



Australian Government
Department of Defence

Simulation Training and Education



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Prepared by:

Australian Defence Simulation Office

Department of Defence, Canberra

<http://intranet.defence.gov.au/cio/>



Australian Government
Department of Defence

Foreword

This Simulation Education and Training document provides a listing of known available simulation education and training activities that can be undertaken to develop simulation expertise.

This is a living document and will be updated when additional information becomes available. Alterations or additions to this document are welcomed and should be directed to:

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Simulation Training and Education Courses

Post Graduate University Courses

Table 1 - Post-Graduate Tertiary Courses in Simulation

Post-Graduate Tertiary Courses in Simulation		
Institution	Courses	Descriptions
RMIT	<ul style="list-style-type: none"> ▶ MC048 Master of Engineering (Simulation Technology) ▶ GD046 Graduate Diploma (Simulation Technology) ▶ GC030 Graduate Certificate (Simulation Technology) 	Focuses on advanced modelling and interactive simulation for training applications. The program is intended to produce graduates targeted, in the first instance, at the simulation industry, but also encompassing the wider domain of multimedia design and computer based training applications.
Uni of NSW (ADFA)	<ul style="list-style-type: none"> ▶ 8562 MSc in Operations Research & Statistics ▶ 5882 Grad Dip Science in Operations Research & Statistics ▶ 7382 Grad Cert Science in Operations Research & Statistics 	This program aims at developing a high level understanding of the principles and practice of operations research and statistical analysis and to strengthen their skills in analysis, problem solving and decision-making. Its consideration of a wide range of analytical and quantitative techniques makes it suitable to both the professional analyst and to the student wishing to develop or employ those skills in higher level research.
University of Central Florida	<ul style="list-style-type: none"> ▶ Master of Science in Modeling and Simulation ▶ Doctor of Philosophy in Modeling and Simulation 	This program is aimed at enabling graduates to work in varied capacities in government agencies, defence, entertainment, and manufacturing industries providing an interdisciplinary core body of knowledge on modeling approaches, human factors, computing infrastructure, and visual representation. Masters students choose to establish one in-depth, and doctoral students four, of the following focus areas: quantitative aspects of simulation; simulation infrastructure; simulation management; computer visualization in M&S; simulation modeling and analysis; interactive simulation/intelligent systems; or human systems in M&S.

Post-Graduate Tertiary Courses in Simulation		
Institution	Courses	Descriptions
Old Dominion University, Virginia Modeling, Analysis and Simulation Center (VMASC), Virginia	<ul style="list-style-type: none"> ▶ Master of Engineering and Master of Science with concentration in Modeling and Simulation ▶ Doctor of Philosophy in Engineering with concentration in Modeling and Simulation 	<p>These degrees are offered to prepare professionals to deal with contemporary simulation development and application issues and have the objectives of being integrative across disciplines, discovery producing, and job-oriented. This course enables graduates to concentrate on: simulation based instruction; analysis and decision making; human/computer interaction; simulation development; or distributed simulation systems.</p> <p>The doctorate program focuses on developing the necessary skills and knowledge to enable the graduate to conduct and evaluate independent, original research in an area of modeling and simulation. The goal of the program is to prepare students for careers in teaching and research at academic institutions, as well as in public and private organizations characterized by innovation, research, and development in modeling and simulation.</p>
The Royal Military College of Science (RMCS), Cranfield University, UK	<ul style="list-style-type: none"> ▶ Masters in Defence Simulation and Modelling ▶ MSc/Postgraduate Diploma [PgDip] ▶ Postgraduate Certificate[PgCert] 	<p>The aim of this course is to explain the main principles of the hardware and software, including the underlying models, used in creating a synthetic battlefield and to consider the issues associated with procuring, using and managing such facilities for the training, testing and assessment of military forces and equipment.</p>
US Naval Postgraduate School	<ul style="list-style-type: none"> ▶ Masters of Science ▶ Doctor of Philosophy 	<p>The Modeling, Virtual Environments and Simulation (MOVES) Academic Program of the Naval Postgraduate School provides the MS and Ph.D. student both fundamental and specialized courses in applied visual simulation technology and the application of quantitative analyses to human-computer interaction in simulation technology.</p> <p>The MS program is a two-year, eight-quarter program whose core covers the fundamentals of computer science, human-computer interaction, and data analysis. These topics include object-oriented programming, artificial intelligence, computer communications and networks, computer graphics, virtual worlds and simulation systems, probability, statistics, stochastic modeling, data analysis, human-performance evaluation and human-behavior modeling.</p>

Post-Graduate Tertiary Courses in Simulation		
Institution	Courses	Descriptions
Arizona State University	▶ Masters of Engineering in Modelling and Simulation (online)	This track offers specialized courses founded on the fundamentals and principles of simulation modeling and software engineering. The applications of modeling and simulation (M&S) incorporate state-of-the-art engineering advances with a focus on systems of the future. The main academic emphasis includes defense applications, large-scale computer and supply chain networks, software factory, and intelligent systems. Students will learn about key technical barriers faced by government organizations - e.g., those set to institutionalize M&S such as DMSO (Defense Modeling and Simulation Organization), - and others in developing increasingly complex decision-making systems. In addition, students will become skilled in M&S science, enabling them to engineer novel solutions for multifaceted problems that the Departments of Defense and Homeland Security, commercial industries, and private and non-profit agencies must contend with.

