The Role of BMC3I Simulation in Advancing the NATO ALTBMD Programme

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OVERVIEW

This paper describes how Modelling and Simulation has played a pivotal role in advancing the NATO Active Layered Theatre Ballistic Missile Defence (ALTBMD) Programme which is one of the largest and technically most complex in the history of the NATO Alliance. As one of a suite of models used on the programme, the SMDC's Extended Air Defense Simulation (EADSIM) was utilised to support an integrated assessment of system architectures and BMC3I options. Its application to Battle Management options analysis including Autonomous, Decentralised, Centralised, and Distributed modes of control shall be described together with the impact of varying the location of BMC3I functions at different levels within the command hierarchy.

The paper then describes EADSIM's capabilities to model systems and BMC3I to include descriptions of the Flexible Commander/Flexible SAM Rulesets and the functional modelling capabilities for the elements and their subsystems. It will focus on the capability, functionality, and fidelity in describing the level of modelling detail a user of the simulation can derive.

1.0 NATO ALTBMD PROGRAMME

1.1 Background

Earlier this year, NATO's Theatre Missile Defence (TMD) Programme reached a key milestone in Alliance efforts to field an Active Layered Theatre Ballistic Missile Defence (ALTBMD) capability by 2010. As a practical example of the ongoing transformation of NATO's military capabilities, on 11 March 2005 the North Atlantic Council approved the Charter for the ALTBMD Programme Management Organisation (PMO). This decision launched the Alliance's ALTBMD Programme, which will provide protection against the threat of ballistic missiles to forces deployed on NATO missions.

The importance of being able to defend deployed troops against theatre-range ballistic missiles, such as SCUD missiles, was made apparent during the 1991 Gulf War (Fig. 1). There were more than 80 launches (Fig. 2), the most deadly of which was on February 25th. The US barracks at Dharan was hit, killing twenty-eight and injuring over on hundred personnel.

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Fig. 1: 1991 Gulf War: Scud launch areas, target regions, and Al Hussein range (Ref. 1)

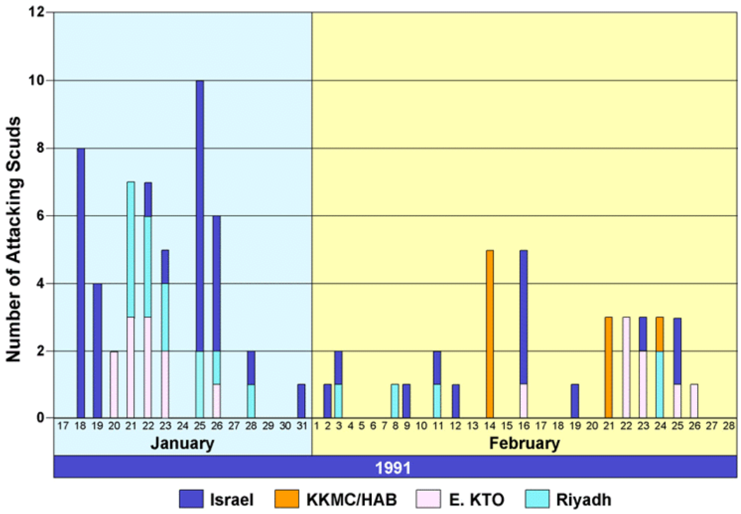

Fig. 2: 1991 Gulf War: Scud attacks by target area (Ref. 1)

As a number of foreign nations continue working on ballistic missile programmes, as well as developing chemical, nuclear, and biological warheads for those missiles, the need for effective defences has increased.

1.2 TMD System Architecture

To counter this threat, NATO has, for the past several years, worked to define a system architecture for TMD (Fig. 3). The system will be able to integrate different TMD sensor and weapons systems into a single coherent, NATO command and control capability that is able to give layered protection against ballistic missiles.

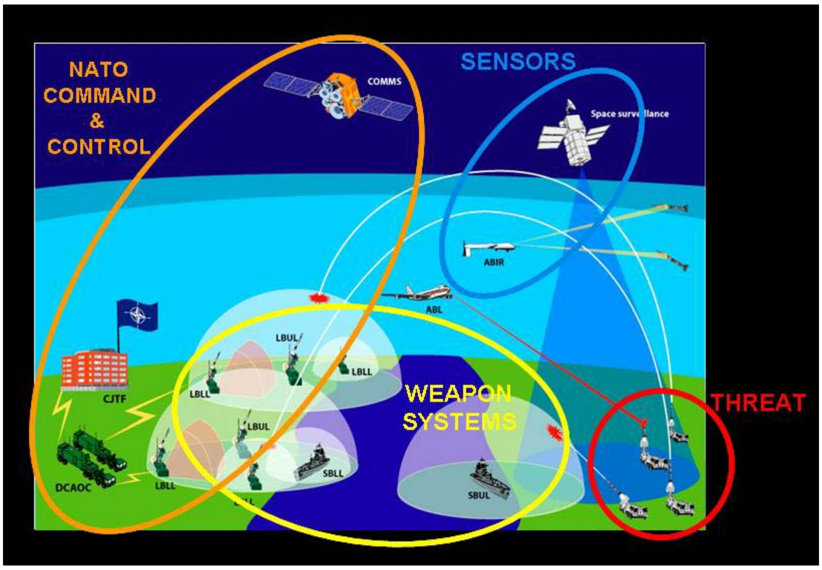

Figure 3: NATO TMD System Architecture

Flexible, reliable Battle Management & Command, Control, Communications and Intelligence (BMC3I) arrangements are fundamental to ensuring successful integration of these capabilities and providing a cost-effective architecture that can evolve incrementally over time in response to changing threats and requirements.

