Chapter 4 – EXPERIMENTATION PROGRAMME OVERVIEW

During its four years of development and experimentation, MSG-048 has made some pragmatic decisions that govern the scope of its endeavours. Work started with a two-Nation C-BML system, then added Orders for several Nations, followed by Reports for several Nations, followed by scaling up through a publish/subscribe capability. This incremental development approach resulted in accomplishment far beyond that normally associated with voluntary efforts of multi-national groups.

The MSG-048 experimentation programme was divided into a successive series of experiments concluding with an operational experimentation. The goals for the experiments were to align knowledge and experience among the international participants and to prepare the foundation for the operational experimentation; it advanced the state of knowledge of C-BML considerably.

The experiments were done in the form of demonstrations while the operational experimentation was performed to assess C-BML with the military end user in the loop. The goal was to address different military areas of interest to include training, mission rehearsal and planning.

The MSG-048 2007 demonstration showed orders issued from C2 systems could be executed by simulations. The scenario description used can be found in [25]. The 2008 demonstration improved over the 2007 work by adding reports flowing from the simulators to the C2 systems to the previous orders. It also introduced Air C2 and simulation in addition to the Ground components previously included. The scenario was upgraded for the 2008 demonstration and can be found in [26].

The 2009 experiment expanded the number of systems interoperating using C-BML. In the 2009 experimentation programme [24] and scenario description [27] the high level organizational, technical and scenario plans can be found. The infrastructure was extended with a publish/subscribe capability so that the various C2 systems could subscribe to reports of interest and the simulation systems could subscribe to orders of interest, avoid the need to poll the SBML[1] Web Service for updates and thus increasing both computational and communications efficiency. Systems from Canada (BattleView and UAV Simulation), France (SICF and APLET), Netherlands (ISIS), Norway (NORTaC-C2IS), Spain (SIMBAD), UK (ICC and the US-produced JSAF), and the USA (MCS and OneSAF) participated in the experimentation. The BML Web Service used to support these was the Scripted BML Web Service [18]. The C2LG GUI order interface middleware from Germany played a supporting role which is discussed in [8].

The sub-sections below briefly describe the goals, setup and results of the demonstrations/experimentations in the years from 2007 to 2009.

4.1 2007 DEMONSTRATION

The 2007 demonstration was presented at the 2007 Interservice/Industry Training, Simulation and Education Conference and Exhibition (I/ITSEC) in Orlando, Florida, in early December. Six Nations (DEU, ESP, FRA, NLD, NOR, USA) participated in the demonstration with a system as part of an architecture of C2 and simulation systems.

[1] "SBML" refers here to the communication infrastructure that was used for the experimentation.

4.1.1 Goal

The goal of the 2007 demonstration was to align knowledge and experience among the participating Nations and to show to the international audience of I/ITSEC 2007 that C-BML holds promise for the exchange of orders between C2 systems and constructive simulators [8][23][39].

4.1.2 Architecture

The architecture illustrated in Figure 4-1 was implemented. Note that only one C2 system was combined with one simulation system at a time. The demonstration included following combinations of C2 and simulation systems:

- C2PC/CAPES with JSAF;
- ISIS with SCIPIO;
- ISIS with SIMBAD; and
- NORTaC-C2IS with SCIPIO.

