



NICTA

Second Quarter Report to the Australian Government 2007

1 January – 30 June 2007

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Abbreviations

NICTA Programs and Abbreviations

ERTOS	Embedded Real-time and Operating Systems
ESE	Empirical Software Engineering
FM	Formal Methods
KRR	Knowledge Representation and Reasoning
LC	Logic and Computation
NIP	Network Information Processing
NPC	Networks and Pervasive Computing
NT	Network Technologies
SGA	Safeguarding Australia
SML	Statistical Machine Learning
SMLKA	Symbolic Machine Learning and Knowledge Acquisition
SN	Sensor Networks
VISTA	Vision Science and Technology Applications
WSP	Wireless Signal Processing

NICTA Projects and Abbreviations

AASEDP	Automated Anatomical Structure Extraction for Diagnosis & Population Norms
Ambient	Ambient Networks Phase 2
ANGIE	Advanced Nonlinear Gradient Methods
B2B	Broadband to the User
Bracetto	Bracetto
CAMKES	Component Architecture for Microkernel-based Embedded systems
CAMP	Context Aware Mobility Project
CG	Cancer Genomics
CTC	Computer Colonic Polyps Detection based on CT Colonography
DAU	Document Analysis and Understanding
DiMIST	Data Mining in Spatio-temporal Data Sets

DPOLP	Dynamic Planning, Optimisation and Learning
FLOW	Fundamental Limits of Wireless
FM for PEWNA	Formal Methods for Performance Evaluation for Wireless Network Analysis
G12	Constraint Programming Platform
GiFi	Millimetre Wave Gigabyte Wireless
Goanna	Goanna
eHRC	Image-Quality-Sensitive Watermarking of Medical Images
I2D2	Interactive Information Discovery and Delivery
L4	L4.verified
LaMP	Last Metre Problem
LEAR	Learning and Representation
LIXI	LIXI Business Processes
Macro	Macro-programming for Wireless Sensor Networks
MAMI	Managing and Monitoring the Internet
MGCC	Mapping Genetic Components in Crops
MUD	Multi-User Detection Algorithm (<i>NB: Changed to Intereferex during reporting period</i>)
NOSA	NICTA Open SensorWeb Architecture
OiB	Integrated ICT Solutions for Rural and Remote Access (Office in a Box)
P2P	Peer to Peer
POTEROO	Probabilistic Temporal Analysis of Operating Systems Code
QUSE	Query under Uncertainty for a Secure and Sustainable Environment
RESA	Requirements Engineering for Strategic Alignment
RSDDD	Road Safety: Drivers Drowsiness Detection
SeL4	Secure Embedded L4
SISM	Spectral Imaging and Source Mapping
Smart Cars	Smart Cars
SWARM	Characterisation, Diagnosis and Assurance of Health and Quality Sensor Formations
SuperCom	Model-based Supervision of Composite Systems

USS or mContext	Universal Storage Scheme
VACMS	Video Analysis and Content Management for Surveillance
VALACON	Visualisation and Analysis of Large and Complex Networks
VNS	Validating Networks Semantics
XQoS	XQoS Systems

Strategic Focus Projects

SAFE	Smart Applications For Emergencies
SAFE Agents	SAFE Agents
SAFE Info	SAFE Information
SAFE Networks	SAFE Networks
SAFE Sensors	SAFE Sensors
STaR	Smart Transport and Roads
STaRComms	STaR Communications Systems
STaR Control	STaR Control
STaR SenServ	STaR Sensors and Surveillance
STaR-UI	STaR Advanced Multimodal User Interfaces for Control Rooms
WIN	Water Information Networks

Other Abbreviations

ACcESS	Australian Computational Earth Simulator
ACM SIGPLAN- SIGACT	Association for Computing Machinery Special Interest Group on Programming Languages – Special Interest Group on Algorithms and Computation Theory
AEEMA	Australian Electrical and Electronic Manufacturers Association
AGIMO	Australian Government Information Management Office
AIIA	Australian Information Industry Association
AMD	Advanced Micro Devices

