and directly exchange relevant information without third party systems or translators.

Ground Force-Level Control

The second issue that the FOSC is pursuing is the Ground Force-Level Control (GFLC) problem. Like the MIP, the FOSC's GFLC OWG seeks to automate the routine C2 information that will streamline the liaison process and enhance situational awareness required for all operations. There is currently no Joint system that provides this

information in an automated form at the tactical level. Additionally, ground information requirements supporting Joint interoperability are not specified in Joint documents.

The mission of the OWG is to develop a method for automating the exchange of blue ground situational awareness data in a joint environment in order to achieve interoperability at the tactical level; in short, automate the liaison process. The information on which the OWG will focus can be generalized for simplification by answering these questions:

- Who am I?
- Who are you?
- Where am I?
- Where are you?
- What do you plan to do?
- What is your operational capability?
- Will the current or future weather effect your plans?

This problem was scoped to developing the tactical information requirements of the view of the friendly ground commander's battlespace. The focus is on "what" information must be passed (not the "how") based on aggregated information with a known precision and accuracy. Technical connectivity is not being considered.

The Army, under the direction of the TRADOC Program Integration Office for the Army Battle Command System (TPIO-ABCS) was selected as the lead agency and the GFLC plan was broken into multiple Phases. In order to accomplish this undertaking within the FOSC's limited resources, the OWG was able to use the foundational work of the MIP to develop the Concept of Operations (CONOPS). Once this was presented to the FOSC, the Flag Officers approved the CONOPS and decided to pursue the development of the next level of detail. Again, the OWG sought the expertise of the MIP personnel for recommendations on the data model to select, the information requirements

which will be the guide for selecting the UJTL tasks from which to begin the trace. When the IRs are completed and the data model selected, the OWG will begin mapping that data to the model.

With the completion of the MSC2 FOSC OWG work, the implementation will begin. The current plan calls for placing the Service approved requirements into the appropriate documents of the respective C2IS systems of each Service. There are other agencies that are interested in using the FOSC products to fulfill different requirements. For example, OSD (C3I) believes GFLC products may be useful to the US Army's Maneuver Control System C2 system and USMC's Tactical Combat Operations C2 system convergence program.

We believe that the FOSC GFLC work is a great step forward in the development of situational awareness for not only the ground commander but also other Components that require knowledge of the ground commander's battlespace.

Conclusion

The MIP work has been the a great leap forward in the coalition arena just as the FOSC work has been instrumental in bringing the Services together to discuss tactical interoperability and work to solve the hard problems. One of the most interesting aspects of these two undertakings has been the method of defining C2 requirements. The service tradition of working Service requirements first, then joint requirements, and finally multinational requirements is a long-standing sequential process that mimics the implementation process. We have learned through these two efforts that this sequence should be reversed, or at least concurrent. Concurrent requirement determination would enable establishment of joint and multi-national requirements as the core of service

requirements. This would facilitate not only Service, but Joint and multi-national interoperability as well, fostering true interoperability without the expense of redefining requirements.