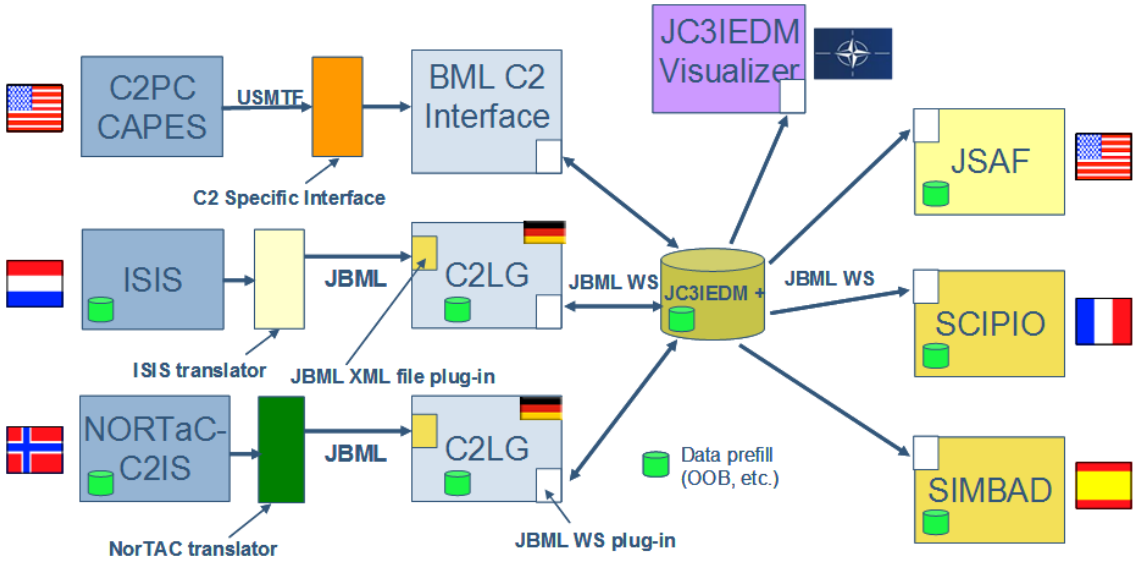

Figure 4-1: MSG-048 2007 Experimentation Architecture.

4.1.3 Results

The demonstration given at I/ITSEC 2007 was successful in showing the audience the initial BML capability for tasking. In addition, the participants gained significant knowledge and experience from each other.

4.2 2008 DEMONSTRATION

The 2008 demonstration was presented at the 2008 I/ITSEC at Orlando, Florida, in late November. Six Nations (DEU, FRA, GBR, NLD, NOR, USA) participated in the demonstration with a system as part of an architecture of C2 and simulation systems.

4.2.1 Goal

The goal of the 2008 demonstration was to show to the international audience of I/ITSEC 2008 that BML is promising for not only exchanging orders between C2 systems and constructive simulators (as was shown in 2007) but also for exchanging reports [19][39][8][41].

4.2.2 Architecture

The architecture shown in Figure 4-2 was implemented. The demonstration included the following combinations of C2 and simulators systems:

- ICC with JSAF;
- ISIS with POLLUX+; and
- NORTaC-C2IS with SCIPIO.