As one of a suite of models used on the programme, the SMDC's Extended Air Defense Simulation (EADSIM) was utilised to support an integrated assessment of system architectures and BMC3I options.

1.3 BMC3I Options Analysis

BMC3I is the planning, tasking and control of the execution of missions through a command and control (C2) architecture of sensors, communications and computers with intelligence support. In this context, a BMC3I option is defined as the particular combination of ways in which the battle management and picture compilation tasks can be fulfilled.

EADSIM models the activities and associated information flows between the operational and system elements of the architecture (i.e. upper-layer control systems, lower-layer control systems, and sensor systems) as well as the system elements. The BMC3I representation, defined generically as a component of the architecture, is sufficiently flexible to simulate a variety of operational modes of control (Fig. 4).

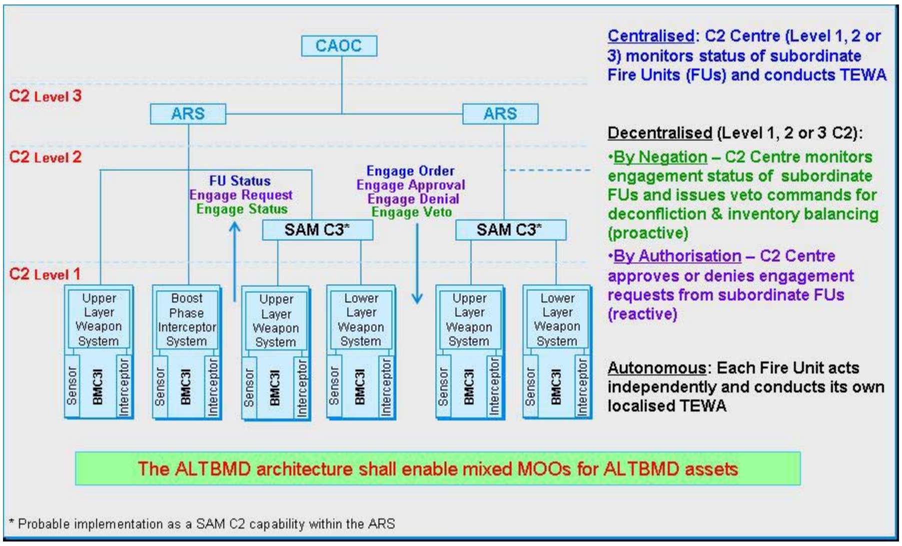

Figure 4: BMC3I Architecture and Modes of Control

A range of control-mode options that embody the concepts of centralized command and decentralized execution and complement the operational and system definitions of the architectures was selected for analysis. These were:

- Autonomous: In an autonomous mode of control, each Fire Unit (FU) acts as an independent entity and is responsible for conducting localized Threat Evaluation and Weapon Assignment (TEWA) and for generating its own fire-control orders (FCO).
- Decentralized (by negation): In a decentralized (by negation) mode of control, the C2 centre undertakes the role of monitoring the engagement status of its subordinate FUs and appropriately issuing engagement veto commands to FUs to achieve weapons system deconfliction and resource balancing.
- Decentralized (by authorization): The decentralized (reactive) mode of control is a variation of the proactive mode above. The higher-level C2 centre receives engagement requests from subordinate FUs and appropriately responds or reacts by either granting or denying the request. This control mode was not considered further because process modelling suggested that unnecessary delay will be induced as each FU waits for a C2 response. Furthermore this mode, unlike decentralized (by negation), is not fail-safe; loss of communications or a communications delay may inhibit the FU from responding to a threat. However, if the commander responsible for TBMD demands the use of this mode of control, the BMC3I component must support it.
- Centralized: Within a centralized or 'positive' mode of control, the higher-level C2 centre closely monitors the detailed system status of each subordinate FU and conducts TEWA by allocating targets to FUs based on its own internal modelling of all potential engagement opportunities.

1.4 BMC3I Options

From the four modes of control listed previously, seven BMC3I options were defined, namely:

- Purely autonomous
- Decentralized (by negation) at level 1; isolated upper-tier systems operate autonomously
- Centralized at level 1, autonomous elsewhere

- Decentralized (by negation) at level 1 with coordination
- Centralized at level 1 with coordination
- Decentralized (by negation) at level 2
- Centralized at level 3.

These options provide flexibility for the Air Component Commander as well as compatibility with NATO's Air Command and Control System, known as ACCS.

