Australian Defence Simulation – Status

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EXECUTIVE SUMMARY

A rapidly expanding international role and increasing economic and environmental constraints is forcing the Australian Defence Organisation (ADO) to adopt new technology, such as simulation, in response to the challenges. Australia's small, but highly educated Defence population have been early adopters of simulation (since the 1960's) and shown a clear appreciation of the benefits of simulation to support training. Australia is continuing this trend but is also adopting other application areas where the benefit of simulation is justified. The Defence Simulation Policy states, "Defence exploits simulation to develop, train for, prepare for and test military options for Government wherever it can enhance capability, save resources or reduce risk."

The use of simulation has been dramatically increasing in the ADO over the last few years and a significant expenditure of A\$2-3 billion[1] over 10 years is cited for future simulation development. This investment needs to be well managed, coordinated and we need to take a collaborative approach with our industry partners and international simulation organisations to ensure each dollar is well spent.

This paper describes the simulation governance arrangements in place for the AOD. It also details the current and proposed future simulation activities for the ADO around the two Defence outcomes of 'Developing the Force' and 'Employing the Force'. It also discusses some existing challenges for Australia that will need to be overcome.

1.0 INTRODUCTION

Australia is a large country with a small population mostly concentrated along its eastern seaboard. Around 60% of the population live in the state capital cities, with the majority of the rest living in minor cities and towns. Australia has high literacy and education standards so Australians generally prove to be early adopters of technology.

Australia's small population has led to a correspondingly small, but modern and well-trained, Defence Force. The Army is around 25,000 strong, and the Navy and Air Force about 13,000 each, with part time reserves roughly doubling these numbers. Around 10% of these forces are currently deployed on operations (mostly within coalition forces) in the Middle East, Lebanon, Iraq, Afghanistan, Sudan, East Timor and the Solomons. This has required Australia to look at new ways to raise, train, sustain, rehearse, plan and operate in a joint and coalition environment.

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[1] Note that A\$1 is approximately US\$0.75 as of September 2006.

Government has approved a record A$51 billion in the recently released 10 year Defence Capability Plan 2006-2016 and requires a higher degree of analysis and scrutiny of how this money is spent. This has required Australia to look at new ways to support decision making in the Capability Life Cycle (CLC).

The tempo of Australian Defence operations and capability development is high and Australia is required to rely significantly more on technology advances and its industry to maintain the 'battle rhythm'. For these reasons Australia is increasingly in demand for simulation to support Defence outcomes for 'Developing the Force' and 'Employing the Force'.

A 1998 report by the Australian National Audit Office (ANAO) [1] stated that Defence had invested about A$1 Billion on simulators since 1960 and would invest over A$1.1 Billion in simulation over the next five years. Currently, it is expected that A$2-3 Billion will be invested in simulation over the next ten years. This significant current and planned investment requires a governance role for simulation at all levels of the Australian Defence Organisation (ADO). Australia has come a long way over the last 6 years to significantly improve governance in an area that was very much neglected. However, there is still a long way to go.

This paper will present an ADO overview of:

- simulation governance,

- current simulation activities,

- potential future simulation activities, and

- challenges to overcome.

2.0   SIMULATION GOVERNANCE

The following paragraphs discuss the current simulation governance arrangements in the ADO.

2.1   Australian Defence Simulation Office (ADSO)

Responding to the ANAO findings, Defence established the ADSO [2] in 2000 to address the identified critical shortfalls. The most significant of these was the need for a Defence policy for simulation and a Plan for managing Defence simulation activities in order to minimise wastage and better realise the benefits achievable from simulation capital investment.

The ADSO is a branch within the Australian Defence Headquarters with the roles of policy direction, collaboration, and coordination of simulation activities across Defence. ADSO has prime responsibility for developing and overseeing the implementation of the Defence Simulation Policy and the Defence Simulation Plan. The ADSO also manages the Defence simulation minors program. The Director General, Simulation (or DGSIM) is directly responsible to the Chief of Capability Development Executive for leading the work of ADSO.

2.2   Defence Simulation Forum (DSF)

The DSF is the peak coordinating body for simulation in Defence which provides a senior, unifying component of the management structure. It deals with the strategic issues impacting upon the development and use of simulation across the Defence organisation. Members guide Defence simulation policy direction, coordination and collaboration initiatives via the DGSIM who chairs the forum. Membership is drawn at the one-star level from each Defence Group and each member is responsible for ensuring that DSF decisions are implemented within their Defence Group. Industry is also represented on the forum via the Chairman of the Simulation Industry Association of Australia (SIAA).

