# Use of Simulations in Support of the Multi-Sensor Aerospace-Ground Joint ISR Interoperability Coalition (MAJIIC) Project

**Mr. Thomas Kreitmair and Ms. Diana Norgaard**
NATO Consultation, Command and Control Agency
Oude Waalsdorperweg 61
2597 AK The Hague
Netherlands

Email: thomas.kreitmair@nc3a.nato.int / diana.norgaard@nc3a.nato.int

## *ABSTRACT*

*The Multi-sensor Aerospace-ground Joint Intelligence, Surveillance and Reconnaissance (ISR) Interoperability Coalition (MAJIIC) project is a multinational effort to maximise the military utility of surveillance and reconnaissance resources through the development and evaluation of operational and technical means for interoperability of a wide range of ISR assets. To test, verify, and refine developed ISR capabilities, the MAJIIC has conducted several technical and operationally focused exercises. In these exercises, simulations played a significant role by providing ground truth data and representing ISR sensors that collect the scenario information. This paper will provide an overview of the MAJIIC simulations and their roles in the most recent exercise. The efforts made to improve interoperability and reuse between the electro-optical sensor simulations for this exercise will also be discussed.*

## 1.0 INTRODUCTION

The Multi-sensor Aerospace-ground Joint Intelligence, Surveillance and Reconnaissance (ISR) Interoperability Coalition (MAJIIC) project is a follow-on to the Coalition Aerial Surveillance and Reconnaissance (CAESAR) project, and was established by nine NATO nations: Canada, France, Germany, Italy, Netherlands, Norway, Spain, United Kingdom and the United States. The NATO Consultation, Command and Control Agency (NC3A) acts as the facilitator for the project and provides overall technical management.

The primary aim of MAJIIC is to improve the commanders' situational awareness on the battlefield through collaborative use of interoperable ISR sensor and exploitation capabilities. To achieve this, MAJIIC addresses interoperability from the following perspectives:

- Operational, including development and demonstration of concepts of employment (CONEMP) and tactics, techniques and procedures (TTP) for collaborative employment and use of coalition ISR assets in support of military missions;
- Architectural, including development of procedures and technology for sharing ISR data and information, system architecture design principles, tools and technology for collaboration, and tools for managing coalition ISR assets; and
- Technical, including definition and development of key data formats and protocols for the various sensor and data types, tools to support common geo-registration, and data exploitation.

Kreitmair, T.; Norgaard, D. (2007) Use of Simulations in Support of the Multi-Sensor Aerospace-Ground Joint ISR Interoperability Coalition (MAJIIC) Project. In *Improving M&S Interoperability, Reuse and Efficiency in Support of Current and Future Forces* (pp. 7-1 – 7-12). Meeting Proceedings RTO-MP-MSG-056, Paper 7. Neuilly-sur-Seine, France: RTO. Available from: http://www.rto.nato.int.

The MAJIIC organizational structure reflects these various perspectives of interoperability. A management team consisting of a representative of each MAJIIC nation and the NC3A Technical Manager provide guidance and planning for the project. Personnel from the participating nations and NC3A form the operational, architectural and technical working groups whose efforts are coordinated with each other.

In preparation for a live-fly exercise scheduled for September of 2007, the MAJIIC project has conducted a technical interoperability experiment (TIE) and two operationally-focused simulation exercises (SIMEX). The most recent exercise, held between February and March of 2007, combined the TIE and SIMEX into one exercise called MAJEX07. The objectives of the exercise were to allow testing of technical interoperability, development of architectural concepts for the ISR assets, and training of military operators to plan, task, and manage ISR assets in a coalition. The exercise spanned over a period of four weeks. The first week involved about 40 people and was used for set up of equipment and to test connectivity. The second week involved about 90 people for technical and architectural testing. Operator training involving about 140 people occurred on the third week. The full operational exercise was conducted in the final week, involving about 100 people. Simulations were used in all phases as it provided the training and operational environment for the exercise.

Various results were obtained from MAJEX07, including:

- Experience collected on the evaluation of various sensor simulations for compliance to various NATO Standardization Agreements (STANAGs);
- Relevance of scenario for testing and evaluation of CONEMP and tactics, techniques and procedures (TTP) for Joint ISR at various levels of command; and
- Analysis of benefits and savings obtained from sharing of three-dimensional terrain databases and model sets for the electro-optical (EO) and infrared (IR) sensors.