Although some options were identified as more viable than others, no single option is the 'best' option under all situations, and therefore no single option can be, or is, recommended. Ultimately, the option, or combination of options, to be used in the theatre will be decided by the Air Component Commander or another commander with responsibility for the conduct of the TBMD battle.

1.5 Modes of Control Analysis

Figure 5 presents some high-level results from the Modes of Control Analysis. Each mode has its own advantages and disadvantages. Those highlighted in yellow are explicitly modelled in EADSIM or extracted from it as Measures of Effectiveness.

Mode of Control	Advantages	Disadvantages	Commander's Real Time Level of Control
Autonomous	- Maximum number of engagements - Maximum kills - Minimum C2 overhead - Minimum engagement delays	- Rapid inventory depletion - High wastage - Risk of fratricide	None
Decentralized (negation with delay)	- Inventory management - Reduced wastage - Fewer launches per kill - Engagement continues unless negated	- Loss of engagement opportunities - Possible wastage - Risk of fratricide	Moderate
Decentralized (authorization)	- Inventory management - Reduced wastage - Fewer launches per kill - Lower fratricide risk	- Loss of engagement opportunities - Possible leakage if no authorization	High
Centralized	- Inventory management - Reduced wastage - Fewer launches per kill - Lower fratricide risk	- Loss of engagement opportunities - Possible leakage	High

Figure 5: Modes of Control Analysis Results

If, for political reasons there is a need to minimize the possibility of fratricide, the commander is motivated to exercise a high level of control over TBM engagements, and may not permit interceptor launches without his express approval. This would make the commander's preferred mode of control either centralized at the highest possible level or decentralized by authorization. However, requiring shooters to have express authorization before engaging TBMs may impact the already stressing time frames. At best, shoot-look-shoot options may be lost and, at, worst, leakers may occur.

Based on these considerations, the BMC3I system will be required to fully support all four of the modes of control in any combination specified by the commander and appropriate for the threat and conditions in the theatre in which the ALTBMD system is employed.

2.0 EADSIM

2.1 Introduction

EADSIM has supported the integrated assessment of system architectures and BMC3I options in the NATO TMD studies. In particular, this has involved the explicit modelling of sensors and weapon systems, and a range of BMC3I options to integrate these.

The Extended Air Defence Simulation (EADSIM) is a many-on-many simulation of air, missile and space warfare. It provides analysis, training, and operational planning to the warfighter in one package. EADSIM is one of the most widely used simulations in the world with over 350 user agencies worldwide. EADSIM is a Missile Defence Agency (MDA) Core Model and has been used extensively by NATO (NC3A) for over 10 years in support of missile defence analyses. EADSIM is managed by the Models and Simulations Division, U.S. Army Space and Missile Defence Future Warfare Center, as the executive agent for the MDA.

EADSIM is used for scenarios ranging from few-on-few to many-on-many. It represents all the missions on both sides. It is unique in the scope of modeling at such a level of detail, where each platform (such as a Missile Defence System) is individually modeled, as is the interaction among the platforms. It includes an extensive functional and statistical representation of perception feeding perception based C3. It models the Command and Control (C2) decision processes and the communications among the platforms on a message-by-message basis. Intelligence, surveillance, and reconnaissance are explicitly modeled to support offensive and defensive applications.

EADSIM Version 12.00 is the latest and most current version. EADSIM is the one of the most mature and widely-used force-on-force models in the world. It has received extensive examination by the user community, resulting in multiple accreditations. EADSIM incorporates user-driven capabilities, with a proven rapid response capability to develop and support the model to meet evolving user needs.

EADSIM is supported with maintenance, configuration management, extensive documentation, a user hot line (1-800-C3I-USER), web and email help (eadsim.hotline@tbe.com), user conferences, and ongoing enhancements.

EADSIM is a comprehensive, widely used and heavily scrutinized model. It has and continues to support numerous analytical activities and the number of organizations using EADSIM continues to increase. EADSIM is being used by NATO (NC3A) and the international community to support numerous studies and analyses activities. To date EADSIM has been released to 16 international partners to the U.S.

2.2 EADSIM Combat Modeling

EADSIM models all the player types for air, missile, and space warfare as shown in Figure 6. These include fixed- and rotary-wing aircraft, ballistic and cruise missiles, satellites, and surface platforms performing both offensive and defensive missions for both friendly and hostile forces.

Land, sea, air and space systems can be modeled. All types of systems in various environments can be treated within the model both as attacker and defender.

Red and Blue players have the same model features. All features available for Red players are also available for Blue players, with the flexibility to represent the differences between Red and Blue. This allows analysts to use scenarios having dynamic, two-sided warfare.