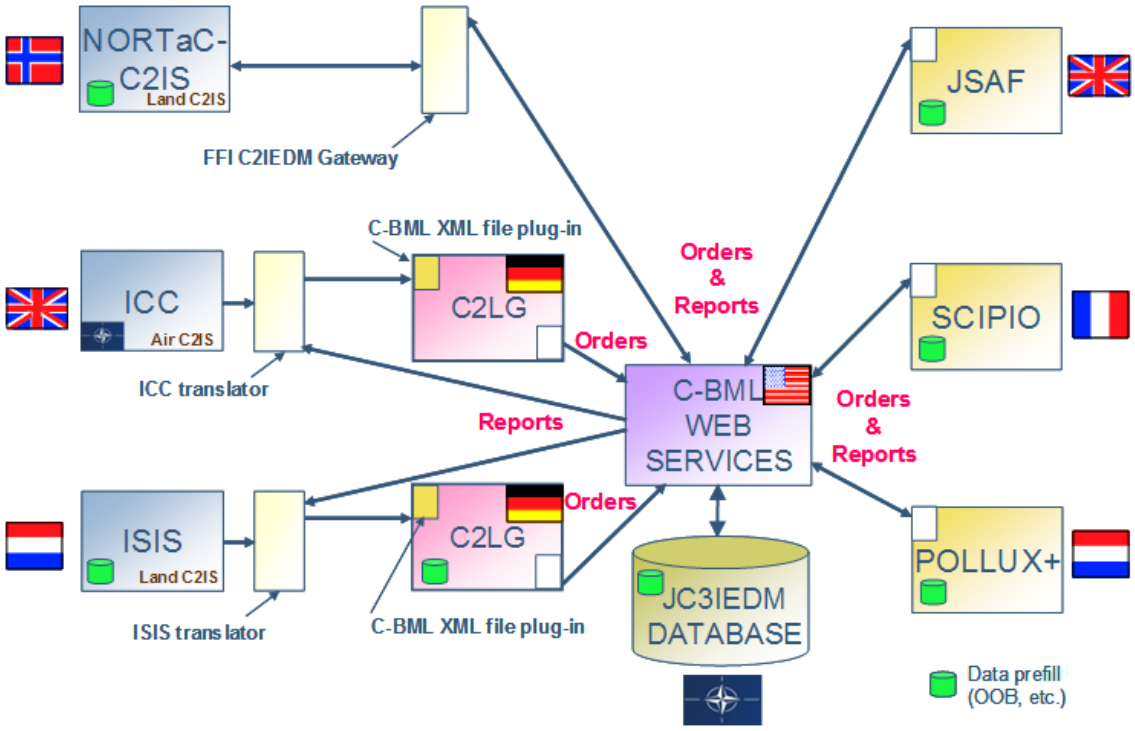

Figure 4-2: MSG-048 2008 Experimentation Architecture.

In the demonstration that included ICC and JSAF, an air component was introduced.

4.2.3 Results

The demonstration given at I/ITSEC 2008 was successful in showing the audience the new C-BML tasking and reporting capability.

4.3 2009 EXPERIMENTATION

Unlike the demonstrations of 2007 and 2008, in 2009 an experiment was held at the campus of George Mason University in Manassas, Virginia. The experiment was conducted with military users and a limited audience. Eight Nations (CAN, DEU, ESP, FRA, GBR, NLD, NOR, USA) participated in the demonstration providing one or more systems that comprised an extensive architecture of C2 and simulation systems.

4.3.1 Goal

The goal of the 2009 experimentation was to expose military end-users to the C-BML capable systems. In particular, to demonstrate the combined tasking and reporting capabilities-enabled by C-BML in a coalition context and to collect their feedback about military usefulness and utility [29].

4.3.2 Architecture

The experimentation was comprised of three “vignettes”. Each vignette covered one of the following specific military activities of interest: planning, training, and mission rehearsal.

Figure 4-3, Figure 4-4 and Figure 4-5 present the architectures used for these three vignettes.

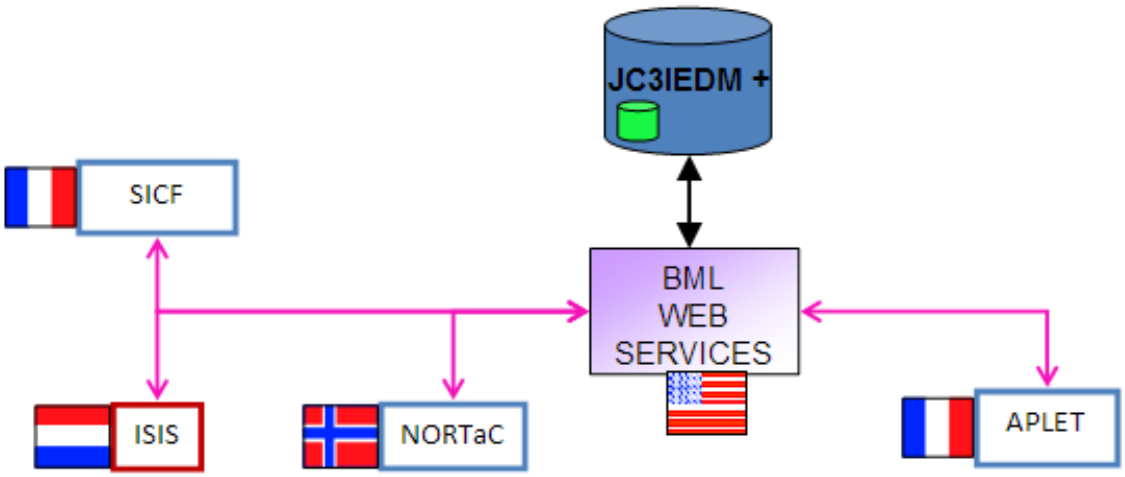

Figure 4-3: MSG-048 2009 Planning Vignette Architecture.