This paper will discuss the simulation architecture for MAJEX07, and summarize the findings relevant to improved modelling and simulation interoperability and reuse to support the coalition from a joint ISR perspective.

## 2.0 MAJIIC SIMULATIONS

Two types of simulations were used in MAJEX07: scenario generation simulations, and MAJIIC sensor simulations. The first type of simulation was used to generate the scenario truth, or to stimulate the sensor simulations. The second set of simulations consisted of a variety of simulated aerospace ground surveillance & reconnaissance (AGS&R) platforms that produced ground moving target indicator (GMTI) data; synthetic aperture radar (SAR), EO, and IR imagery; and electronic warfare support measure (ESM) data. Additionally, artillery hunting radar (ARTHUR) simulations were used to determine artillery firing and impact positions. The AGS&R platform simulators access data generated by the scenario generation simulations and produce representative sensor products which were transmitted to other platform simulators, exploitation stations, and command and control (C2) systems.

### 2.1 Scenario Generation Simulations

The overall scenario and detailed vignettes for the exercise were provided by the MAJIIC operational working group. The operational working group defined the processes against which the CONEMP and TTP would be tested against. The scenario for MAJEX07 spanned over five consecutive days of operation, at six hours per day in real-time. The scenario was situated in North-Western Poland stretching over an area of about 160 x 200 km, including parts of the Baltic Sea. The scenario consisted of peace-keeping missions that included multiple vignettes with a defence against terrorism aspect. The vignettes dealt with arms trafficking, improvised explosive devices, the taking and freeing of hostages, and more. The scenario used for the operational execution segment of the exercise was also used for the technical integration and training segments of the exercise.

There were three scenario generation simulations used in MAJEX07: the Joint Conflict and Tactical Simulation (JCATS), the Flexible Analysis Modelling and Exercise System (Flames®), and the Airspace Control and Operations Trainer (ASCOT®). JCATS served as the primary stimulator, with approximately 2200 entities, modelling all ground entities, as well as a few aircrafts and vessels. The ground units had regular opposing forces, own forces, terrorist teams and civilians. Most force movements and artillery firings in JCATS were pre-planned with minimal operator intervention. The Flames modelled majority of the air traffic, mainly in pre-planned air missions. There were roughly 200 air platform entities of which about 40 were airborne at any given time. ASCOT produced electromagnetic emissions of the various emitters in the scenario, such as fixed ground-based radars for coastal and airspace surveillance, for mobile radars associated with SAM, artillery locating radars and weather radars. ASCOT was also used to control air missions dynamically, when the commanders at various levels ordered air operations over targets. The division of labour was necessary, as no single one of the scenario generation simulators could provide all sensor input and dynamic re-tasking for vehicles and aircraft. There was a certain effort required to keep the three simulators synchronized.

Given the objectives for the exercise, it was possible to pre-define majority of the scenario ahead of time with detailed planning and consideration for the dynamic aspects of the scenario. The force-against-force scenario required little to no flexibility. Only one operator was required to start and monitor JCATS and Flames throughout the exercise. On-demand artillery firing requests in JCATS were handled by one operator. Dynamic air missions in ASCOT were performed by two additional operators. JCATS Coyote reconnaissance missions also required an additional operator to control eight vehicles. The scenario generation simulators were also co-located with exercise control in the white cell to enable smooth communications.

## 2.2 Sensor Simulations

The sensor simulators received the ground truths generated by the scenario generation simulations and produced representative sensor products which are transmitted to other platform simulators, exploitation stations, and C2 systems. Table 1 lists the 16 different sensor simulations used during MAJEX07. Some of the sensors simulated operational systems (i.e. JSTARS) while others simulated generic systems.

The “Sensor Class” column identifies the types of sensors the system is capable of simulating. These sensor types are GMTI, SAR, EO, artillery location, and ESM.

The column “STANAG” references the STANAG and its implementation guide to which the sensor simulation product has to be compliant. The use of STANAGs enables interoperability between all applicable systems by allowing ISR data of a sensor class to be exchanged between various users. For example, during MAJEX07, a French tracker system was capable of using GMTI produced by a US sensor and an overlapping UK sensor. The track products of the French tracker were then displayed on a Norwegian information system, overlapping a US SAR image. STANAG 5516 covers the Link 16 format messages that were used to report the locations of identified emitters or artillery positions. STANAG 4607 describes the GMTI format. SAR results and EO or IR images were reported as STANAG 4545 images. STANAG 4609 describes the data format for motion imagery products.