University Subjects Offered

Table 2 - Representative Simulation Subjects Offered in Tertiary Courses

Representative Simulation Subjects Offered in Tertiary Courses		
Institution	Subject	Descriptions
Central Queensland University	▶ COIT12120 System Simulation	This subject aims to introduce students to modelling systems using discrete system simulation methodologies. At the end of the course students should be able to analyse simple systems, determine if simulation is an appropriate methodology, build a computer model, validate the model and draw practical implications from the model.
Curtin University of Technology	▶ 304631 Introduction to Simulation 304 (almost prerequisite to Computer Technology 403)	Introduction of modelling techniques, which enable simulation of real world systems and phenomena. Current applications of simulation environments for analysis, training and gaming. The main areas of presentation are introduction to modelling and simulation core areas, simulation development, and application areas
	▶ 12858 Computer Technology 403	Selected topics in computer engineering - parallel computing structures, advanced graphics and presentation systems, pattern recognition, machine vision, rule-based systems, multimedia and virtual reality. Robotic mechanisms and hierarchical control. Sensors for robots, proximity, force and tactile. Autonomous robots. Applications of artificial and computational intelligence. Neural Network and Fuzzy control systems
	▶ 306 331 Simulation 604	Investigation of the discipline of modelling and simulation for replicating real world systems or phenomena using modelling approaches and simulation environments for analysis, training, and gaming applications. Selected topics include - modelling and simulation principles, model engineering, experimental design, system analysis and reduction, and simulation study design and analysis
	▶ ACSC2006 Decision Analysis	The aim of this subject is to expose students to various methods of analysing decision-making problems and demonstrate their use. The topics covered will include decision tables, decision trees, influence diagrams, descriptive theories. Utility theory, multifactor evaluation techniques and group decision-making techniques

Representative Simulation Subjects Offered in Tertiary Courses		
Institution	Subject	Descriptions
	<ul style="list-style-type: none"> ▶ ACSC2018 Linear Programming 	The aim of this introductory subject is to examine the basic quantitative techniques of Operations Research (OR). The course generally covers: history of OR, nature of OR problems, OR modelling and problem solving approaches. Specific topics include: linear programming, distribution and allocation models, integer programming, network models, game theory, goal programming and OR modelling using computer packages
	<ul style="list-style-type: none"> ▶ ACSC3006 Simulation 	Introduces students to the skills of writing simulation models. Topics will include concepts of modelling, continuous and discrete systems, random number generation and tests for randomness, time-stepped and event-stepped simulation, object oriented simulation techniques, statistical analysis of output, verification and validation approaches of simulation models
	<ul style="list-style-type: none"> ▶ ACSC3015 Operations Research 	This subject introduces a number of Operations Research techniques and their applications to various real-world problems. The topics include: project planning and controlling tools, markov models, queuing systems, reliability, maintenance and replacement models, inventory theory, dynamic programming and case studies in OR
University of Ballarat	CP806 High Level Architecture	Course description currently being updated
University of Central Florida	<ul style="list-style-type: none"> ▶ CAP 6835 Visual simulation, Rendering, and Photometry 	Modeling: SFM, space carving, voxel coloring; Image-based rendering: morphing, plenoptic resampling, lumigraph, layered 2.5D representation; Image-based photometry: light, color constancy, BRDF, intrinsic images, invariants
	<ul style="list-style-type: none"> ▶ CCE 5406 Construction Equipment and Productivity 	Selection of appropriate equipment based on operational parameters. Principles of construction productivity measurement and analysis. Discrete event simulation
	<ul style="list-style-type: none"> ▶ CDA 5530 Performance Models of Computers and Networks 	Senior standing or beginning graduate student. Performance models of computer systems and networks using probability models and discrete event simulations. Queuing theory and modeling tools
	<ul style="list-style-type: none"> ▶ COP 6615 Operating 	Scheduling and queuing theory, simulation, and performance evaluation of computer systems.

Representative Simulation Subjects Offered in Tertiary Courses		
Institution	Subject	Descriptions
	Systems Theory	
	▶ CWR 6102 Advanced Hydrology	Single site and regional frequency analysis; modeling hydrologic systems; lumped and distributed event models for urban and natural drainage basins; continuous simulation; real-time forecasting
	▶ EEL 5353 Semiconductor Device Modeling and simulation	Large signal and small signal model development for semiconductor diodes, BJTs, and MOSFETs. Parameter extraction, numerical algorithm, and SPICE simulation are included
	▶ EEL 5390 Full-Custom VLSI Design	CMOS VLSI design methodologies; full custom chip design, industrial CAD tools; simulation; verification
	▶ EEL 5762 Performance Analysis of Computer and Communication Systems	Stochastic modeling and discrete-event simulation; Markov chains; networks of queues; SemiMarkov models; application to multiprocessor systems, switching and multi-user communications
	▶ EEL 5891 Continuous System simulation	Use of state-space techniques, numerical integration, and CSSL programs. Laboratory assignments
	▶ EEL 6208 Advanced Machines	Theory of electric machines using reference frame transformations. Basic principles of dc and ac machines, including induction and synchronous, are included. simulation techniques for steady state and dynamic performance analysis will be used to analyze operation of electric machines with solid state drives.
	▶ EEL 6843 Machine Perception	Advanced methods of machine understanding; simulation of intelligent machine systems; automatic recognition systems; visual tracking systems; multispectral feature analysis.
	▶ EEL 6878 Modeling and Artificial Intelligence	Introduction to various applications of artificial intelligence techniques as they affect the engineering aspects of computer-based simulation, modeling, and training. The course will be taught as a seminar, making significant use of the current research.
	▶ EEL 6893 Continuous	Continuation of EEL 6426 including advanced features of Continuous simulation Languages such