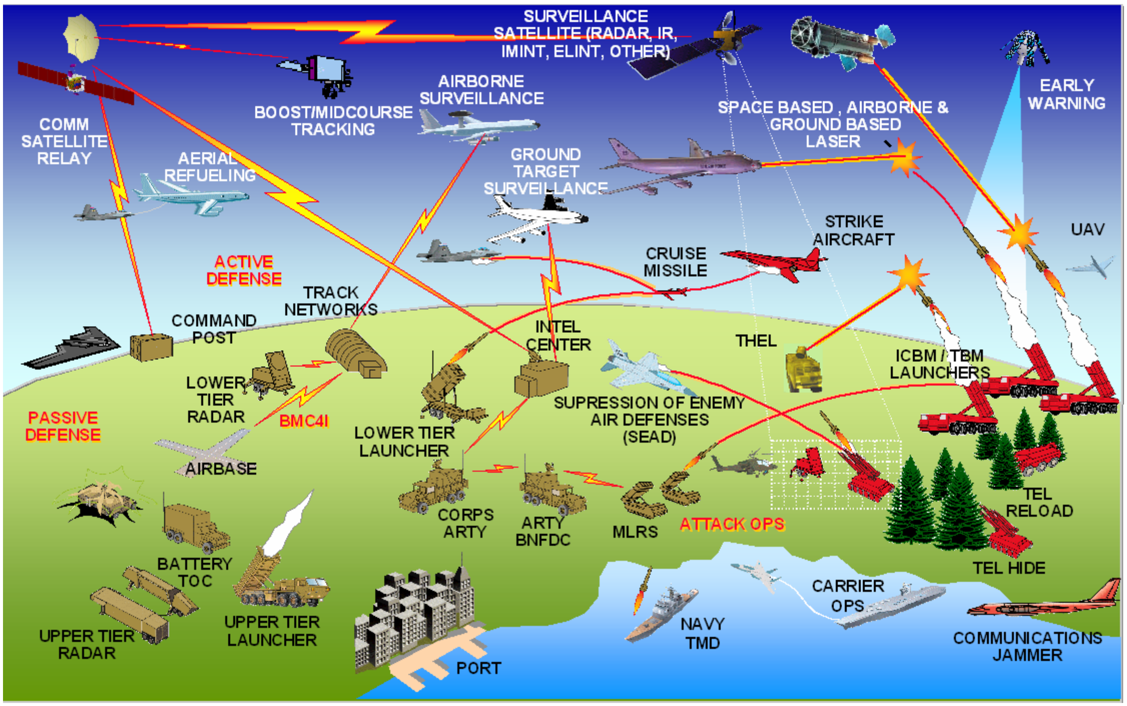

Figure 6: EADSIM Combat Models

Command, control, communications, computers, and intelligence, surveillance, and reconnaissance (C4ISR) is explicitly modeled for both sides. The activities of both friendly and hostile players are determined by sensed and communicated information.

Surface-to-air engagement modeling allows the participant to search and identify targets, choose the target most threatening to itself or to its assets, assign a weapon or weapon system to the threat, and engage and attempt to destroy the threat. Engagement of both Air-Breathing Threats (ABTs) and Tactical Missile (TM) threats is modeled. Engagement status and multiple targeting deconfliction is also involved in the surface-to-air engagement modeling.

Surface-to-surface modeling allows targets to be selected, an appropriate weapon to be selected, and the target to be engaged. The model accounts for the time delay required for the launcher to relocate. The target selection and weapon selection can be user-defined. The counterforce engagements can be dynamically determined for either friendly or hostile forces.

2.3 EADSIM Mission / Functional Areas Modeling

A number of mission / functional areas are modeled in EADSIM, as shown in Figure 7. The general areas modeled include air defence, attack operations, electronic warfare, and support operations. Each of these is discussed below.