All STANAGs mentioned here (and their associated Allied Engineering Documentation Publications (AEDPs) which provide guidance for the implementation) are listed in the References section.

**Table 1: MAJEX07 Sensor Simulations**

| Sensor simulation | Nation | Sensor Class | STANAG |
|---|---|---|---|
| Airborne Warning And Control System (AWACS) Mission Simulation (AMS) | USA | ESM | 5516 |
| ARTHUR | NOR | Artillery location | 5516 |
| ASTOR | GBR | GMTI, SAR | 4607, 4545 |
| Aurora | CAN | EO | 4545, 4609 |
| COSMOS/SIDM MALE Unmanned Aerial Vehicle (UAV) | FRA | GMTI | 4607 |
| Generic UAV | NC3A | EO | 4545, 4609 |
| Global Hawk | USA | GMTI, SAR | 4607, 4545 |
| Hélicoptère d'Observation Radar et d'Investigation sur Zone (HORIZON) | FRA | GMTI | 4607 |
| Joint Surveillance Target Attack Radar System (JSTARS) | USA | GMTI, SAR | 4607, 4545 |
| Opale Sensor Simulation | DEU | EO | 4545, 4609 |
| SIMLAB (Radarsat, Coyote) | CAN | GMTI | 4607 |
| Tactical UAV simulator | NLD | EO | 4545, 4609 |
| Tactical UAV simulator | GBR | EO | 4545, 4609 |
| U2 | USA | GMTI, SAR | 4607, 4545 |
| VideoSIM | USA | EO | 4545, 4609 |

## 2.3 DIS Filtering and Monitoring

Distributed Interactive Simulation (DIS) was used as the interoperability protocol for all simulations. During a simulation exercise, the DIS traffic is generally recorded and monitored for load and compliance against IEEE Standard 1278. During one of MAJIIC's previous exercises, where the scenario contained about 14,000 entities, it was determined that the DIS traffic consumed much of the bandwidth of the Confederation of Battle Laboratories Network (CFBLnet). The CFBLnet connects NC3A to Langley, Virginia, USA where some of the sensor simulations were located. The DIS traffic to Langley alone consumed roughly 75% of the bandwidth, allowing very little capacity for the sensor products to be transmitted back and forth between NC3A. To overcome this limitation of the bandwidth, NC3A developed a DIS filtering software which forwarded to Langley only the traffic that fell within their sensor simulations' geographical area of interest. The filter successfully reduced the DIS traffic on the CFBLnet to 40% of the remote connection capacity.

Although the scenario size was significantly reduced for MAJEX07, filtering of DIS traffic also proved beneficial for sensor simulators with EO sensors. EO sensors have a relatively small area of observation. Therefore, computational power is often wasted in identifying targets within their field of view if the scenario contains large number of entities. Without filtering of the DIS traffic for these simulators, their performance and ability to successfully participate in a MAJIIC exercise are compromised. Therefore, sensor simulations with a small area of interest receive filtered DIS traffic. Sensor simulations with a large area of interest receive all DIS traffic.