ARC	Australian Research Council
ATP	Australian Technology Park (Laboratory)
CAS-ICT	Chinese Academy of Sciences Information Communication Technology
CCTV	Closed Circuit Television
CIAO	Centre for Informatics and Optimisation
CiSRA	Canon Information Systems Research Australia
CORE	Computing Research and Education
CRL	Canberra Research Laboratory
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Research Organisation
DCITA	Department of Communications Information Technology and the Arts
DEST	Department of Education Science and Technology
DVFS	Dynamic Voltage and Frequency Scaling
EEO	Equal Employment Opportunity
EMQ	Emergency Management Queensland
EPIPAGRI	Towards European Collective Management of Public Intellectual Property for Agricultural Biotechnologies
FEAST	Forum for European-Australian Science and Technology cooperation
ICAPS	International Conference on Automated Planning and Scheduling
ICSE	International Conference in Software Engineering
ICT	Information Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
IID	Imperial Irrigation District
IJCAI	International Joint Conference on Artificial Intelligence
INRIA	The French National Institute for research in Computer Science and Control
ISAG/IBAG	International Science Advisory Group/International Business Advisory Group
NCSS	National Computer Science School
NICTA	National Information Communication Technology Australia

NII	National Institute of Informatics (Japan)
NRL	Neville Roach Laboratory
OFC	Optical Fibre Conference
OKL	Open Kernel Labs
PVR	Project Value Rating
SAT	Propositional Satisfiability
QECC	Queensland Education Coordination Committee
QRL	Queensland Research Laboratory
QUT	Queensland University of Technology
RMCC	Research Management Coordination Committee
RTA	Roads and Traffic Authority
SME	Small to Medium Enterprise
SWS	Smart Water System
TIM	Traffic Incident Management
UNSW	University of New South Wales
UQ	University of Queensland
USyd	University of Sydney
VRL	Victoria Research Laboratory
WIDCORP	Water in Drylands Cooperative Research Project

Introduction

This report provides details of progress against the milestones identified in the Annual Activity Plan 2007 for the period 1 January to 30 June 2007. In line with the requirements for the report, it contains the following details:

- a) Details of NICTA's progress and performance against the activity, outputs, milestones and performance indicators specified in the Annual Activity Plan for that calendar year
- b) Details showing the extent to which the Centre's activities were consistent with the Centre's Intellectual Property Policy document for the management and commercialisation of intellectual property rights
- c) Discussion outlining proposed activities over the remainder of the period required to perform the activity, milestones and performance indicators in the Annual Activity Plan
- d) Identification of any issues that will impact adversely on NICTA's ability to achieve the activity, milestones and performance indicators and an indication of how NICTA intends to address these issues to ensure that the activity continues in accordance with the Annual Activity Plan
- e) Details of asset disposals in accordance with subclause 7
- f) Details of all public acknowledgements of funding made under subclause 23.1
- g) An indication of whether any changes are emerging that may necessitate variation to this Agreement.

The following items not specified in the Funding Agreement have been added:

- A summary list of outcomes over the second quarter that are outside the AAP milestones
- An annexed printout of project details from NICTA's project management information system
- General purpose un-audited accounts
- An un-audited statement of expenditure for DCITA and ARC funds.

Summary List of Outcomes

The following points provide a summary of the general outcomes from activity in the period 01 January to 30 June 2007.

During the reporting period (1 January – 30 June 2007), National ICT Australia (NICTA) achieved impressive progress in the areas of commercialisation, people, education and linkages. It also made many exciting research breakthroughs and saw several research projects progress along the path to commercialisation.

