Annex A – EVOLUTION OF BML

BML began in work sponsored by the US Army's Simulation-to-C4I Interoperability Overarching Integrated Product Team (SIMCI OIPT). Carey et al. [5] describe the overall process used to show the feasibility of defining an unambiguous language, based on manuals capturing the doctrine of the US Army. This first BML project started by analyzing more than 70 doctrinal manuals related to tasking and reporting, beginning with general manuals, such as the Field Manual 3.0 on Operations and the US Joint Staff's Universal Joint Task List. The review included field manuals of Army elements such as Field Artillery, Air Defense Artillery, Engineers, Military Police, down to the platoon level. This work resulted in definition of an unambiguous Operational Order (OPORD) using the traditional "5 Ws" (who-what-when-where-why) to describe military tasks [1], including a prototype for battalion operations orders, in 2003.

Under sponsorship of the US Defense Modeling and Simulation Office (DMSO) and the US Joint Forces Command (JFCOM), the Extensible BML (XBML) project was chartered to build on the US Army's initial work, with two main objectives:

1) Using Service Oriented Architecture (SOA) technology for information exchange among the systems' interfaces; and
2) Using the MIP's Command and Control Information Exchange Data Model (C2IEDM, an earlier version of the JC3IEDM) as a basis to represent the information to be exchanged between the systems.

JFCOM was particularly interested in the XBML project's potential to increase interoperability between C2 systems and simulations of the US military Services. The Air Operations BML (AOBML) effort was supported by JFCOM J7 to evaluate whether the concepts of BML are applicable to air forces as well as ground forces, using Theater Battle Management Control System (TBMCS) and Air Warfare Simulation (AWSIM) systems with positive results [6]. XBML also became the basis for an international experiment, driven by interest of the Exploratory Team formulating the proposal that led to MSG-048 [7].

Expanded interest in applying BML to the Joint environment led to JBML, which expanded BML into a combination of the ground, air and maritime domains and urban warfare and was successfully demonstrated in May 2007. JBML achieved considerable technical progress by creating a revised Web service schema, based on lexical grammar and designed to facilitate expansion into other military realms, which was implemented in the open source JBML Web Services as described below [3][4]. In parallel with JBML, the US Army Topographic Engineering Center (TEC) has been developing a geospatial BML (geoBML) which will bring a wealth of geospatial data to the C2-M&S environment [8]. The JBML schema was based on the Command and Control Lexical Grammar (C2LG) [11][12]. To ensure that the orders can be processed automatically, C2LG defines how orders are to be expressed in a BML that is a formal and unambiguous language.

The need for C2-simulation interoperability in coalition operations is even greater than that of national Service and Joint operations. Coalitions must function despite greater complexity arising from significant differences among doctrine and human language barriers; thus the agility to train and rehearse rapidly before the actual operation is highly important [9]. The NATO Modelling and Simulation Group (MSG), in recognition of this need, chartered Technical Activity MSG-048 to explore the promise of BML in coalitions combined with SOA technologies [10]. During the same time period the SISO C-BML standards process began [13].

Successive MSG-048 activities in 2008 and 2009 advanced the state of knowledge of BML considerably. The MSG-048 2008 demonstration improved over previous work by adding Reports to the previous Orders. It also introduced Air C2 and simulation in addition to the Ground components previously included [15].

The 2009 effort improved over previous work by expanding the number of systems interoperating and undertaking experimentation using the C-BML system of systems. In order to do this, it expanded the Service Oriented Architecture (SOA) communication pattern to include publish/subscribe, 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 BML Web service for updates and thus increasing both computational and communications efficiency. Systems from Canada (BattleView and UAV-SIM), France (SICF and APLET), Netherlands (ISIS and Pollux), Norway (NORTaC-C2IS), Spain (SIMBAD), UK (ICC and the US-produced JSAF), and the USA (ABCS and OneSAF) participated in these. The BML Web Service used to support these was the Scripted BML Web Service, an innovative approach developed by the GMU C4I Center and supported by the US Army Simulation – C4I Interoperability (SIMCI) program, designed for rapid service evolution in a prototyping environment [14]. The C2LG GUI [11] order interface middleware from Germany also played a supporting role.