## 2.4 Role of the Simulations in the Overall MAJEX07 Architecture

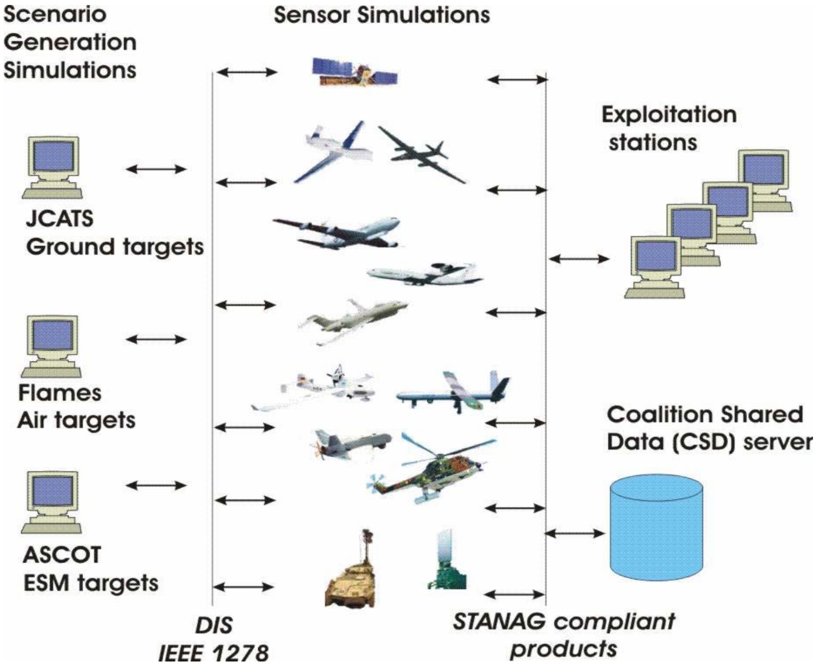


**Figure 1: MAJIIC architecture**

The scenario generation simulations produce ground truths for the sensor simulations in the exercise. In turn, the sensor simulations produced products which were used by 20 sensor ground stations, exploitation stations, and C2 stations. A Coalition Shared Data (CSD) facilitates the exchange of data between the imagery producers and users. The Figure 1 shows the overall architecture of the MAJEX07 exercise. The three scenario generation simulations and the 16 sensor simulations were connected via DIS protocol. The various sensor simulations communicated with the exploitation stations and the CSD, following STANAG protocols.

The CSD is an implementation of the NATO Standard ISR Library Interface (NISLI), STANAG 4559. It is a central collection point of all ISR data, original and exploited. The CSD can disseminate ISR data to C2 or intelligence systems, or users can subscribe to data from the CSD. All CSD entries use metadata, such as time tags and geo-references, for fast search and subscription mechanisms.

Four countries provided their national representation of a CSD in MAJEX07. Nineteen exploitation stations were used for tracking based on GMTI, imagery analysis, or combining of products from various sensor classes. Most of the exploitation stations produce air reconnaissance intelligence report in the format of STANAG 3377 and 3598. These two STANAGs consolidate forms for reporting and presenting intelligence information derived from air reconnaissance and sensor imagery. The connection to the C2 systems was demonstrated with the latest version of the NATO-wide integrated C2 (ICC) capability for air operations. The interface to intelligence systems such as the Battlefield Information Collection and Exploitation Systems (BICES) will be tested during an exercise in September 2007.

The use of STANAGs is critical to the interoperability between the various NATO systems. For each STANAG used, tools are available to check the format compliance of products produced by the sensor simulation or the exploitation systems. For the sensor simulation, samples of their products are collected well in advance of an exercise to test for format compliance and to share with other MAJIIC participants for their testing purposes.

## 3.0 RELEVANCE FOR TESTING OPERATIONAL CONCEPTS

One of the key questions is whether or not a simulation exercise is relevant for testing of operational aspects such as CONEMP or TTP documents. The MAJIIC community produces a CONEMP, which will be used by Supreme Headquarters Allied Powers Europe (SHAPE) to develop Concepts of Operations (CONOPS). MAJIIC had a pre-cursor project CAESAR. Based mainly on CAESAR documents, MAJIIC expands and refines documents covering ISR architectures, CONEMP, TTP and special aspects such as theatre collection management (TCM). A list of documents covering these issues is provided in the Reference section.

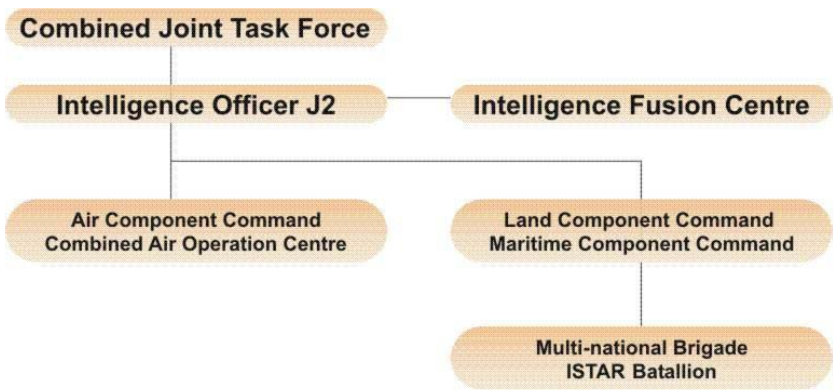


**Figure 2 - Military Structure of MAJEX07**

The military structure of MAJEX07 is shown in Figure 2. A Combined Joint Task Force (CJTF) was represented by exercise control and the white cell, with a key role for the intelligence (J2) officer and staff. Below CJTF, the air component command (ACC) and the land component command (LCC) were represented, with a small maritime component within the land component command. Below the LCC, an intelligence, surveillance, target acquisition and reconnaissance (ISTAR) battalion provided a multi-national brigade (MNB) with ISR products.