Research

- Networks and Pervasive Computing (NPC) researchers bid to host the Pervasive '08 conference in Sydney in 2008 was successful.
- The model driven capacity planning demonstrator, *Revol8or*, was demonstrated at the International Conference on Software Engineering (ICSE) and generated a lot of interest.
- In January, ERTOS hosted the First International Workshop on MicroKernels for Embedded Systems. The workshop attracted international speakers from academia as well as industry (hardware manufacturers Intel and AMD and operating-system vendors Green Hills and SYSGO).
- The MAMI project presented two optical monitoring technologies at the premier international optics conference and trade show, OFC, in Anaheim, California.
- The L4-verified project published and presented its work at the 34th ACM SIGPLAN-SIGACT Symposium on Programming Language, the leading conference on Programming Languages, at a number of institutions across Europe (Technical University Munich, INRIA, ST Microelectronics).
- At IJACI in January, the Trustees of the International Joint Conference on Artificial Intelligence (IJCAI) voted for Toby Walsh (KRR Program leader) to be Program Chair of the conference. The conference will be held in Barcelona in 2011 and is expected to attract over 1000 delegates.
- The GiFi project led by Stan Skafidas received the Merit Award in the Research and Development category of the Australian Information Industry Association annual iAwards for the best Australian information and communications technology (ICT) innovations, announced 30th May. This project includes a significant student contribution, making this a particularly pleasing result.
- On the AASEDP project, PhD student Luping Zhou was able to confirm the existence of hippocampal shape difference for males vs females.

People and Acknowledgements

- NICTA internal impact awards have been developed and nominations will be called for over the remainder of 2007.
- A citation index has been developed as part of our research quality infrastructure.
- Guillaume Jourjon, Emmanuel Lochin and Patrick Senac received the Best Paper Award in the Multimedia Communications and Home-networking Symposium at the IEEE International Conference on Communications 2007.

- In February, Roy Timo won the Mike Miller paper Award from the University of South Australia ITR, for his paper entitled '*Source coding for a noiseless broadcast channel with partial receiver side information*'.
- Jinbo Huang won the bronze medal in one of the categories of the 2007 International SAT Competition, held in conjunction with the International SAT Conference in Portugal.
- Patrick Haslum won The International Conference on Automated Planning & Scheduling (ICAPS) Dissertation Award 2007.
- Raymond Wong, Bill Shui, Franky Lam from the mContext project won the inaugural CeBIT.AU Early Innovators Award at CeBIT, Sydney 2007.
- Conrad Sanderson won the most cited paper for Digital Signal Processing through Elsevier. The paper was called '*Identity verification using speech and face information*'.
- Duc Nghia Pham and Charles Gretton from NICTA's SAFE Agents team won the Gold Medal for the Random SAT Category at the International SAT 2007, with their solver gNovelty+.
- Asad Pirzada, Marius Portman and Jadwiga Indulska all won the AsSC Best Paper Award at CORE (Computing Research and Education).

Education

- By the end of the reporting period there were 9 PhD completions, bringing the total graduate number to 37. There were also 24 submissions during this period.
- The Research Training Network was established, with all partner universities agreeing to the implementation of a nationally coherent Study Plan.
- NICTA has established two internship programs for masters and PhD students. To date, the education group has brokered internships with two organisations: the National Institute of Informatics (NII) Japan and Canon Research Laboratories (CiSRA) Sydney.
- NICTA co-sponsored and supported the National Science Summer School (NCSS) hosted by the University of Sydney
- As part of the ARTEMIS Orchestra, NICTA sponsored and entered the "RoboFiddler" in the inaugural competition held in Berlin in June. The sponsored team from the University of Adelaide placed second at this event.
- Plans for the introduction of four advanced information communications technology courses to NICTA enhanced students were finalised. The units are Cryptology from QUT, Advanced Topics in Statistical Machine Learning; Convex Optimisation, and Real Time Operating Systems. Preliminary responses to the courses point to a substantial demand not only from NICTA enhanced students, but other PhD students enrolled at the partner universities.
- Xiaonan Ji, a PhD student working in the NIP program, was involved in a three month internship at Microsoft Beijing from March. Xiaonan was a recipient of the 2006 Microsoft Asia Fellowship in recognition of his outstanding research potential.

Commercialisation

- 16 patent applications were submitted during the reporting period.
- The NICTA spin-out company, Audinate, acquired technical staff at the start of the reporting period and commenced a joint research project with NICTA.