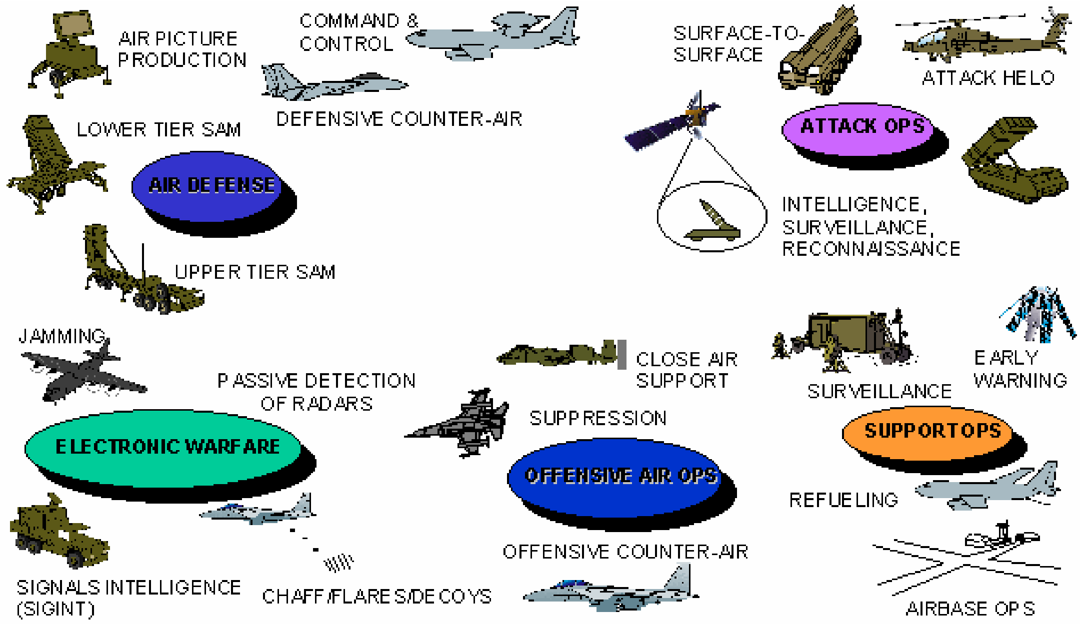

Figure 7: Mission / Functional Areas Modeled

2.4 EADSIM Air Defence Modeling

Surface-to-air engagement modeling encompasses missiles and guns operating in both anti-missile and anti-air roles. Surface-to-air missile (SAM) engagements are modeled for the full range of systems from shoulder-fired weapons to integrated air defences and multi-tier theatre missile defence systems. The units are either assigned targets by controlling C2 nodes or they choose their own targets from among targets for which they have track data. An engagement will be initiated when the target can be intercepted by one of the SAM's weapons.

EADSIM models defensive and offensive command and control with unlimited levels of command. The defensive and offensive commander centers can be configured to make decisions at all levels. This integrated structure can model command of both air and ground forces. The defensive commander ruleset types allow modeling of centralizing command anywhere in the command chain. Hierarchical, distributed, and cooperative relationships are modeled. The offensive command and control controls all facets of attack operations including intelligence, surveillance, and reconnaissance, target engagement, and battle damage assessment. The rulesets used to represent these capabilities provide options and capabilities to tailor the representation of a particular system.

Air picture production and dissemination is modeled, with track processing, target identification, and sharing of tracks among multiple platforms. This air picture is based on sensed and communicated information and can disagree among the players.

2.5 EADSIM Track Processing

Track processing is modeled for surface, air, and missile targets. Sensor detections form the basis for the formation of tracks. Sharing of track information among multiple platforms is modeled. The management of multiple tracks is modeled, with saturation alleviation processing for large numbers of tracks.

2.6 EADSIM Target Identification

Identification and classification is modeled for both single platforms acting against multiple targets and also for multiple platforms sharing information on one or many targets. A robust combat identification capability is provided, including IFF interrogations, procedural identification, and non-cooperative target recognition. Factors considered in procedural identification include Point of Origin, Self-Defence, target on a Low-Level Transit Route (LLTR), Jammer detected, Safe Velocity/Altitude, Pop Up threats, Prohibited Volumes, Restricted Volumes, and Classification volumes.

All of the factors are considered in making identification decisions, using a weighted decision scheme controlled by the user. Similarly, each platform can use information from other platforms in making decisions concerning identification and classification.

2.7 EADSIM Attack Operations Modeling

Command and control of strike operations is modeled for both sides. The command and control can prioritize among targets and direct surveillance changes and strikes on targets. The strikes on targets can be surface-to-surface engagements or air-to-surface engagements. The air-to-surface engagements can be carried out by either fixed wing or rotary wing aircraft. Aircraft can be scrambled from air bases, vectored from patrol, or diverted from other missions. Also, aircraft can strike scripted targets and targets of opportunity.

Intelligence gathering and processing (including imagery intelligence) is modeled. Surveillance is modeled for both sides, with all sensor types gathering information and with processing of surveillance information. The intelligence gathering can be either scripted missions or dynamically determined missions. The intelligence gathering platforms can be space, air or surface based. Any player can collect and disseminate data while conducting other activities. Any player can receive and process multi-source data. Intelligence collection centers are modeled including data correlation, fusion and processing from multiple sources. Correlation failures, identification and classification errors, and errors in perceived positions are modeled. User-defined latency, accuracy, throughput, confidence and target prioritization are used in the modeling.

EADSIM models several aspects of ballistic missile transporter-erector-launcher (TEL) behaviour and their interaction with an attack operations threat. TELs launch surface-to-surface missiles at both scripted and dynamically determined targets. EADSIM models the tactics of TELs to hide, launch, and reload.

2.8 EADSIM Physical Models

The mission/functional area modeling is supported by a number of physical models as shown in Figure 8. These include flight and movement, communications, sensors, jammers, weapons, and constructs such as air space control.