During the training and operational week, all positions were occupied by experienced military operators provided by the MAJIIC nations. A wide variety of ISR related management and C2 tasks were executed at various command levels. For example, the ACC was represented by a combined air operation centre (CAOC) as seen in Figure 3. The ACC collection manager and the ACC intelligence officer were supervising liaison officers for the various sensors such as NATO Airborne Early Warning (NAEW), JSTARS, Global Hawk, U2, and the Dutch Tactical UAV. A cell for time sensitive targeting (TST) with seven positions was manned by CAOC 2 operators. The TST cell used the latest version of NATO-wide ICC capability for air operations.. The Air C2 component was tasking in real time air missions against targets for reconnaissance or engagements. Four exploitation systems were providing ISR products, of which two were located at Langley, Virginia, USA.

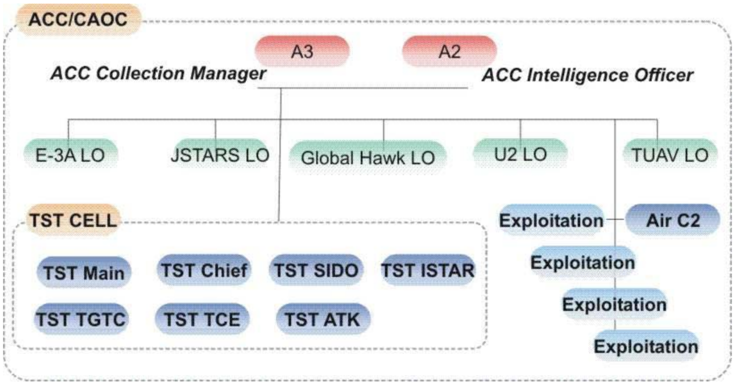


**Figure 3 - ACC CAOC Command Structure**

The scenario selected contained sufficient operational challenges for the military operators to react with dynamic tasking or cross cueing of ISR assets. The tasks, executed by experienced military operators, covered collection coordination, intelligence requirements management (CCIRM), intelligence preparation of the battlefield (IPB), support to target nomination and engagement, as well as support for battle damage assessment (BDA). The procedures applied and the results obtained were documented and evaluated. Findings from the simulation based exercise thus far are being considered relevant for real operations. The use of MAJIIC assets, concepts and techniques will also be tested in a live exercise in September 2007.

**Figure 4 - Cell Conducting Time Sensitive Targeting**

## 4.0 IMPROVING REUSE BETWEEN EO SIMULATIONS

The previous sections have summarized how the simulations support the larger MAJIIC initiative. This section will provide an example of cooperation at a lower level that aimed to improve reuse and efficiency of simulations used for MAJIIC. Specifically, this effort was made by the various simulation teams that supported the six EO sensor simulations during MAJEX07. Although the specific air platforms and sensor capabilities of the EO sensors were different, each sensor simulation required a three-dimensional terrain database, populated with models of aircraft, ships, vehicles and life forms. Consequently, an attempt was made to reduce the overall effort and cost associated with preparing these simulations by developing a commonly shared terrain database and model set. The result was not only savings in cost and effort, but improved realism obtained through consistency between the imagery products from the different simulations.

## 4.1 Terrain Database Development

Three-dimensional terrain databases are constructed using terrain elevation data and photo-realistic imagery of the area. The photo-realistic imagery can be aerial photography or satellite imagery. While such imagery may be provided by the exercise organizers, usually with limited distribution, this may not always be feasible. Commercially available imagery at an acceptable resolution, minimum of about 1.5 m per image pixel, is generally very expensive. The price is even higher for more current images and for those with higher resolutions (i.e. aerial photography). The imagery required to build the terrain database for MAJEX07 would have reached approximately €200,000 if purchased commercially. These images cover two areas: an 8x12 $km^2$ area over Kolobrzeg, a harbour on the Baltic Sea, and a 25x25 $km^2$ area over the village of Drawsko Pomorskie to the South.