2.3 Senior Management Roles

Defence simulation is governed by the following three star senior management positions:

- Chief of Capability Development Executive for overall Defence simulation governance and implementation of simulation to support the CLC (i.e. 'Developing the Force'). The DSF reports to this position.

- Chief Joint Operations Command as the Capability Manager for Joint simulation.

- Chief of Navy as the Capability Manager for Navy simulation.

- Chief of Air Force as the Capability Manager for Air Force simulation.

- Chief of Army as the Capability Manager for Army simulation.

The latter four positions combine to provide simulation support to operations (i.e. 'Employing the Force').

2.4 ADO Policy & Planning

The ADO has established a policy [3] for simulation with a vision to 'exploit simulation to develop, train for, prepare for and test military options for Government wherever it can enhance capability, save resources or reduce risk.' To achieve this vision the Policy cites six key implementation strategies:

- Manage simulations effectively.

- Increase the use of simulation in Defence processes.

- Combine simulations for greater benefit.

- Ensure adequate personnel.

- Ensure simulation life cycle support.

- Secure access to data to support simulations.

The Policy also cites six criteria to determine if a simulation proposal should be progressed:

- User Requirements - who wants it? – to do what exactly? – why? – and, in particular, what questions are to be answered with the help of simulation?

- Representations – how are people and things, with their behaviors and interactions in various environments, to be represented over time?

- Data availability & reliability – how well can these representations be enabled?

- Technology – how can these ideas be made to work effectively for the user?

- Verification & Validation approaches – how is "Fitness for Purpose" to be assessed to establish overall credibility?

- Cost/benefit – how are returns on investment to be determined to secure resources needed to build, deploy and use the system?

Other policies developed by ADSO are the Defence Simulation VV&A Policy (awaiting signature) and the Defence Policy on Computer-Based, commercial military simulations and Games (awaiting signature).

ADSO, in consultation with the DSF, developed and is currently implementing the Defence Simulation Plan. The Plan identifies the individual tasks necessary to implement the above strategies. ADSO, in consultation with the DSF, is currently developing the Defence Simulation Roadmap. The principal purpose of the Defence Simulation Roadmap is to start a process of continual improvement to guide

actions and decision making on governance, development and use of simulation that will achieve the long term vision for coherence and synchronisation of simulation activities and capabilities across Defence.

2.5   ADO Simulation Guidance

ADSO has developed numerous guidance documents on simulation aspects that have been compiled into a document called the Defence Simulation Manual (or SIMMAN) and is available on the ADSO web site [2]. The structure of this document is shown in Table 1.

Volume 1: Defence Simulation Management		Volume 2: Defence Simulation Applications
Part 1: Defence Simulation Policy	**Part 9**: Distributed Simulation Guide	**Part 1**: Simulation Support to Capability Life Cycle
Part 2: Defence Simulation Planning		• Needs Phase Guide
Part 3: Introduction to Simulation	**Part 10**: Simulation Data Guide	• Requirements Phase Guide

Part 4: Simulation Investment   Reference Guides
   • Simulation Application Guide
   • Simulation Benefits Guide
   • Simulation Costing Guide
	Part 11: Simulation Standards	• Acquisition Phase Guide
		• In-Service Phase Guide
		• Disposal Phase Guide

Part 5: Simulation Proposal Guide	**Part 12**: Simulation Safety Guide	
Part 6: Defence Simulation Glossary	**Part 13**: Simulation Security Guide	**Part 2**: Simulation Support to Analysis
Part 7: Simulation And Defence Capability	**Part 14**: Simulation Training and Education	• Experimentation Simulation Support Plan
Part 8: Simulation Verification, Validation and Accreditation Guide	**Part 15**: Defence Current & Future Simulation Projects	

Table 1: Defence Simulation Manual (SIMMAN)

3.0   CURRENT SIMULATION ACTIVITIES

3.1   Background

Simulation enables Defence to develop its military preparedness without over-stretching a constrained budget, or damaging our personnel and platforms. The uptake of simulation has been gradually increasing over time as user awareness increases and technology advances.

Today, a majority of military technologies and capability acquisitions depend upon some form of simulation capability to support them. As outlined in the Defence Simulation Policy, DI(G) OPS 42-1, simulation supports the following application areas:

- Training,
- Force Assessment,
- Experimentation,
- Research and Development,
- Acquisition,
- Life-Cycle Management,
- Crisis Management and Planning,
- Mission Rehearsal, and
- Conduct of Operations.

Most current capital equipment expenditure will support Training. However, there is a growing requirement to provide simulation capabilities to support the other application areas to aid Defence decision-making.