Representative Simulation Subjects Offered in Tertiary Courses		
Institution	Subject	Descriptions
	System simulation II	as user-defined macros, linear analysis package, sampled data systems. A simulation study term project is required.
	▶ EEL 6895 Current Issues in Real-Time simulation	Design considerations in real-time, computer-based, training simulator systems. Laboratory assignments.
	▶ EIN 5255 Interactive simulation	Post-Baccalaureate status or C.I. Introduction to significant topics relative to the development and use of simulators for knowledge transfer in the technical environment.
	▶ EIN 5602C Expert Systems in Industrial Engineering	Overview of basic concepts, architecture and construction of expert systems in IE. Intelligent simulation training systems, case studies and problems. Laboratory exercises.
	▶ EIN 6524 Simulation Modeling Paradigms	Modeling techniques and designs for simulation, conditions for use, and implementation algorithms. Introduction to modeling theory and formalisms for computer simulation.
	▶ EIN 6529 Simulation Design and Analysis	All required courses in Simulation Modeling and Analysis or Interactive Simulation and Training Systems curricula. Integrates all aspects of the curriculum in a project-focused capstone course. Involves design, development, implementation, validation, and evaluation of a simulation project.
	▶ EIN 6603 Readings in Expert Systems/AI in Industrial Engineering	Reading and discussing current topics in expert systems/AI as applied to IE. Current literature in intelligent simulation training systems.
	▶ EIN 6645 Real-Time simulation Agents	Mathematical modeling and computer simulation of engineering and scientific systems as agents within a simulation. Examination of hardware, software, and solution methods for real-time systems.
	▶ EIN 6647 Intelligent simulation	The range of architectures and technologies relative to the simulation of intelligent processes.
	▶ EML 5532C Computer-Aided Design for Manufacture	Builds on introductory material covered in EML 4535C. Topics include computer modeling for the synthesis, simulation, design and manufacture of mechanical, thermal, and aerospace systems.

Representative Simulation Subjects Offered in Tertiary Courses		
Institution	Subject	Descriptions
	▶ EML 6227 Nonlinear Vibration	Robust, reliable algorithms for simulation of nonlinear phenomena; phase planes; limit cycles; stability; period-multiplying bifurcations; strange attractors; Poincare maps; Floquet theory; Lyapunov exponents; applications to mechanical and aerospace systems.
	▶ ESI 5316 Operations Research	Methods of operations research, including formulation for models and derivation of solutions; linear programming, network models queueing theory, simulation, and nonlinear optimization techniques.
	▶ ESI 5531 Discrete Systems Simulation	Methods for performing discrete systems simulation, including network modeling, will be treated.
	▶ ESI 6217 Statistical Aspects of Digital simulation	Statistical issues in digital simulation including input data analysis, pseudorandom number generation, experimental design, and simulation output analysis.
	▶ ESI 6358 Decision Analysis	Classical Bayesian analysis; utility and its measurement; multiattribute utility methods; influence diagrams; Analytic Hierarchy Process; behavioral aspects; simulation.
	▶ ESI 6529 Advanced Systems simulation	Combined networks discrete and continuous simulation, applications, statistical analysis and comparison of simulation languages.
	▶ ESI 6532 Object- oriented simulation	Object-oriented modeling and development techniques for building large process-based discrete event simulation models. Concurrency in discrete event simulation. Object-oriented simulation environment.
	▶ ESI 6546 Process simulation	Basic principles of steady state and dynamic process simulation. Software and hardware trends. Math approaches using ordinary differential equations and differential-algebraic equations.
	▶ IDS 5145 . Interdisciplinary y Course in simulation	Calculus, matrix algebra, probability and statistics, high level programming language. An interdisciplinary course on simulation with hands-on experience in discrete event modeling, continuous modeling and shared virtual world. May be repeated for credit.
	▶ IDS 5709	Interdisciplinary study of autonomous characters-

Representative Simulation Subjects Offered in Tertiary Courses		
Institution	Subject	Descriptions
	Autonomous Characters	computer programs that mimic human behavior; in games, simulations and interactive literature. Formal models of strategy, tactics and actions.
	▶ IDS 5717C Introduction to Modeling and simulation	. Introduction to the theory and practice of modeling and simulation with emphasis on multidisciplinary scientific underpinnings.
	▶ IDS 5718 Science and Technology of Dynamic Media	Graduate level survey of key scientific, technical issues in interactive media. Information algorithms, objects, models. Theories of computer graphics, sound, modeling, simulation, interfaces, artificial intelligence.
	▶ IDS 5719 Quantitative Aspects of Modeling and simulation	Introduction to matrix algebra and other discrete mathematics topics for modeling and simulation applications.
	▶ MAP 5106 Introduction to Quantitative Aspects of Modeling and simulation	An introduction to calculus, matrix algebra, probability and statistics, and high level programming languages. A student who has mastered this content does not have to take this course.
	▶ PCB 5485 Models in Ecology	A survey of how simulation models are applied to ecological questions of both a theoretical and managerial nature.