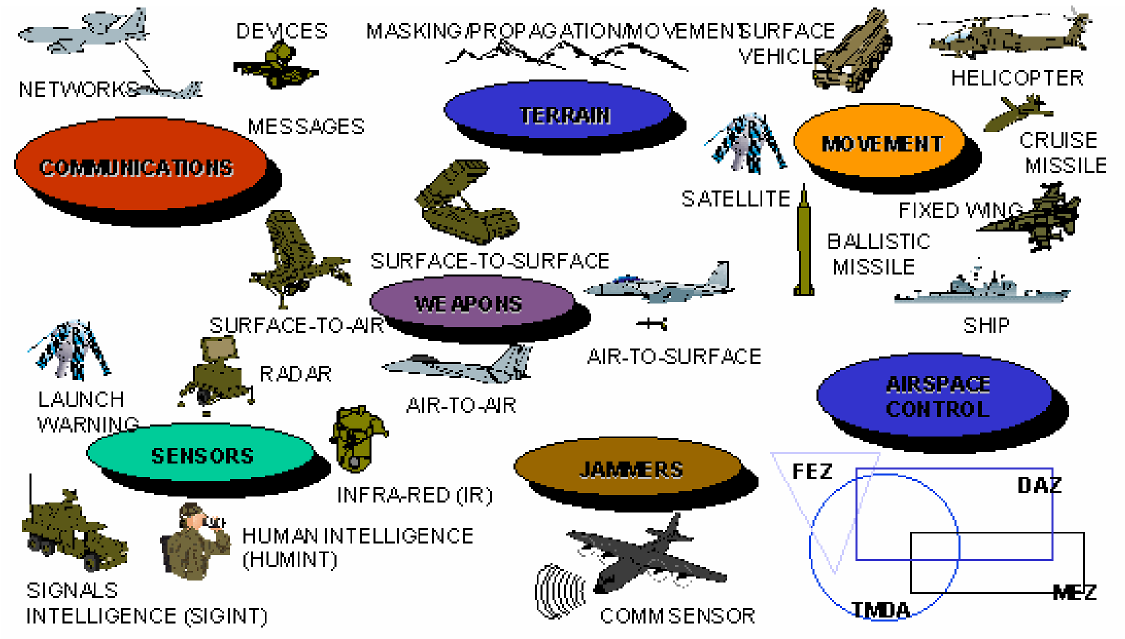

Figure 8: Mission / Functional Areas Modeled

2.9 EADSIM Communications Modeling

The communications modeling within EADSIM has three major aspects: the networks, the messages, and the devices. The networks allow the specification of which players will attempt to communicate with each other and the types of information exchanged. The messages are then transmitted over these networks, providing both the loading on the network and the transfer of the message content. The networks can change as the conditions dictate. EADSIM includes logic to dynamically alter networks, modeling the reconfiguration of the network. The device modeling allows the modeling of the RF propagation, capturing the impact of relative geometry, terrain, and jamming.

2.10 EADSIM Sensor Modeling

EADSIM models sensor types including radar, infrared, passive RF, and intelligence sensors. Targets are detected if sensor/target specific detection tests are passed, there is an unobstructed line-of-sight between the target and the sensor, and the target is within the sensor's field-of-view.

2.11 EADSIM Radar Modeling

EADSIM provides comprehensive radar modeling capabilities. Constructs are provided to model single function radars (surveillance, track, etc.) and multifunction radars that perform surveillance, tracking, fire-control, and engagement support. Multifunction radars can model autonomous search, cued search, tracking, and engagement. Radar sensors can detect aircraft, tactical ballistic missiles (TBMs), and surface platforms. For aircraft and missile targets, the specific detection tests can be deterministic (scaling with radar cross section) or probabilistic and based on target fluctuation models. For ground targets, probability of detection is a function of range.

2.12 EADSIM Passive RF Sensor Modeling

This sensor class models the detection of RF emissions. This sensor detects targets based on active emitters such as radars, communications devices, and jammers on those targets. The user may restrict which emitters are detectable by the passive RF sensor. The Passive RF sensor applications include suppression aircraft (such as Wild Weasel or jammer platforms), Intelligence, Surveillance, Reconnaissance (ISR) applications (such as Electronic Support Measures [ESM]), air defence applications (where the sensor can be configured to perform jammer strobe detections), and seeker applications (such as a HARM seeker).

2.13 EADSIM HUMINT, IMINT Modeling

Both of these classes of sensors are modeled probabilistically, with sensor characteristics represented by detection probabilities for different target types and target characteristics represented by probability of susceptibility.

2.14 EADSIM IR Sensor Modeling

This sensor class uses the infrared signature of a target, the amount of the signature presented to the sensor, and the geometry involved. Target types are selectable by the user (i.e., ground, air, TBM).

2.15 EADSIM Movement Modeling

EADSIM provides movement models for a variety of platform types. These movement models include fixed wing and rotary wing aircraft, cruise missiles, air-to-surface weapons, ballistic missiles, surface to air missiles, satellites, and surface platforms. The movement models provide for both the scripted and reactive movement of platforms.

The aircraft flight can be represented in several ways within the simulation:

- An internal physics based model
- An internal interpolation model
- Externally provided aircraft flight paths
- Externally flown aircraft via a distributed simulation interface

The physics based model includes both fixed wing and rotary wing flight dynamics. Fixed and rotary wing aircraft can fly in formations specified by the user. Formations can be "broken" based on mission requirements or in response to threats, then aircraft can return to formation. Cruise missiles and explicitly flown air to surface weapons use the same flight models as aircraft.