- Evaluation of commercialisation opportunities is continuing for the WIN, Optical Performance Monitoring and the new Bionic Eye projects. Significant interest has been generated out of successful promotion activities at OFC (the largest Optical Fibre Conference in Anaheim, US) and from developing work packages for our new Bio Projects.
- There has also been significant interest in licensing NICTA QRL software in the area of face recognition. Discussions are underway with two organisations to licence elements of this software.
- A commercialisation register has been implemented, tracking the commercialisation status of all projects in detail, including factors such as phase on the life-cycle pipeline, commercialisation staff allocation, outstanding issues and actions.

Networks and Linkages

- NICTA has signed a research collaboration agreement with the Chinese Academy of Sciences, Institute for Computer Technology (CAS-ICT).
- Early in Q2 the Empirical Software Engineering (ESE) program hosted a special seminar/short course, with support from the Australian Government Information Management Office (AGIMO), on Process Definitions for Business and Government. This presentation was extremely well-received with around 200 industry participants registering for the seminar.
- The Research Agreement was finalized with the ANU Centre for Mental Health Research and the Automated Anatomical Structure Extraction for Diagnosis and Population Norms project to investigate the automated diagnosis of Alzheimer's disease.
- An initiative by the Australian Electrical and Electronic Manufacturers' Association (AEEMA) begun to explore the establishment of a NSW Telematics Cluster.
- The VALACON project hosted the 6th Asia-Pacific Symposium based on Visualisation (APVIS) 2007 in February at the ATP lab.
- Collaboration memorandum completed with Tsinghua University for a joint project in multimedia signal processing for video analysis in surveillance.
- The STaR Human Machine Interface project is participating in the Australian Technology Showcase in a joint project which is enhancing the capability of a scenario-based platform being used by the RTA for Traffic Management Centre operator training and user interface design.
- Research collaboration agreements were signed with ACT Planning and Land Authority and the Bureau of Rural Sciences (BRS) to extend the work in environmental monitoring alongside the Cooperative Research Centre in Plant Bio-security.
- During the first quarter, the Victoria Research Laboratory hosted visits from ANZATechnet (USA), Invest Victoria, AIIA Industry Leadership Group on ICT Skills, Starfish Ventures, Melbourne Ventures, Multimedia Victoria and Barry Jones.

Activity Overview

RESEARCH

NICTA's research aims to deliver breakthroughs, create user-focused technologies, and progress scientific and engineering knowledge. Key outcomes for the reporting period were:

- Increased collaboration by researchers across NICTA on several key projects;
- Exciting and significant advances in all three of the strategic focus projects, STaR, WIN and SAFE;
- New research strategy was launched, which includes Research Themes and Business Areas;
- New research management system implemented; and
- NICTA researchers received several high-profile awards and recognition for their work.

Research Strategy:

During the first half of 2007 NICTA launched a research strategy that will take us forward for the term of the current strategic plan. We now describe our portfolio of research activities across four Research Themes.

The current research strategy is based on themes, which are the collection of disciplines in which we have a strong research capability. Across these themes we also build interdisciplinary research efforts. They provide the platforms of knowledge and technology from which we tackle projects. Our themes are:

- Embedded Systems;
- Networked Systems;
- Making Sense of Data; and
- Managing Complexity.

In this report we make reference to projects, programs and research themes as the integration of research themes was a gradual process occurring over the Q2 reporting period.

The table below shows the spread of projects under each research theme, as well as the number of projects due for completion over the next three years.

Project Portfolio

Under the research strategy we have established a project portfolio which shows where our research efforts are directed. The following table shows the percentage number of projects across the various research themes. During the development of this project portfolio some projects have been merged, some completed and some have been reallocated. At the end of the reporting period, our project portfolio stood at 43 projects.

Themes	Making Sense of Data	Networked Systems	Managing Complexity	Embedded Systems
% of project research	35.7	25.3	22.1	16.9

Project Completion

The following table shows the expected number of project completions to 2009.

Year	2007	2008	2009
Number of projects due to complete	10	21	10

Project Selection and Management Processes

Over the course of the reporting period, our project selection and management processes was refined in order to facilitate the implementation of our current strategic plan. The main focus was to:

- refine the criteria and processes used for the selection of new projects through the Project Value Rating (PVR) method; and
- improve the management and monitoring of project performance, outcomes and follow-through.