In November 1998, the ANAO estimated a Defence spend on simulators of A$1.1 billion between 1998 and 2002. Analysis by Defence has shown that around A$1.3 billion on major capital simulation equipment will be invested during the period 2003 to 2010 (or A$164 million annually). However, in addition to this estimate (and the ANAO estimate) one must also consider:

- the A$20 million per year simulation investment forecast by the Defence Science and Technology Organisation (DSTO),

- other Group simulation investment expenditure,

- capital equipment support costs (estimated at A$16.4 to A$24.6 million per year),

- minor capital investment expenditure,

- simulation facilities expenditure , and

- simulation support to acquisition costs.

With the above considerations in mind, realistic overall estimates for Defence's annual investment in simulation would seem to be between A$200M and A$300M.

3.2   National Simulation Activities

The following paragraphs will discuss some of the major activities in the ADO.

3.2.1   Developing the Force

3.2.1.1   *Science and Technology*

The DSTO is a significant user of simulation in Defence and has a coordinating body known as the DSTO Simulation Hub. It maintains a number of centres of excellence for simulation to support capability acquisition and development, training, support to operations, force structure analysis, and research and development. These are listed briefly below:

- **Air Operations Simulation Centre** – within Air Operations Division (AOD) provides a test bed for air platforms (F/A18, F-111, Blackhawk, C-130, ARH and others). AOD is also developing an overarching Aerospace Battlelab Framework that will include the Air Operations Simulation Centre and other simulation facilitates – the Advanced Distributed Simulation Laboratory, Air Operations Experimentation Centre and the Missions Systems Research Centre to create a distributed aerospace simulation environment.

- **Synthetic Environment Research Facility** – within Land Operations Division (LOD) represents the land environment via the OneSAF test bed, Command support system demonstrators and land platform test beds (TUAV, ARH and others).

- **Maritime Experimentation Laboratory (MEL)** – within Maritime Operations Division (MOD) houses the Virtual Maritime System which provides representations of the ANZAC and FFG frigates, AWD destroyer, and Collins submarine. Using various features of the Virtual Maritime System Architecture the MEL brings together simulated and real combat systems elements to explore future warfighting concepts and capabilities, and to support studies aimed at reducing the integration risk for combat systems.

- **Centre for Evaluation, Simulation and Analysis of Weapons** – within Weapons System Division (WSD) undertakes analysis of weapons using modelling and simulation.

- **Future Operations Centre Analysis Laboratory** – within Command and Control Division (C2D) is aimed at exploring new paradigms for situation awareness, and command and control in military command centres, making use of new technologies developed for simulation, virtual reality, and real-time 3D animation.

3.2.1.2 Australian Industry

Industry continues to build simulation capability to support the CLC. Some of the better known centres are the Boeing Systems Analysis Centre, Thales Ocean Lab, and the ADI/Thales Australian Transformation and Innovation Centre.

3.2.2 Employing the Force

The Services have made significant use of simulation to train and prepare for operations as well as to support force and combat development. The following paragraphs discuss some of the more significant of these capabilities.

3.2.2.1 Army

Army is supported by the Army Simulation Wing to manage, develop and foster simulation within Army. Army's significant simulation capabilities are [4]:

- **Battle Simulation Centres** – based in Puckapunyal, Brisbane, Townsville and Darwin these centres use virtual and constructive simulation to deliver individual and collective training to support units within Army.

- **Combat Training Centre** – based in Townsville this centre uses live and constructive simulation to support the delivery of collective training for Army.

- **Land Command Battle Laboratory** – has the role of maximising campaign planning, force preparation and operational capabilities through the exploitation of simulation, modelling, operational analysis and war gaming in order to win the land battle.

3.2.2.2 Navy

Navy is supported by the Navy Simulation Office to coordinate simulation activities within Navy. Navy's significant simulation capabilities are:

- **Maritime Warfare Training System (MWTS)** – is primarily a training capability to enhance Warfare Command Team Training and combatant fleet operational readiness. In May 2006, the first in the series of synthetic training exercises with US Pacific fleet elements was conducted. This exercise, known as Pacific Coalition Fleet Synthetic Training, networked the Australian combat system training simulators at HMAS Watson with two US guided missile destroyers and a cruiser equipped with On Board Training Systems and used a scenario based on RIMPAC 2006.

- **Maritime Warfare Bridge Training Facility** – is located in Sydney and uses a simulator to provide realistic training required for Junior Seaman Officers to become fully capable of carrying out the duties of the Officer-of-the-Watch in all classes of RAN ships.