Short Courses

Table 3 - Short Courses in Simulation

Short Courses in Simulation		
Institution	Courses	Descriptions
Curtin University & UNSW/ADFA	▶ Introduction to Simulation Foundations (2 days)	This course focuses on the history and legacy of simulation as embraced within the defence community and presents the basic science issues surrounding real world representation within a synthetic environment. The defence application areas of training, analysis and acquisition are also presented and discussed.
	▶ Advanced simulation practicum (3 days)	Provides professionals currently developing, using, or procuring simulation systems, an in-depth understanding of the simulation principles, methodologies, and architectures which underpin the appropriate use of a given modeling approach and simulation technique for a specified purpose. This course focuses more on the science and engineering aspects of modeling and simulation and is conducted in the workshop environment allowing for discussion, practicals and group exercises.
University of Ballarat	▶ A short course in the High Level Architecture	This course is designed to provide a comprehensive introduction to the High Level Architecture covering in detail the essentials of the HLA and a comprehensive practicum, based around construction of a real distributed simulation example. It is designed for experienced Java and C++ programmers and is aimed to equip participants with the skills and confidence required to tackle real world applications of HLA.
SIAA	▶ Simulation staff officers course	Under development
The Royal Military College of Science (RMCS), Cranfield University, UK	▶ Foundations of Modelling & Simulation (one week)	The aim is to make students aware of the roles, concepts and applications of modelling and simulation in defence, and to understand how to construct simple models.
	▶ Modelling & Simulation of Engineering Systems (one week)	This course aims to enable students to study modelling and simulation processes and techniques as applied to engineering problems, particularly during the military systems procurement lifecycle.
	▶ Discrete & Continuous Simulation (one week)	The aim of this course is to provide students with a good understanding of the principles underlying both discrete event simulation (DES) and continuous simulation, focusing, in the latter case, on System Dynamics (SD) modelling.
	▶ ESD60 Systems Modelling & Simulation (two days)	The course aims to introduce the roles of modelling, simulation and synthetic environments in Systems Engineering.
Permian Pty	▶ The High Level	The one day seminar provides an introduction to the architecture,

Short Courses in Simulation		
Institution	Courses	Descriptions
Ltd	Architecture (HLA) - An Introduction'	including the terminology used within the Simulation industry. Design and implementation issues are considered, along with limitations of HLA.
Distributed Simulation Technology Inc (DiSTI)	<ul style="list-style-type: none"> ▶ Military Simulation Techniques & Technology ▶ Visual Simulation Techniques & Technology ▶ Fundamentals of Distributed Simulation ▶ Simulation-Based Acquisition ▶ A Practical Guide to HLA ▶ DIS applications ▶ Other courses 	DiSTI in the US provide several short courses in simulation topics in the DiSTI® Simulation Professional Series that is designed to educate professionals on the state-of-the-art for modeling and simulation. Further information can be found at www.simulation.com
ADSO	<ul style="list-style-type: none"> ▶ Introduction to JSAF ▶ Developers JSAF 	ADSO, upon request and with sufficient numbers, may fund courses in introduction to JSAF and JSAF development

Simulation Workshops

Table 4 - Simulation Workshops

Simulation Workshops		
Provider	Workshop	Description
▶ SimTect 2004	▶ Advanced HLA Course [1/2 day - 24 May 2004]	This workshop gives a brief introduction to the High Level Architecture concepts and components, followed by a hands-on session (10 workstations in the PC Games area) using the Calytrix SIMplicity toolset. The workshop is targeted at programmers (eg Java or C++) who have little or no experience of programming an HLA federation. Some very basic understanding of HLA is desirable.
	▶ An Overview of Simulation Standards [1/2 day]	This workshop provides an overview of SISO activities and comments on international simulation standards from the chairman of SISO, an introduction of the newly formed Standards Australia simulation committee and a summary of activities, a summary of a DSTO standards report, following interoperability exercises with the RAN/USN, the latest on Australian input to the SEDRIS standard, and an overview of current CASA flight simulator regulations activities and related international activities
	▶ Computer Generated Forces Behavioural Models and Agent Enabled Simulation [1 day]	This tutorial covers essential concepts, detailed interactive demonstrations and worked examples of behavioural modelling using intelligent agents. The workshop is aimed at model and simulation developers, and is highly recommended as a precursor to specific agent language training. It will also suit the project manager seeking a degree of technological insight into agents and behavioural modelling.
	▶ Visual Database Development [1/2 day]	Participants will gain insight into the process of database design and development and the applicability to a particular training outcome gaining an understanding of data sources used for database development, specifying visual database requirements, constraints, general processes involved in database development, types of tools required. The workshop is targeted at end users, system engineers, and developers who need to understand the visualisation capability provided by modern systems and the availability of source data.
	▶ Introduction to Simulation and Virtual Environments [1 day]	This short course is a basic introduction to the field of Simulation and Virtual Environments. It focuses particularly on the nature and design of the interface that will permit humans to interact in real-time with complex 3D graphical models that depict the virtual environment. It also introduces the major components of current and future VEs, describes their use, and addresses the issues and constraints faced by the components of this technology. Finally it describes a range of applications for simulation and virtual environments.