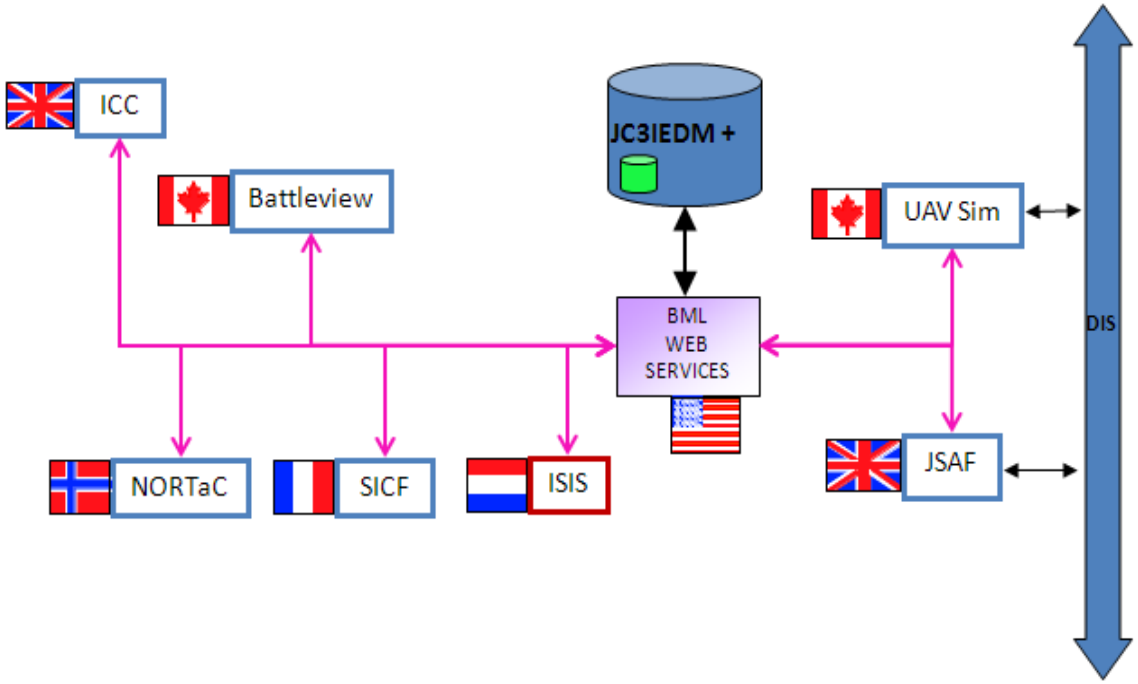

Figure 4-4: MSG-048 2009 Training Vignette Architecture.