Through the new selection process, projects are evaluated against a range of factors. The PVR method is based on assessment by specifically constituted panels against the following factors: technology and science; commercialisation (including end user impact); national benefits to Australia; collaboration/linkages; fit into NICTA's research portfolio balance; and educational benefits.

The RMCC assesses new project applications three times per year.

In addition to the new selection process for projects, the RMCC has implemented a more rigorous process for monitoring project outcomes. The initial step in this is ensuring that project leaders better document their expected research outcomes in the term-sheet. The term-sheet acts as a master document in monitoring the success of the project. Additionally, the regular Project Review also functions to evaluate how a project is tracking.

Overall, this new project management system is working successfully.

Research Themes

Embedded Systems

The Embedded Systems research theme spans activities across many projects in the areas of embedded operating systems; software architectures; wireless communications (personal and metropolitan); computer vision and image processing; hardware systems; and system-on-a-chip development. In each of these areas, NICTA has developed internationally recognised research strength. The goal of the Embedded Systems research theme is to bring these strengths together into large scale projects with increased levels of academic or commercial impact.

NICTA's research in embedded systems has made significant progress during the reporting period.

The Goanna team worked on improving the precision of their bug finding analysis. Precision is an important factor to keep the false alarm rate low and it is also a major research

challenge. A number of scientific obstacles were overcome and the team prototyped an implementation which is currently benchmarked.

Additionally, the ERTOS team achieved unprecedented accuracy in predicting the performance of virtually arbitrary programs under Dynamic Voltage and Frequency Scaling (DVFS). DVFS is an important mechanism for reducing power consumption in battery-powered embedded systems, but without the ability to predict performance on a scaled processor, it cannot be used safely. Existing approaches depend on unrealistic assumptions on the hardware and software, typically ignoring the increasingly relevant contribution of static power, as well as ignoring memory power.

The new approach developed in ERTOS uses hardware performance counters for run-time measurements of factors determining performance. These are then fed into an empirical model, whose parameters are determined once for the particular hardware platform. This approach has been shown to provide highly accurate (within a few percent) predictions of the performance under DVFS on modern real-life embedded processors. The team is now working on extending this model to predicting power consumption, which will enable its use for power management in real-life systems.

Networked Systems

Networked Systems are technologies which connect “smart” products to form “smarter networks”. NICTA’s approach to managing networks is to ensure that they operate efficiently, reliably, safely and predictably. The goal of the Network Systems research theme is to build on the internationally recognised strengths in the areas of Anomaly Detection and Correction; Mechanisms for Supporting Mobility; and Content Routing and Storage. The work is underpinned by a number of major projects, including aspects of SAFE and STaR, which have strong links with industrial partners. Other projects, such as MAMI are already being considered with a view to commercialisation.

The MAMI multi-impairment monitor is a great example of the interdisciplinary work that occurs in NICTA: it is a combination of fibre-optic and machine learning technology – an unusual combination that has been judged, by review of the Network technologies program leaders, to be potentially a very significant advance. This panel also concluded that MAMI was very successful and would most likely be commercialised.

During the reporting period, the MAMI project presented two optical monitoring technologies via a trade exhibit booth at the premier international optics conference and trade show, OFC, in Anaheim, California. Additionally, the project was awarded a \$100,000 proof-of-concept grant to develop the optical monitoring technologies in preparation for possible spin out.

The Braccetto project engaged with the AusCope project (consisting of CSIRO Exploration and Mining, Australian Computational Earth Simulator (ACcESS) UQ, iVEC Australian Resources Research Centre, QCIF UQ, and the CSIRO Life Sciences Centre) to plan user-studies in the field of e-research.

Also during the reporting period, the Braccetto project team developed strong links with A/Professor Judy Kay’s research group at the University of Sydney resulting in mutual visits. The project attracted several students to work on projects and is currently working on an Intellectual Property arrangement that will allow the use of the groups’ tabletop interaction framework. Additionally, the project engaged with the Australasian CRC for Interaction Design (ACID) through participation in a series of design workshops.