Simulation Workshops		
Provider	Workshop	Description
	<ul style="list-style-type: none"> ▶ Human Factors - Where is the Learning Happening? [1/2 day] 	This workshop provides a review of key theoretical issues' concerning the emotional and learning issues relating to simulation and gaming.
	<ul style="list-style-type: none"> ▶ Getting Results – Simulation And Achieving Organisational Objectives [1/2 day] 	The workshop aims to provide participants with an understand learning techniques used in business simulation and how simulations can be developed to address specific organisational objectives and reviews a range of simulation tools and how they can be applied.
<ul style="list-style-type: none"> ▶ SimTect 2003 (26-29 May) 	<ul style="list-style-type: none"> ▶ Introduction to Simulation and Virtual Environments 	This course aimed to introduce those attending to the issues involved in the design and deployment of human-in-the-loop simulations and interactive virtual environments. It focuses particularly on the nature and design of the interface that will permit humans to interact in real-time with complex environments that employ 3D graphical descriptions to depict the virtual environment. It also introduces the major components of current and future VEs, describes their use, and addresses the issues and constraints faced by the components of this technology.
	<ul style="list-style-type: none"> ▶ Introduction to HLA 	A general introduction to the architecture, covering the broad conceptual elements of the architecture, along with the formal elements of Rules, Object Model Template and Interface Specification.
	<ul style="list-style-type: none"> ▶ Computer Generated Forces / Behaviour Representation (1 day) 	This full day workshop focused on the application of intelligent agent technology in modelling & simulation (M&S) to represent the behaviour of situated decision makers in sociotechnical systems. A mixture of background theory and deployed case studies in representing military operator behaviour in constructive simulation was presented.
	<ul style="list-style-type: none"> ▶ Simulation Interoperability 	This simulation interoperability workshop will introduce to the attendees the concepts, issues and latest developments in the interconnection of synthetic environments. It will be of interest to those who wish to learn more about the mechanics of simulation interoperability and what the options/issues are, as well as to those practitioners who wish to share the experiences gained by other practitioners.
	<ul style="list-style-type: none"> ▶ Medical Symposium 	The Medical Simulation Symposium will serve as a valuable information exchange between the medical and simulation fraternities.

Simulation Workshops		
Provider	Workshop	Description
	▶ Simulation Over the Internet	The presentation discussed current implementations of Internet training, the feasibility of future projects as well as the limits and benefits of Internet simulation.
▶ SimTect 2002 (13-16 May)	▶ Simulation Interoperability	The simulation interoperability workshop was designed to expose participants to the complex issues associated with the design, development, operation and maintenance of synthetic environments. The workshop covered issues of policy, standards, future direction, and lessons learnt through the practical analysis of a number of case studies and presentations. The workshop was designed to provide practical 'real' world examples and draws on the experience of a number of international presenters from the US Defence Modelling and Simulation Office, the Simulation Industry Standards Organisation, the Australian Defence Modelling and Simulation Office, and industry.
	▶ Introduction to Simulation	This short course introduces the major components of distributed virtual environment (DVE) technology, described their use, and addressed the issues faced by each component of this technology. The course discussed upcoming trends in distributed simulation, with particular emphasis being placed on the DoD High Level Architecture (HLA).
	▶ Introduction to HLA	A general introduction to the architecture, covering the broad conceptual elements of the architecture, along with the formal elements of Rules, Object Model Template and Interface Specification.
	▶ Computer Generated Forces / Behaviour Representation	This full day workshop focused on the application of intelligent agent technology in modelling & simulation (M&S) to represent the behaviour of situated decision makers in sociotechnical systems. A mixture of background theory and deployed case studies in representing military operator behaviour in constructive simulation was presented
	▶ Simulation Over the Internet	The presentation discussed current implementations of Internet training, the feasibility of future projects as well as the limits and benefits of Internet simulation.
	▶ Manufacturing - Prototyping	This workshop explored the components of a successful virtual manufacturing and engineering platform, presented the factors for successful implementation of virtual manufacturing models, established realistic expectations for current technology, and helped the participant prepare for future innovations in modeling and simulation.

Simulation Workshops		
Provider	Workshop	Description
▶ SimTect 2001 (28 May)	▶ Terrain Modelling Issues - Trends in Urban Visualization	<p>Presenter: David McKeown - President TerraSim, Inc. (US)</p> <p>There is increased automation in geospatial visualization using GIS source data, automated model generation, placement, and terrain integration. This workshop will cover:</p> <p>Use of remotely sensed imagery for database intensification.</p> <p>Source data collection strategy: leveraging geospatial attribution in place of feature geometry.</p> <p>Linking Live and Virtual simulation via video surveillance and monitoring.</p> <p>Regional planning and virtual tours: One man's MOUT is another's urban redevelopment site.</p>
	▶ Practical Issues of Distributed Voice in Networked Training Applications	This workshop provided a general VoIP overview, discussed VoIP as implemented in training and simulation, theoretical issues including latency, jitter etc., practical quality and deployment issues and implications of HLA -new benefits; new issues.
	▶ 3D Modelling in an Immersive Environment	This workshop covered a general overview of editing models for use in an immersive environment, how to use a two handed interface, creating, reviewing and modifying an application and an overview of SmartScene™
	▶ Introduction to HLA	A general introduction to the architecture, covering the broad conceptual elements of the architecture, along with the formal elements of Rules, Object Model Template and Interface Specification.
	▶ Simulation Over the Internet	The presentation will discussed current implementations of Internet training, the feasibility of future projects as well as the limits and benefits of Internet simulation.
	▶ Virtual Worlds - Enterprise Architecture for Combined Operational and Simulation Environments	The aim of this workshop was to explore the principles and practice of enterprise architecture for combined operational and simulation environments. The workshop drew on various projects such as Virtual Air Commander, and Virtual Air Environment, and architectures for distributed training, and multi-agent environments.
	▶ Manufacturing - Prototyping	This workshop gave insight to current uses of virtual reality as a simulation tool for manufacturing, discussed the key components of a virtual engineering workspace, identified the current challenges in simulating product manufacturing, and identified future trends.