- **Navy Experimentation** – uses constructive simulation (JSAF, HARPOON) to examine Navy force preparation and operational capabilities.

- Navy also operates training simulators for its fleet air arm of Sea King, Sea Hawk, and Seasprite helicopters.

3.2.2.3 Air Force

Air Force has significant simulation capability for individual training and maintenance. Air Force's significant capabilities are:

- **Air Platform Support** – Simulators are available for F-111, F-18, C130H&J, B707, Hawk, AP3C for crew and support training at a number of sites around Australia.

- **Air Defence Ground Environment Simulation (ADGESIM)** – provides virtual simulation training for air defence operators/officers.

- **Air Force Experimentation** – uses constructive simulation (JSAF) to support examination of Air Force force preparation and operational capabilities.

3.2.2.4 Joint Operations Command

Joint Operations Command has largely been supported by simulation for joint command training. This has largely been based around the JSAF and JTLS constructive simulations based at the Australian Defence Warfare Centre (ADFWC).

3.3   NON ADO

3.3.1   Simulation Industry Association of Australia (SIAA)

In an effort to advance the research, development, and use of Simulation technologies and practices in Australian industry, academia, and government the SIAA was formed. "The SIAA provides a focus and a forum for those involved with simulation technology in Australia, to allow for discussion and distribution of information, and to further advance the research, development and use of simulation technologies and practices in Australian society, industry, academia, and government." [5] The SIAA also hosts 'SimTecT', the largest simulation conference in the southern hemisphere. In 2007 it will be held in Brisbane, Queensland.

3.3.2   Standards Australia

Standards Australia facilitates the development of Australian standards and has established a Committee IT-031: Computer Modelling and Simulation to address modelling and simulation standards. The Committee's mission is twofold [6]:

- to coordinate, develop, disseminate and promote Standards for Computer Modelling and Simulation in Australia; and

- to contribute to national and international Computer Modelling and Simulation Standards development.

3.4   International

3.4.1   Joint Combined Training Centre

The Joint Combined Training Centre (JCTC) will establish a network of state-of-the-art facilities where Australian and US forces can undertake joint training, supported by improved instrumentation and simulation. The JCTC vision is to enhance high-end, bilateral training in order to increase and measure operational capability and preparedness, improve interoperability and facilitate capability development.

JCTC is for use by the Australian Defence Force and its United States counterparts. The JCTC will deliver an enduring Initial Operating Capability in conjunction with Exercise Talisman Sabre 2007.

3.4.2   North Atlantic Treaty Organisation (NATO)

Australia has been formally involved in the following NATO simulation activities.

3.4.2.1 NATO RTA MSG-046 (Military Application of Commercial Games) Working Group

Australia is a lead nation in the exploitation of commercial games and is an active member of the MSG-051 [7]. Australia is currently utilising the following commercial products: TACOPS, Steel Beasts, Virtual Battle Systems (VBS), Uncommon Valour, Combat Mission, HARPOON, and Decisive Action. Multinational unclassified demonstrations between Australia, Sweden, The Netherlands and Canada are planned to take place at the next games working group.

Defence continues to examine the utility of commercial games to:

- Expose Defence members at all levels to the benefits of simulation, while recognising potential cost-savings associated with some commercial products.

- Grow the knowledge and skill base within Defence in selected areas.

- Raise the profile of simulation and of the potential returns on new Defence investment in the area.

- Keep Defence abreast of the fast growing developments in the commercial world.

3.4.2.2 NATO Virtual Ships

Australia has made significant contribution to NATO Naval Armaments Group 6 (Sub-Group 61 on Virtual Ships (SG61)). The sub group provides focus upon Simulation-Based Design and Virtual Prototyping (SBDVP) technologies for naval ships. The group has developed a STANAG and is currently seeking approval for a Naval Ships Framework Memorandum of Understanding (Virtual Ships MOU) to pursue cooperative efforts in individually negotiated Project Arrangements for development of SBDVP technologies. The ADSO is currently designated to be the Australian principal for the MOU.

3.4.3   Simulation Interoperability Standards Organisation (SISO)

Over the years Australia has contributed to various working groups of SISO. Australia has now set up a SISO Australia Standing Study Group (SISO Australia) [8], sponsored by the SIAA, to liaise and inform the international SISO in order to meet the needs of the Australian Simulation community.

3.4.4   The Technical Cooperation Program (TTCP)

Australia participates in the TTCP [9], which is an international organisation that collaborates in defence scientific and technical information exchange, program harmonization and alignment, and shared research activities for Australia, the United Kingdom, Canada, the United States and New Zealand. The Joint Systems and Analysis Group's Technical panel 2 focuses on modelling and simulation (M&S), although M&S is used in many other Groups.