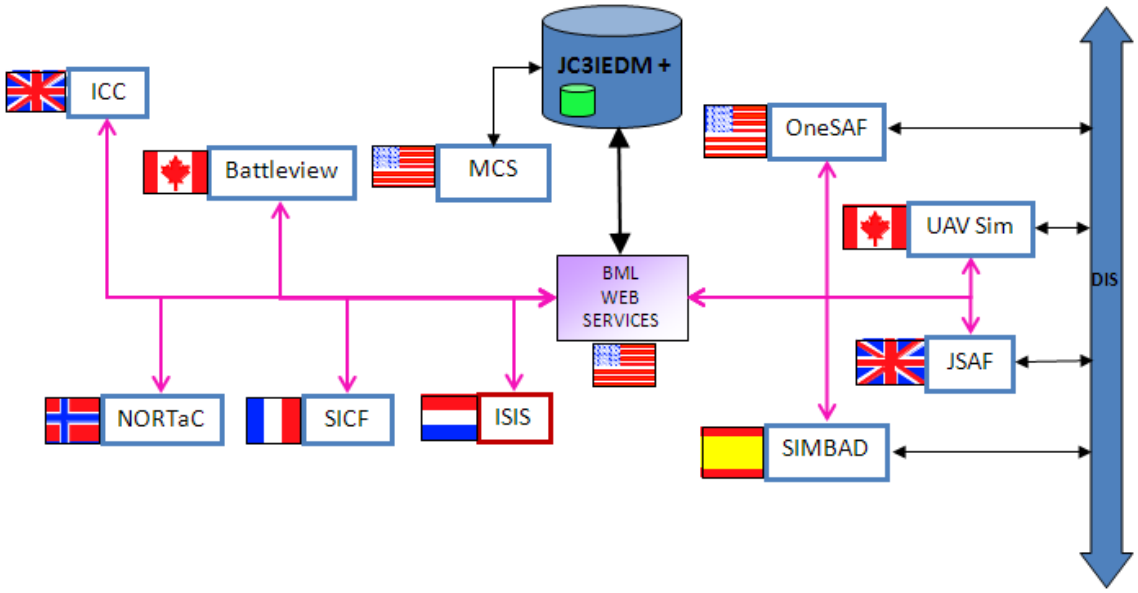

Figure 4-5: MSG-048 2009 Mission Rehearsal Vignette Architecture.

The planning vignette was used to play a number of Courses of Action (COAs) with two Battalions, commanded via the Norwegian and French C2 systems, NORTaC-C2IS and SICF, respectively, and simulated by the French simulation APLET. The aim was to show how planning could benefit from C-BML.

The training vignette was used to play out a scenario with two Battalions, commanded from the Norwegian and French C2 systems, NORTaC-C2IS and SICF, respectively, an air component commanded from ICC and a UAV commanded from Battleview with the ground components and air component simulated in JSAF and the UAV simulated in UAVSim. The aim was to illustrate how training could benefit from C-BML.

The mission rehearsal vignette provided the scenario for a mission rehearsal exercise based on the training scenario augmented with a Reconnaissance (RECCE) Battalion that was commanded from the US ABCS C2 system and simulated in OneSAF. For this vignette SIMBAD, the Spanish simulation system, was responsible for simulating one of the Battalions previously simulated in the training scenario by JSAF. The aim was to show the benefit of C-BML during a mission rehearsal exercise.

4.3.3 C-BML Exchange

The C-BML expressions that were exchanged as part of the experimentation were constructed from a small set of C-BML types agreed to by the Nations to support basic tasking and reporting as per the experimentation requirements. These selected expressions were based on a simplified version of the IBML schema – successor to the JBML work [7][12][37].

Annex C – provides some examples of C-BML expressions that were exchanged during the experiments. The first example is a FRAGO to direct the UAV to conduct close air support, the second is part of an order to a Company of a Norwegian to conduct an attack and the third is an extract from a French General Status Report. Air operations were limited by the constraints of the MSG-048 C-BML schema and complete implementation of ATOs, etc. remains as a future activity.

4.3.4 Results

Integrating and interoperating the various systems proved challenging and prevented Nations from fully executing all three vignettes. The first vignette, *planning*, was able to be executed, but took longer than the allotted time. Nonetheless, this vignette demonstrated the usefulness of C-BML for coalition mission planning.

The large number of systems present in the Training and Mission Rehearsal vignettes resulted in even greater complexity that presented significant integration and coordination challenges. These vignettes were not fully executed, as planned. However, a number of advantages and challenges concerning the future of use of C-BML were identified during the execution of these vignettes.

Despite the technical challenges experienced, the C-BML demonstrated effective C2 to simulation interoperability for potential operational military application.

The 2009 experimentation event brought together many Nations with a great variety of requirements and expectations. One of the main outcomes of this event was the elaboration of a set of “lessons learned” and recommendations for the future development of C-BML. These are addressed in the following chapter.