Simulation Workshops		
Provider	Workshop	Description
	▶ Manufacturing - Process Simulation	The introductory session gave insight into how simulation has been used, and the benefits of simulation in the design or operation of material handling and distribution systems. Case studies in various industries will be presented, and the pitfalls of simulation will be reviewed. The workshop was aimed at getting a better understanding of the process of building a simulation model.
	▶ Medical Symposium	An introduction to the technologies involved in Simulation, including Fidelity, Training Needs Analysis, and Interoperability. A number of presentations providing examples of the use of simulation in clinical applications, including the importance of Human Factors.
▶ SimTect 2000 (28 Feb to 2 Mar)	▶ Medical Applications	This workshop covered techniques for assessment and evaluation in simulation. Evaluating the efficacy of simulation for training is an important area of research and one that tends to get overlooked when simulators are built. Methods of linking technical and psychomotor skills between simulators and the real operating environment will be discussed. There will be some emphasis on medical applications, but the considerations apply equally to other types of simulation.
	▶ Medical Simulation Symposium	The Medical Applications Workshop was extended to a special afternoon of presentations and discussion for Medical Simulation.
	▶ HLA Applications	This workshop will cover how HLA is used in various distributed simulation applications.
	▶ Computer Generated Forces	This tutorial will focus on addressing the technical challenges of providing computer generated actors and computer generated forces for use in distributed simulation.
	▶ Training Approaches and Fidelity	This workshop featured presentations on key training analysis and design issues and a hypothetical defence acquisition project with opportunities for the employment of simulation.
	▶ Manufacturing Applications	This workshop will describe the virtual prototyping tools currently being used and their applications in industry. These will encompass contributions from major manufacturers and discuss how modelling and simulation is applied in manufacturing applications. Participants will gain an awareness and knowledge of current and future uses of simulation in manufacturing businesses.

Simulation Workshops		
Provider	Workshop	Description
	▸ Strategies for Migrating to HLA Compliance	Presentations as to how various projects are moving towards HLA compliance, followed by a panel discussion/question session. This workshop described some of the initiatives used, difficulties encountered and/or overcome, and management strategies.
	▸ SEDRIS	This tutorial addressed issues concerning the use and implementation of Synthetic Environment Data Representation and Interchange Specification (SEDRIS). It covered such topics as: setting requirements, the SEDRIS format, conversion from legacy databases, achieving interoperability, etc. An overview of its use in some modelling and simulation applications will be given.

Short Courses Through SIAA

Table 5 – Short Courses Conducted through SIAA

Short Courses Through SIAA		
Provider	Course	Description
<ul style="list-style-type: none"> ▶ Simulation Industry Association of Australia (SIAA) in conjunction with AEGIS Technologies Group, Inc. 	<ul style="list-style-type: none"> ▶ Verification, Validation, and Accreditation Courses 	<p>The Simulation Industry Association of Australia (SIAA) in conjunction with AEGIS Technologies Group, Inc. is offering two short courses in Australia on Verification, Validation & Accreditation. In this course, students will gain the knowledge necessary to ensure M&S data are accurate. The goal of this course is to prepare students to make informed and independent judgements about the credibility of models and simulations. They will also gain a working knowledge of the activities required to certify a simulation as credible for a specific application.</p>
<ul style="list-style-type: none"> ▶ SIAA in conjunction with RMIT 	<ul style="list-style-type: none"> ▶ Simulation-Based Business, and Simulation-Based Design - 21 November 2001 	<p>The SIAA held this course in conjunction with RMIT. The development of new model based lifecycle and systems engineering standards by the ISO was discussed as was the defence background to these developments. The STEP information model based ISO standards for engineering and manufacturing are also outlined with references so that the audience can follow this up on the web later. The course presented procedures for Simulation Based Design that are relevant to all organisations that provide infrastructure and capabilities. It describes the development of Virtual Prototypes of equipment and infrastructure from Capability Plans that are derived from organisational models defining the competitive environment, mission and resources of the organisation.</p>
<ul style="list-style-type: none"> ▶ Australian Defence Force Academy 	<ul style="list-style-type: none"> ▶ Defence Simulation - Digital Environments for Training and Analysis (2 day) 2003 ▶ Advanced Simulation Practicum (3 days) 	<p>The Australian Defence Force Academy, Canberra, held two courses generally entitled "Defence Simulation - Digital Environments for Training and Analysis": The course focused on the history and legacy of simulation as embraced within the defence community, as well as presented the basic science issues surrounding real world representation within a Synthetic Environment. The defence application areas of training, analysis and acquisition were also presented and discussed.</p> <p>The 3-day Advanced Simulation Practicum provided professionals currently developing, using, or procuring simulation systems, an in-depth understanding of the simulation principles, methodologies, and architectures which underpin the appropriate use of a given modelling approach and simulation technique for a specified purpose. Therefore the course focused more on the Science and Engineering aspects of modelling and simulation conducted in a workshop environment allowing for discussion of relevant topics and provide for practicals and group exercises.</p>

Short Courses Through SIAA		
Provider	Course	Description
▶ University of Ballarat	▶ High Level Architecture (HLA) Course (Feb 2001)	The Short Course provided an introduction to the essentials of HLA and designing and programming with HLA.