**Figure 5 - MAJEX07 Terrain Database**

The development of a detailed three dimensional (3D) terrain database is also a costly effort. Each of the terrain databases for MAJEX07 required about one man-month of work to build. To save effort, NC3A developed the two terrain databases covering Kolobrzeg and Drawsko Pomorskie, which was then shared with the other EO sensor simulations. The terrain database was built in OpenFlight® format, a widely used standard for terrain databases and models, so that they can be translated as necessary for use within each of the EO sensor simulations. Since most sensor simulations were developed to use application specific terrain format, the selection of OpenFlight® standard was carefully made based on the various simulations' ability to convert from OpenFlight® to the required format. The conversions were not without problems for some simulators, but in the end, the products of the EO sensor simulations looked very similar.

### 4.2 Model Sharing

A similar approach to cost savings can be taken by sharing model repositories for buildings, ships, aircraft, vehicles, and terrain features. However, re-selling or sharing of commercially purchased models with other users is typically prohibited. In MAJEX07, the model list included about 140 different military and civilian vehicles and life forms. At a potential cost of few hundred to few thousand Euros per model, this could be a significant expense, particularly if every sensor simulation owner were required to purchase a set.

The most ideal way to overcome this is for the EO sensor simulation owners to fully own (i.e. built in-house, no legal restrictions) a set of models and to exchange them with each other. This was done for MAJEX07 to some extent, but some models still had to be purchased. The next step then is to reduce the cost spent on these models. This can be achieved by reducing the level of detail and animation features required by the models.

While models should have some varying levels of detail, it is not always necessary to have the most detailed model. For example, in MAJEX07, it was necessary to be able to identify a tank as T-72, but it was not necessary for an operator to be able to discriminate between the 10 variants of the T-72 tanks. Similarly, it was not necessary in MAJEX07 to model individual buildings accurately. It was sufficient to model classes of buildings as representatives: family houses, row houses, apartment buildings, industrial buildings, etc. With this in mind, a set of models was available for less than €300. The number of models required for civilian vehicles and human characters could also be reduced in the same way.

With regards to animation, not all simulations can trigger an animation feature. For example, JCATS may not be able to trigger the animation of a tank turret, but Joint Semi-Automated Forces can. For an exercise focused on the general collection, storage and dissemination of ISR products, the animation of the tank turret is not required. For a simulation of force-on-force battle, this might be insufficient as the orientation of the tank turret has an influence in tank duels. Such considerations should be made when determining what animation features are required by the simulations.

By reducing the level of detail and animation features, the overall cost of the models used for MAJEX07 was reasonable enough to allow each EO sensor simulations to purchase the same set of models and display them. It is necessary to keep in mind, however, that this was only feasible by agreeing at the beginning of the project the model requirements and the standard (i.e. OpenFlight®) to be used.

## 5.0 SUMMARY AND FUTURE OF MAJIIC

This paper described some of the simulation aspects of the multinational MAJEX07 simulation exercise. This exercise saw the integration of 20 different simulations, from nine nations, generating and working on a single shared scenario, in real-time. The sensor simulations produced ISR data which was shared across the coalition with another 30 stations. Technical interoperability between these various systems was only possible with the strict application of standards, NATO (STANAGs) or otherwise, and the use of implementation guides. The use of standards also enabled reuse of terrain databases and models for the EO sensor simulations.

The use of simulations, and exploring the possibility of reuse within the area, has provided a cost effective means of developing and testing of operational concepts. The simulation exercises have also been part of the preparation effort for MAJIIC's most important exercise, Trial Quest, to be held in September in Norway. The objective of this exercise is to demonstrate the capabilities of MAJIIC in a live environment. The exercise will be combined with Bold Avenger, a live flying exercise for air crews and air mission controllers. The main operation base for the air operations will be Ørland, although many of the ISR assets, as well as the ground targets for the ISR assets will operate around the Rena area. Following Trial Quest, there is another MAJIIC simulation exercise planned for October 2008. Much of the work performed for and the lessons learned from previous MAJIIC exercises are expected to be applied in this exercise.

The use of technical standards and implementation guides, as well as the operational documents, must be examined repeatedly, in simulation based exercises and in live exercises, to achieve interoperability at all levels. Although the MAJIIC project will end in 2009, it is expected that a follow-on project will continue to enable technical and operational improvements in the future employment of ISR assets by coalition forces.

# 6.0 REFERENCES

## 6.1 Standards for simulations

[1] IEEE 1278.1, IEEE Standard for distributed interactive simulation – application protocol, Institute of Electrical and Electronical Engineers, New York, NY, USA, March 1995.