Aircraft can fly in formations specified by the user. Formations can be "broken" based on mission requirements or in response to threats, then aircraft can return to formation. Search profiles are modeled where the formation will split up in order to search an area, with different search profiles for the flight leader and wing. There are a number of flight modes:

- Scripted waypoint flight using orbit patterns, push-off-points, target waypoints, hover waypoints, refueling waypoints, and simple route waypoints
- Combat Air Patrols definable for offensive or defensive operations, with user control over shape of orbit pattern through multiple waypoint deployment
- Altitude maintenance during air-to-air engagement operations
- Predicted intercept during threat aircraft pursuit, keeping target within sensor FOV limits
- FPole maneuver to keep target within sensor FOV limits while minimizing closure during target engagement

- Fuzzy vectoring after enemy aircraft or ground targets
- User-defined dynamic profiles adopted during air-to-surface attack operations; used also during cruise missile flight
- User-definable defensive maneuvering
- Airborne refueling operations as part of aircraft mission
- Terrain following at user-definable altitudes
- Earth curvature sensitivities throughout using all flight modes

Ballistic Missiles can be represented in several ways within the simulation:

- an internal physics based model
- an internal curve fit
- externally provided missile trajectories, commonly called threat tapes
- externally flown missiles via distributed simulation interfaces

All representations have the capability to realistically represent multi-segment trajectories; the TBMs can have distinct propulsive, aerodynamic, guidance, and RCS characteristics in each flight segment.

Satellite movement provides the capability to model orbits based on specification of a state along an orbit. The orbit over time is then modeled using equations of motion. Satellites can also be externally flown via distributed simulation interfaces.

Surface platform movement is a constant speed movement along great circle paths between specified locations. Surface platforms can also be externally moved via distributed simulation interfaces.

Surface to air missiles have a selection of flight models. The simple model uses a constant speed approximation to fly the missile to intercept. There is also the ability to use a physics-based flight model with guidance considerations.

2.17 EADSIM Weapon Modeling

EADSIM models four general types of combat engagements covering a variety of weapon capabilities. EADSIM models air-to-surface, surface-to-air, surface-to-surface, and air-to-air engagements.

Air-to-surface engagement modeling supports free-fall bombs, anti-radiation missiles (ARMs), a warhead, and other Air-to-Surface Missiles (ASMs). The engagements may be either pre-briefed or dynamically determined engagements. Simple models of the weapons are available, where the weapon directly strikes the given target. The air-to-surface modeling also supports additional fidelity of certain types of weapons through the use of captive platforms. These platforms can be used to model such systems as cruise missiles, drones, or ARMs. Once launched, these platforms are capable of performing any of the functions that a platform with the same ruleset can perform. An additional feature allows the captive platform to be a smart weapon type possessing a sensor. For example, an ARM defined as a captive platform could follow a defined set of waypoints, use its sensor to find the designated target, fly into its target, and cause the kill/no-kill determination to be performed. ARMs unable to detect primary or alternate targets will dead-reckon a path toward the last known position of the primary target. Cruise missiles can be modeled to launch munitions against several targets and impact the final target.

Modeling of surface-to-air engagements allows representation of SAM and gun systems in engagements against both aircraft and tactical missiles. Semi-active, command-guided, "fire-and-forget," and Non-Line of Sight (NLOS) missiles are modeled. Several flyout model approaches are available, from constant velocity flight, through definition of a missile flyout table or through explicit flyout of the interceptor. When a missile reaches its target, a kill/no-kill determination is made based on the Pk assigned to the missile against the target. Semi-active missiles require track by the platform on the target all the way through to intercept. Fire-and-for-get missiles and guns only require track by the platform through launch of the weapon. Command-guided missiles have varying degrees of requirements for track maintenance throughout interceptor flyout. The NLOS weapon requires track on the target at the time of engagement decision; however, this track does not have to be from a sensor on the platform.

Air-to-air engagement modeling supports both semi-active and fire-and-forget missiles. The semi-active weapon model requires the aircraft to maintain track on the target through intercept of the missile with the target. The semi-active model also limits the engagement to one target at a time. Once a fire-and-forget missile is launched, the aircraft does not have to maintain track on the target. The aircraft is thus able to engage another target during the missile flight to the first target. The flight model is the same straight-line, constant-velocity model used for the other missile engagements; however, the intercept time is updated as the target aircraft maneuvers. The kill/no-kill determination is based on the Pk of the weapon against the target.

The surface-to-surface modeling handles both ballistic missiles and the cruise missile weapon types. The kill/no-kill determination is based on the Pk of the weapon against the target. Collateral damage and damage of multiple targets is modeled. Errors in weapon impact are modeled.

2.18 EADSIM Terrain / Environment Modeling

Natural environments modeled include terrain, atmosphere, and weather within that atmosphere. Digital Terrain Elevation Data (DTED) is used to model the terrain. The terrain impacts flight and movement, sensor coverage, and communications capabilities. Standard atmospheric models are used for aircraft and missile flight modeling and RF propagation. Weather modeling is limited to uniform layers of clouds, particulants, etc. over the entire scenario (unless running with an external weather model, in which case non-uniform effects are captured).