Managing Complexity

NICTA has established a research theme called Managing Complexity to address a number of important issues which arise when dealing with the analysis, design, implementation, testing, integration and operation of large scale, complex systems.

In the area of managing complexity, NICTA is distinguished among competitors through its world leading capability in a number of crucial areas. Some examples of our work in this area include:

- Constraint modelling and design optimisation technology developed in the G12 project which provides NICTA with the capability to model and optimise critical logico-numeric aspects of large complex system problems.
- Logic and formal methods techniques and tools developed in the knowledge representation and logic group of projects provides NICTA with the capability to verify certain classes of problem solution and software systems arising in complex systems. This research will lead to greatly improved automatic verification and validation tools.

Within the managing complexity theme, NICTA also has strong research capability in the areas of system and software design processes; analysis and control tools for large-scale decentralised and network interconnected systems; and operation, planning and decision making tools for large complex systems.

Making Sense of Data

In order to control, use and understand data from a range of areas – including security and surveillance systems, medical data and images, management of electronic documents and environmental monitoring – NICTA is creating new technologies based on research in areas such as machine learning, image and video analysis, natural language processing, and knowledge representation and reasoning. Making Sense of Data is the research theme which works to solve the challenges posed by analysing large amounts of complex data.

During the reporting period, the Universal Storage Scheme (mContext) project team won the Early Innovator's Award at CeBIT.AU. The aim of this project is to allow XML information to be stored in space-efficient representation which also maintains low access and update costs for all of the desired operations. This is especially critical for devices with limited resources such as handheld computers, sensor networks or mobile phones.

Additionally, the Automated Anatomical Structure Extraction for Diagnosis and Population Norms (AASEDP) project team had a significant breakthrough during Q2 with PhD student Luping Zhou being able to confirm the existence of hippocampal shape difference for males vs females. This project applies mathematical modelling to create 3D images of the hippocampus region of the brain to help diagnose conditions such as Alzheimer's, epilepsy and schizophrenia.

Strategic Focus Projects

NICTA's three established Strategic Focus Projects, Smart Transport and Roads (STaR), Water Information Networks (WIN) and Smart Applications for Emergencies (SAFE), each made significant progress during the first half of 2007 in developing technologies that support partner objectives and advancing knowledge in their respective disciplines.

Smart Transport and Roads (STaR)

The STaR portfolio comprises collaborative projects to develop:

- Traffic sensing and surveillance (STaRSense)
- Reliable and secure communications over wide-area wireless mesh networks (STaRComms)
- New algorithms and models for traffic control (STaRControl)
- Multimodal user interfaces to streamline control room operations (STaRUI)

All teams continue to maintain excellent relationships with the NSW Roads and Traffic Authority (RTA) and are progressing well against committed milestones and deliverables.

Trials with the initial set of NICTA mesh routers on Sydney streets continue. Trial outcomes provide encouragement to NICTA's continued research in this area and provide the basis for further collaboration with Cohda.

In late June, the RTA was asked to provide an intersection for an active trial of NICTA's traffic sensing and control technologies. A roundabout has been suggested for the trial. The roundabout currently causes large queues to form in peak times. It is proposed that NICTA technologies will be applied to monitor the onset of queuing and switch traffic lights which are being installed to operate only when needed.

NICTA's initial video sensing test-bed for the STaR project has been established at the intersection of Anzac Parade and Barker Street at Kensington. As expected, this project has served to accelerate aspects of the integration between the STaRSense and STaRControl research and will provide an early opportunity to showcase initial research outcomes. According to the RTA, a successful outcome here could allow more flexibility in road planning and avoid the reconstruction of a number of other roundabouts.

A further discussion with RTA regarding NICTA's involvement in the Transport Management Centre's 5-year Strategic Plan has resulted in two opportunities for future projects beyond the current STaR-UI being pursued.

The STaR Project featured in NICTA's Intelligent Transport Systems exhibit at CeBIT.