Training and Education Provider Details

Table 6 – Simulation Training and Education Providers

Provider	Country	State	Website	Address	Contact Name	Contact Details
Australian Defence Simulation Office (ADSO)	Australia	ACT	www.defence.gov.au/ocio	R1-3-A162 Russell Offices Canberra ACT 2600	Cliff White	Email: ADSO@defence.gov.au
Arizona State University	US	Arizona	http://asuengineeringonline.com http://www.asu.edu	Centre for Professional Development Ira A. Fulton School of Engineering PO Box 874411 Tempe Arizona 85287-4411		Tel: +480 965 1740 Fax: +408 965 8653 Email: Asu.cpd@asu.edu
Australian Defence Force Academy (ADFA), University of NSW	Australia	ACT	http://www.defence.gov.au/adfa	Australian Defence Force Academy Northcott Drive Campbell ACT 2600		Tel: +61 2 6268 6000 Fax: +61 2 6268 8666 Email: student.admin@adfa.edu.au
Central Queensland University	Australia	QLD	http://www.cqu.edu.au	108 Lonsdale Street, Melbourne VIC 3000 Bruce Highway, Rockhampton QLD 4702 333 Kent Street, Sydney NSW 2000		Tel: +61 7 4930 9777 or +61 7 4930 9000 or 1300 360 444 Fax: +61 7 4923 2100 Email: admissions@cqu.edu.au
Curtin University of Technology	Australia	WA	http://www.curtin.edu.au	Kent Street, Bentley WA 6102		Tel: +61 8 9266 9266 Fax: +61 8 9266 2255 Email: customer-service@curtin.edu.au
Distributed Simulation Technology Inc (DiSTI)	US	FL	www.simulation.com	11315 Corporate Blvd Suite 115		registra@simulation.com

Provider	Country	State	Website	Address	Contact Name	Contact Details
				Orlando FL 32817-8340		
Old Dominion University, Virginia Modeling, Analysis and Simulation Center (VMASC), Virginia	US	VA	http://www.odu.edu/engr/vmasc/overview.shtml	7000 College Drive Suffolk VA 2343		Tel: +757 686 6200 Fax: +757 686 6214
Permian Pty Ltd	Australia	VIC	http://www.permian.com.au	5/334 Highbury Road Mt Waverley VIC 3149 Innovation House First Avenue, Technology Park Mawson Lakes SA 5095		Tel: +61 3 9881 9881 Fax: +61 3 9881 9800 Email: reception@permian.com.au
Royal Melbourne Institute of Technology (RMIT)	Australia	VIC	http://www.rmit.edu.au	124 La Trobe Street Melbourne VIC 3000		Tel: +61 3 9925 2000 Fax: +61 3 9663 2764 Email: admissions@rmit.edu.au
SimTecT	Australia	ACT	http://www.siaa.asn.au/SimTecT/2004/2004.htm	Conference Secretariat PO Box 3127 Belconnen Delivery Centre ACT 2617		Tel: +61 2 6251 0675 Fax: 61 2 6251 0672 Email: SimTecT@consec.com.au
Simulation Industry Association of Australia (SIAA)	Australia	NSW	http://www.siaa.asn.au	The Secretary Simulation Industry Association of Australia C/- Simcon Services Pty Ltd PO Box 226 Lindfield NSW 2070	Mr Peter Hill	Tel: 0417 457 105 Fax: +61 2 9415 3611
The Royal Military College of Science	United Kingdom	Shrivenham	http://www.rmcs.cranfield.ac.uk	Cranfield University Shrivenham		Tel: +44 (0) 1793 782551 Fax: +44 (0) 1793

Provider	Country	State	Website	Address	Contact Name	Contact Details
(RMCS), Cranfield University		m		Swindon Wiltshire SN6 8LA United Kingdom		783878
University of Ballarat	Australia	VIC	http://www.ballarat.edu.au	PO Box 663 Ballarat VIC 3353		Tel: 1800 811 711 Email: prospective@ballarat.edu.au
University of Central Florida	US	Florida	http://www.ist.ucf.edu	Institute for Simulation & Training 3280 Progress Drive Orlando FL 32826	Randall Shumaker (Director) shumaker@ist.ucf.edu	Tel: +407 882 1300 Fax: +407 658 5059
US Naval Postgraduate School	US	CA	http://www.nps.edu http://www.movesinstitute.org	1 University Circle Monterey CA 93943		Tel: +831 656-3164 Fax: +831 656-3238