2.19 EADSIM Behaviour Modeling

Object behavior is controlled via flexible rulesets. Figure 9 outlines how data and triggers influence this behavior. This is the primary means for modeling battle management in EADSIM. The rulesets for phase and message processing contain battle management and engagement decision processing as well as the engagement modeling for the simulation. Users select rulesets, select behaviours, set parameters in the rulesets, and program trigger event/response combinations to control the dynamic reactions of platforms to events in a scenario. For example, the ruleset on an airborne platform will take control of the plane and perform maneuvers to achieve its objectives if needed. Multiple rulesets are available for each of the following categories: airbases, aircraft, defensive commanders, offensive commanders, sensor platforms, and surface platforms.

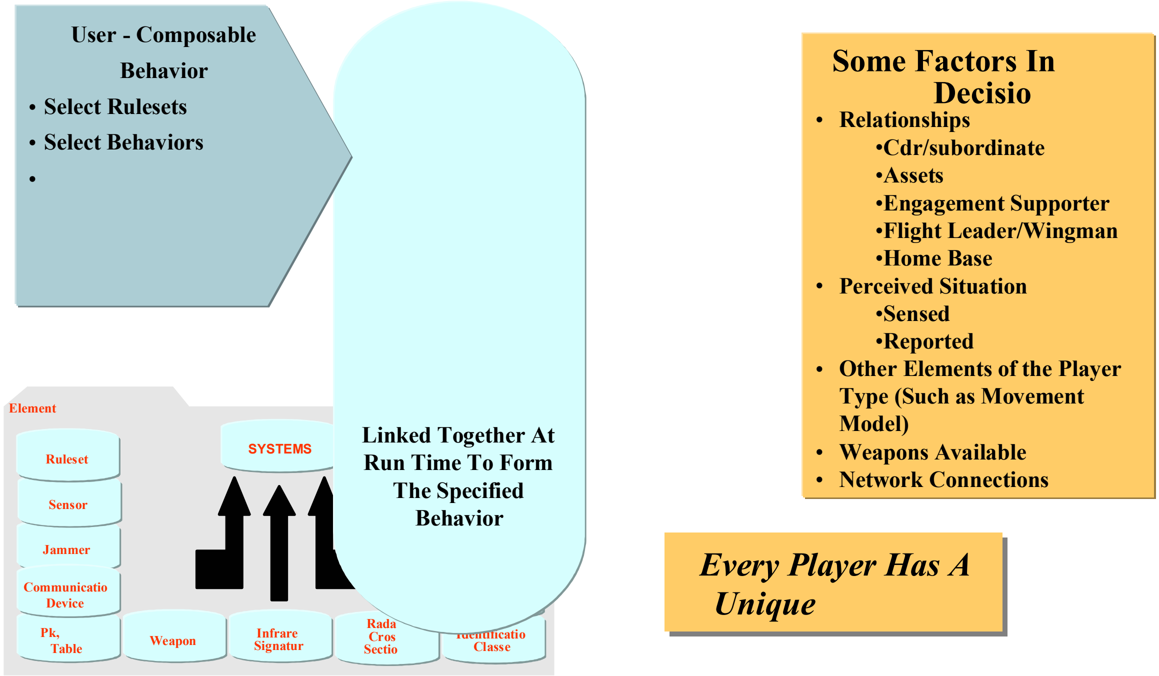

Figure 9: Behavior Modeling

The model allows for both scripted and reactive behaviours. While the interactions in EADSIM are primarily reactive, a significant portion of a scenario must be established according to a script, i.e., scenario specification. Other portions of a scenario can be either reactive or scripted. Scripted actions fall into specific categories: platform placement and movement, emitter timing and pointing, targeting, and weapon launches both air-to-surface and surface-to-surface. Each of these scripted areas is complemented by an analogous reactive decision capability to perform each of these missions.

Scripted operations for platform placement and movement include static deployment of ground/surface platforms, scripted movement of ground/surface platforms, scripted waypoints for aircraft, refueling and rearming operations for aircraft at airbases, airborne refueling operations for aircraft, formation specification for aircraft relative to flight leads, and orbit specification for satellites.

Platforms can transition from scripted behavior to reactive behavior as a function of their respective ruleset and ruleset options. The majority of the switching is as a result of threat detection by a specific platform. Threat detections can trigger a reaction or an engagement. The ruleset for an airborne platform will take over control of the platform's maneuvers and perform maneuvers to achieve its current objectives if needed. In instances where the reaction is to modify the current setting of available emitters, the platform's ruleset will operate its jamming control logic to determine the best setting of its jammer suite to counter the threat.

3.0 SUMMARY

The NATO Active Layered Theatre Ballistic Missile Defence (ALTBMD) Programme is underway.

Integrated assessment of system architectures and BMC3I options has been supported by EADSIM, and involved the explicit modelling of sensors and weapon systems, and a range of BMC3I options to integrate these.

These modelling and simulation activities have assisted in the derivation of Architecture-level and System-level technical requirements for the ALTBMD programme.

4.0 REFERENCES

[1] Information Paper - Iraq's Scud Ballistic Missiles, US Department of Defense, (July 25, 2000).