4.0   FUTURE SIMULATION ACTIVITIES

The following paragraphs will discuss some of the major future simulation activities in the ADO

4.1   Joint Synthetic Environment (JSE)

The ADSO continues to evolve the JSE concept. The JSE is the component of the Defence Simulation Capability, which provides the ADO with an adaptive, responsive and pervasive capability to combine existing and evolving elements of simulation Capability to support Defence outcomes with an initial focus on collective training, operations, and concept and capability development.

4.2   Live, Virtual, and Constructive (LVC) Simulation Exercises

It is proposed to continue to build on the capability provided by JCTC for Talisman Sabre 07 for Joint and Combined training. What form this takes will depend on the outcome of the Exercise as well as the enabling studies currently being undertaken by the US and Australia.

The Navy's MWTS will continue to conduct Pacific Coalition Fleet Synthetic Training. In the near future this will also include the On Board Training System capabilities being delivered by the FFG upgrade program. It is hoped that a virtual exercise will precede all future RIMPAC exercises. Eventually, the MWTS will provide surface training, sub surface training, amphibious training aviation training, and mine counter measures training. Navy is also investigating a 'Distributed Engineering Plant' capability to test communications interoperability.

The Air Force aims to use LVC technology to support the multinational exercise Pitch Black in 2008. The planning is still underway, but will most likely involve linking individual flight simulators with the ADGESIM, and constructive simulation.

4.3   Defence Experimentation

Defence is currently investigating a Canberra Based Simulation Centre (CBSC) to offer a distributed hub for Canberra based decision makers by:

- providing supporting functions such as concept and capability development, decision support, and mission planning.
- by making available the appropriate range of industrial, scientific and defence simulation facilities via distributed connectivity.

DSTO has also instigated the Defence Experimentation Initiative (DEI) to provide a coordinated approach to providing experimentation support. The DEI has two broad objectives:

- to coordinate and direct the support to experimentation activities across DSTO Divisions (management function); and
- to integrate the battle laboratories (battlelabs) available in each Division to deliver the technical functionality available with the formation of a Federated Battle Laboratory.

4.4   NATO

Australia hopes to increase its level of involvement in NATO NMSG activities in the future. Initially, Australia would welcome involvement in the following working Groups:

- MSG-027 Pathfinder: Integration Environment for Multi-purpose Application of Distributed Networked Simulation.

- MSG-030 Collaborative Working Environments (CWEs) for Simulation Based Acquisition (SBA).

- MSG-031 The Cost-Effectiveness of Modelling and Simulation (M&S).

- MSG-032 Urban Combat Advanced Training Technology.

- MSG-046 Modelling and Simulation for Network Enabled Capability.

Australia would also welcome involvement in any working groups that investigate the use of simulation applications to support joint simulation for training or planning support.

5   CHALLENGES

5.1   Culture Management

The military environment is one deeply ingrained in tradition and military judgement. Although, simulation technology is welcomed, it is often pushed aside for more traditional methods, some of which do not realise the cost and benefits (e.g. training fidelity) that simulation can offer. Simulation awareness programs are in progress within Australia to overcome this challenge. One example is the list of simulation case studies (both national and international) in the Defence Simulation Benefits Guide that we are continuously seeking to increase.

5.2   Resources: people and money

With a small Defence force and the current tempo of operations and capability development the competition for resources is fierce. It is imperative that simulation show a real cost saving to satisfy our financial gatekeepers. Additionally, as Australia consists of only 20 million people, finding people with skills in simulation is difficult. Australia is gradually building up a simulation education program to overcome this challenge.

5.3   Effective coordination

The challenge here is not only to make organisations aware of what each is doing but also getting them to work and share resources to overcome a common problems. A small Defence force makes this less challenging for Australia as opposed to some other countries, but still remains a challenge.

5.4   Data

Availability and management of 'credible' data for simulation remains a significant challenge for us. The challenge is amplified by the response times for fidelity data required for some of our more recent operations.

5.5   Geography

Australia, in distance terms, is a long way from our northern NATO colleagues. The challenge of effective collaboration with our northern neighbours still remains but is improving. Additionally, the physical distance between Australia's simulation centre's is significant and challenges close working relationships.

5.6 Certification and Accreditation

With the increased uptake of simulation both within the AOD and Defence industry the ability to effectively conduct simulation certification (safety and security) and accreditation will continue to be demanding. However, Australia does have a Verification, Validation and Accreditation Policy (Draft) and Guide in place to assist this process.

6.   REFERENCES

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