[2] IEEE 1278.1a, IEEE Standard for distributed interactive simulation – application protocol, Institute of Electrical and Electronical Engineers, New York, NY, USA, March 1998.

[3] SISO-Ref-010-2005, Enumeration and Bit Encoded Values for use with Protocols for Distributed Interactive Simulation Applications, Simulation Interoperability Standards Organization, Orlando, Fl, USA, March 2005.

## 6.2 Standards and implementation guides for sensor simulation products

[4] NATO STANAG 4545, NATO Secondary Imagery Format (NSIF), Edition 1, Amendment 1, NATO Standardization Agency, Brussels, BEL, November 1998, NATO Unclassified.

[5] AEDP-4, Allied Engineering Documentation Publication Number 4, NATO Secondary Imagery Format (NSIF) implementation Guide, Version 0.7, NSIF Custodial Support Team, Arnold, MO, USA, January 2005, NATO Unclassified.

[6] NATO STANAG 4607, NATO Ground Moving Target Indicator Format (GMTIF), Edition 1, NATO Standardization Agency, Brussels, BEL, NATO.

[7] NATO Joint ISR Capability Group Custodial Support Team, NATO Ground Moving Target Indicator Format Custodial Support Team, Errata Sheet No. 1 to STANAG 4607, Arnold, MO, USA, April 2007, NATO Unclassified.

[8] AEDP-7, Allied Engineering Documentation Publication Number 7, NATO Ground Moving Target Indicator Format (GMTIF) Implementation Guide, Study Draft 1, Joint ISR Capability Group Custodial Support Team, Arnold, MO, USA, April 2007, NATO Unclassified.

[9] NATO STANAG 4609, NATO Digital Motion Imagery(MI) Format, Edition 1, NATO Standardization Agency, Brussels, BEL, March 2006, NATO Unclassified.

[10] AEDP-8, Allied Engineering Documentation Publication Number 7, NATO Motion Imagery (MI) STANAG 4609 (Edition 1) Implementation Guide, NATO Standardization Agency, March 2006, NATO Unclassified.

[11] NATO STANAG 4559, NATO Standard Image Library Interface (NSILI), Edition 1, NATO Standardization Agency, Brussels, BEL, April 2003, NATO Unclassified.

[12] NATO STANAG 5516, NATO Tactical Data Exchange Link 16, Edition 3, NATO Standardization Agency, Brussels, BEL, April 2003, NATO Unclassified.

### 6.3 Standards for exploitation reports

[13] NATO STANAG 3377, Air reconnaissance intelligence report forms, Edition 6, NATO Standardization Agency, Brussels, BEL, November 2002, NATO Unclassified.

[14] NATO STANAG 3598, Air Reconnaissance Requesting and Target Reporting Guide, Edition 5, NATO Standardization Agency, Brussels, BEL, November 2001, NATO Unclassified.

### 6.4 ISR concepts and architectures

[15] CAESAR CONOPS, Coalition GMTI/SAR ISTAR concept of operations, working paper version 5.1, S. Bond, G. Nellans, V. Cattera, J. Ross, NC3A, CCSD-CAESAR-14, The Hague, April 2003, NATO Unclassified (Currently under review, releasable on request).

[16] MAJIIC TTP, Coalition interoperable ISTAR tactics, techniques and procedures, Version 1.7, MAJIIC Operations Working Group, NC3A, CCSD-MAJIIC-04, The Hague, June 2007, NATO Unclassified (Releasable on request).

[17] NC3A TN 986 (Rev. 1), Proposed overarching NATO intelligence, surveillance and reconnaissance architecture and its relationship to the NATO alliance ground surveillance core capability, J. Ross, P. Lee, T. Kreitmair, J. Mahaffey, NC3A, Technical Note 986 (Revision 1), The Hague, December 2003, NATO Unclassified

[18] NC3A TN 995(Rev. 1), Alliance ground surveillance core capability system architecture interfaces, J. Ross, P. Lee, T. Kreitmair, J. Mahaffey, NC3A, Technical Note 995, The Hague, December 2003, NATO Unclassified

[19] NC3A TN 1280, Joint Surveillance and Reconnaissance Architecture Development, NC3A, Technical Note 1280, The Hague, June 2007, NATO Unclassified

There are no restrictions regarding presentation neither during the conference nor of the publication of the paper (as described in the abstract) in the Meeting Proceedings.