Chapter 1 – INTRODUCTION

The need to interface C2 systems with simulation systems has long been established [1]. The simulation community has developed simulation-to-simulation standards such as Distributed Interactive Simulation (DIS) and High Level Architecture (HLA) through standards bodies such as the *Simulation Interoperability Standards Organization* (SISO), while the *Multi-national Interoperability Programme* (MIP) has elaborated the Joint Consultation Command and Control Information Exchange Data Model (JC3IEDM) for the exchange of military information across C2 systems. However, the work to establish standards for C2-simulation interoperability has been limited. As a result, many simulations have a unique C2 interface.

Early Battle Management Language (BML[1]) work on defining interfaces for information exchange between C2 and simulation systems utilized the Command and Control Information Exchange Data Model (C2IEDM) – predecessor of the JC3IEDM – as a basis for a system-independent community vocabulary for passing plans orders, and reports [3][4]. BML seeks to manage complex interactions among Service, Joint and Coalition C2-simulation interoperation by providing a common means of exchanging information that all C2 and simulation systems can implement.

1.1 COALITION BATTLE MANAGEMENT LANGUAGE BACKGROUND

In September 2004, SISO formed the Coalition Battle Management Language (C-BML) Study Group (SG) which ultimately led to the formation of the C-BML Product Development Group (PDG) in Spring 2006 [2]. Reference [2] relates some of the earlier work that influenced and contributed to the C-BML effort. One of the main recommendations of the SISO C-BML SG was utilizing the C2IEDM as the underlying reference model upon which C-BML should be based. Also, the applicability of a BML approach to interoperability with robotic systems was identified clearly in this work. In parallel with the SISO C-BML standard development activity, SISO has also developed a related standard in the Military Scenario Definition Language (MSDL) [21]. MSDL and C-BML are considered to be closely related specifications that likely both will be used in developing C-BML compliant applications. MSDL addresses the issue of providing the necessary information required for initializing simulations.

1.2 C-BML RELATIONSHIP TO BML

In the course of the past decade, there have been many BML efforts that will not be mentioned here. Although, the focus of the MSG-048 mandate was on C-BML, the activities that are reported on in this document utilized elements from other BML initiatives.

For the purposes of this document, Battle Management Language (BML) refers to the general approach of utilizing a digitized form of military information in support of the unambiguous exchange across C2, simulation and robotic systems. C-BML refers to the branch of BML that specifically addresses needs associated with coalition operations. The term "SISO C-BML" is used in this document to refer to the SISO C-BML standards effort.

[1] This report deals primarily with C-BML, which for the purpose of this document represents a standardized version of BML in support of (NATO) coalition operations – even though during the execution of the MSG-048 Technical Activity no such standard was available. The term "BML" is used in a more general sense to denote the family of Battle Management Languages that share the same constructs and often much of the same foundational research. Note that many of the C-BML benefits, requirements, lessons learned and recommendations cited in this report go beyond the strict needs of the coalition and apply, in many instances, to the needs of national forces (operating independently) and also to the broader BML family as well.

1.3 NATO MSG-048 OVERVIEW

The need for C2-simulation interoperability in coalition operations arguably is even greater than that of national Service and Joint operations. Coalitions must function despite greater complexity due to significant differences among doctrine and human language barriers; thus the ability to train and rehearse rapidly before the actual operation is of significant importance [4].

1.3.1 NATO MSG-048 Technical Activity Proposal

In parallel with the SISO C-BML efforts and in order to promote the standardization of C-BML, the NATO RTO approved the Technical Activity Proposal (TAP) [7] for MSG-048 "Coalition BML" (C-BML) in spring 2006. The MSG-048 TAP expressed the following need:

> *"An open framework is needed to establish coherence between Command and Control (C2) and Modelling and Simulation (MandS) type systems in order to provide automatic and rapid unambiguous initialisation and control of one by the other. To accomplish this, C2 and MandS concepts must be linked in an effective and open manner defining new, system-independent, community standards and protocols. The MSG-048 intends to explore the emerging concept of "Battle Management Language" as a component of an open framework to link C2 systems and MandS or robotic systems in the NATO context."*

The primary objective of this TAP is stated as:

> *"...to provide a NATO C-BML specification by analysing and adapting the available specifications and implementations from SISO or Nations..."*

Because the SISO C-BML specification was not available for evaluation and experimentation purposes[2] at the onset of MSG-048, the MSG-048 technical activity based its work on input from participating Nations. However, throughout the technical activity, MSG-048 has maintained close ties with the SISO C-BML PDG and has communicated MSG-048 findings and recommendations that have served and continue to serve as valuable inputs for the SISO C-BML PDG Drafting Group (DG).

1.3.2 NATO MSG-048 Experimentation Programme

The assessment of C-BML for use in support of coalition operations was performed based on a series of experiments conducted collectively by the MSG-048 Member Nations in 2007, 2008 and 2009. The following paragraph highlights this 3-year experimentation programme and is further described in Chapter 4.

In 2007, the MSG-048 planned and performed an experiment utilizing C-BML that involved the execution of orders sent from a C2 system by a simulation system [8][9][10]. The 2008 experimentation added the capability of the simulations to send reports back to the C2 systems. Also this experiment introduced Air C2 and simulation elements in addition to the Ground components previously included. The final 2009 experimentation built upon the previous experiment. It involved a significant number of C-BML-enabled systems (five simulation systems and six C2 systems) communicating over a C-BML communication infrastructure and involved active and retired military personnel in training and planning exercises. These events, described in more detail in Chapter 4, advanced the state of knowledge of C-BML considerably. They have been reported on in various publications (see Chapter 4) and the lessons learned that are presented in this document draw upon this experimentation and also form the basis for the recommendations made in Chapter 6 (Recommendations).

[2] The SISO C-BML PDG published its initial C-BML draft specification in September 2007.

1.3.3 NATO MSG-079 C-BML Workshop

In addition to the experimentation programme and this final report, the MSG-048 TA Programme of Work (POW) planned for MSG-048 to organize a symposium or workshop to report back the lessons learned from the experimentation programme [46].

1) *The technical activity MSG-048 will conclude with a symposium on NATO C-BML.*
2) *The symposium will provide information and education on NATO C-BML and give a summary of the studies conducted by MSG-048.*
3) *Lessons learned and way ahead will be presented.*

MSG-048 organized a workshop dedicated to C-BML that took place in Farnborough UK from February 24 – 25 2010. The highlights of this event are discussed in Chapter 5 on lessons learned.

1.4 MIP AND C-BML

The relationship between the NATO MSG-048 C-BML activities and the MIP has been a topic of much discussion. Certainly SISO C-BML is linked closely to the MIP-JC3IEDM, as it is the reference data model. However, it is not always immediately obvious to all how the two standards complement each other and more specifically: What is the added-value of developing a new standard such as SISO C-BML with respect to the alternative of simply using a well-established standard such as the JC3IEDM. Annex B – summarizes how these two standardization activities differ and how they are complementary.

1.5 DOCUMENT OVERVIEW

This is the final report of the MSG-048 Technical Activity. Its intended audience is the NATO technical community, in particular, those in the domains of C2 and Modelling and Simulation.

This report is structured in eight chapters, Introduction (Chapter 1), Description of C-BML (Chapter 2), Requirements for C-BML (Chapter 3), MSG-048 Experimentation Programme (Chapter 4), Lessons Learned (Chapter 5), Recommendations (Chapter 6), Summary and Conclusions (Chapter 7) and References (Chapter 8).