Simulation Training and Education by Category

Table 7 – Simulation Generalist – Training and Education

Category Skill Level	How the Skill Level is Demonstrated	Development Activity Options		
		Training activity	Providers	Duration
<p>Generalist. The generalist has a number of skills across the <i>13 simulation skill areas</i>. It is generally not expected that this person would have considerable expertise in any particular skill area.</p> <p>The skill areas of most importance are:</p> <ul style="list-style-type: none"> ▶ Simulation development ▶ Simulation management ▶ Simulation training infrastructure ▶ Human system's simulation ▶ Simulation based training ▶ Simulation hardware ▶ Simulation technologies and standards ▶ Environmental representation ▶ Systems representation 	<p>The person has a general awareness of current simulation technology and a general understanding of relevant aspects of simulation.</p> <p>The person is suited for employment in all simulation roles (developer, acquirer, manager, user and supporter), with a primary expectation of employment in the roles of simulation acquirer, manager and user.</p>	System simulation	Central Queensland University	1 semester
		Introduction to Simulation	Curtin University	1 semester
		Introduction to Simulation Foundations	UNSW/ADFA Curtin University	2 days
		Simulation Staff Officers course	SIAA (under development)	5 days
		Foundations of Modelling & Simulation	RMCS, UK	2 days
		Systems Modelling & Simulation	RMCS, UK	2 days
		An Overview of Simulation Standards	RMCS, UK	½ day
		Visual Database Development	SIAA (SimTecT 2004)	½ day
		Introduction to Simulation & Virtual Environments	SIAA (SimTecT 2004)	1 day
		Getting Results – Simulation and Achieving Organisational Objectives	SIAA (SimTecT 2004)	½ day
		Introduction to HLA	SIAA (SimTecT 2004)	1 day
			SIAA (SimTecT 2003)	

Table 8 – Simulation Specialist – Training and Education

Category Skill Level	How the Skill Level is Demonstrated	Development Activity Options		
		Training Activity	Provider	Duration
<p>Specialist. The specialist has a number of skills across the 13 simulation skill areas. It is expected that this person has considerable expertise in a particular skill area.</p> <p>The skill areas of most importance are:</p> <ul style="list-style-type: none"> ▶ Quantitative aspects of simulation ▶ Simulation development ▶ Simulation management ▶ Simulation technologies and standards ▶ Human system's simulation ▶ Simulation training infrastructure ▶ Operations Research, Analysis & Experimentation ▶ Environmental representation ▶ Systems representation 	<p>The person has a general to detailed awareness of current simulation technology and some specific to considerable expertise in a particular aspect of simulation. The person is suited for employment in all simulation roles (developer, acquirer, manager, user and supporter), with a primary expectation of employment in the roles of simulation developer, acquirer, user and supporter.</p>	Grad Dip/Grad Cert (Simulation Technology)	RMIT	
		Grad Dip/Grad Cert Science in Operations Research & Statistics	ADFA, UNSW	
		Pg Dip/Pg Cert in M&S (tbc)	RMCS, Cranfield University, UK	
		High Level Architecture Computer Technology; Simulation; Decision Analysis; Linear Programming; Operations Research	University of Ballarat	
		Advanced Simulation practicum	ADFA, UNSW Curtin University	3 days
		Modelling & Simulation of Engineering systems; Discrete & Continuous Simulation	RMCS, Cranfield University, SimTecT	5 days
		Advanced HLA	SIAA (SimTecT 2004)	½ day
		CGF Behavioral Models & Agent Enabled Simulation	SIAA (SimTecT 2004)	½ day
		Human Factors- where is the Learning Happening?	SIAA (SimTecT 2004)	½ day
		Simulation Interoperability	SIAA (SimTecT 2003)	
		3Dmodelling in an Immersive Environment	SIAA (SimTecT 2001)	

Table 9 – Simulation Expert – Training and Education

Category Skill Level	How the Skill Level is Demonstrated	Development Activity Options		
		Training Activity	Provider	Duration
<p>Expert. The expert has a number of skills across the 13 <i>simulation skill areas</i>. It is expected that this person has a significant expertise in one or more skill area.</p> <p>The skill areas of most importance are:</p> <ul style="list-style-type: none"> ▶ Quantitative aspects of simulation ▶ Simulation development ▶ Computer visualisation ▶ Interactive simulation (e-learning)/Intelligent systems ▶ Operations Research, Analysis & Experimentation ▶ Simulation technologies and standards ▶ Human system's simulation ▶ Simulation training infrastructure ▶ Environmental representation ▶ System representation 	<p>The person has a high level of understanding of current and projected trends in simulation technology and a deep expertise in one or more particular aspects of simulation. The person is suited for employment in all simulation roles (developer, acquirer, manager, user and supporter), with a primary expectation of employment in the roles of developer and user.</p>	<p>PhD in Modelling & Simulation</p> <p>PhD in Engineering (Modelling & Simulation)</p> <p>MSc in Modelling & Simulation</p> <p>MSc in Operations Research & Statistics</p> <p>MEng (Simulation Technology)</p> <p>MEng (Modelling & Simulation)</p> <p>Masters in Defence Modelling & Simulation</p> <p>Simulation over the Internet</p> <p>Terrain Modelling Issues – Trends in Urban Visualization</p>	<p>University of Central Florida, USA</p> <p>Old Dominion University, Virginia, USA</p> <p>University of Central Florida, USA</p> <p>Old Dominion University, Virginia, USA</p> <p>ADFA, UNSW</p> <p>RMIT</p> <p>Old Dominion University, Virginia, USA</p> <p>RMCS, Cranfield University, UK</p> <p>SimTecT 2003</p> <p>SimTecT 2001</p>	