A two day STaR/SAFE (Safe Applications for Emergencies) workshop in Brisbane resulted in plans for further dialogue and future cross-business area research project development in wireless (infrastructure), incident management (user interface and sensing) and traffic management for emergencies.

Five patent applications (three from the STaR User Interface Project and two from the STaR Sensors and Surveillance Project) have been submitted and a further invention disclosure (arising from the STaR Traffic Scheduling and Control Project) is being considered for submission by RTA patent attorneys.

STaR-UI

The STaR-UI team completed a comprehensive experiment design, implementation and user study on cognitive load measurement based on traffic management scenarios. Data analysis is currently being carried out.

They continued the discussions with the RTA regarding NICTA's involvement in the Traffic Management Centre's 5-year Strategy Plan. This resulted in two potential areas for future work being identified.

An MOU which will enable the exploration of using NICTA's cognitive load measurement techniques on data collected from the bushfire management centre has been drafted. It is currently being reviewed by the legal department.

Water Information Networks (WIN)

The longer term goal of the Water Information Networks Project (WIN) is to deliver information and technologies that will assist in development of better water strategies, policies and resource allocations at national and state level. The immediate objective of WIN is to provide ICT infrastructure for the management of water resources throughout the entire cycle, from catchment to end-user, in order to achieve efficiency gains and to obtain optimal economic returns on water usage.

The WIN team are continuing to develop a research program in pipeline control through collaboration with the University of Ballarat and the Cooperative Research Centre (CRC) for Water in Drylands Cooperative Research Project (WIDCORP). Submission of a proposal to the Grampians Mallee Wimmera Pipeline Project is expected in the first half of July.

Development was completed of three adaptations to the NICTOR systems found to be essential to ensure robust field operation. Prototype enhancements to WIN's operational NICTOR networks have been refined to ensure: enhanced quality of service; reduced maintenance requirements for NICTOR units; enhanced reliability of NICTOR systems under operational conditions; and reduced cost of operation of NICTOR sensor networks.

Development is also continuing of three additional enhancements to the NICTOR system that will also enhance robustness and flexibility of operation, and will permit monitoring and scheduling of field experiments from any internet-capable site: ethernet access directly to coordinator nodes; wireless LAN functionality between field sites and Dookie Campus; and solar power compatible with all NICTOR nodes.

In collaboration with CUBIN, implementation continued of WIN's component of VRL's Big Net Project. Initial implementation is for the campus of The University of Melbourne at Parkville. For subsequent implementation, a site has been confirmed for a 45 hectare dairy farm at Dookie in northern Victoria.

The Gamma version of the Smart Water System (SWS) has been installed successfully at a Corop vineyard in Victoria. Initially, continuous operation of the combined network and SMS could not be sustained. An in-field technical investigation revealed network disruption due to electromagnetic interference in the near field of network control elements. Relocation of network nodes has delivered satisfactory performance.

The Gamma version of the SWS has been installed at the dairy and horticulture sites of the Dookie research farm. This accelerated implementation of the Gamma version is mandated by foreshortening of the irrigation period by severe drought and is essential to viability of the 2007 experimental program for horticulture.

Dr Su Ki Oi continued development of closed loop control algorithms for channel and high pressure irrigation systems in support of experiments for the forthcoming Demonstrator trials. A report on control systems development has been submitted to Melbourne Water Resource Centre for the Government of Victoria under the STI grant.

WIN continued collaboration with Rubicon Limited for development of water flow and soil moisture sensors. The research objectives of this collaboration support major objectives within WIN's strategic plan for the period 2007-2011.

Prof Iven Mareels visited El Centro and the Imperial Irrigation District (IID) in the US, holding discussions with the Chief Engineer and General Manager concerning use of real-time data to better control the IID. One day was devoted to inspections of Rubicon control operations in the IID.

Discussions have been held with Prof Han and Prof Wute concerning Project 111 which is an initiative of the People's Republic of China that aims to enhance irrigation in the dry lands of north-west China.

Smart Applications for Emergencies (SAFE)

Software by NICTA researchers took out first place in one of the major divisions of the 2007 International Satisfiability competition, an affiliated event of the Tenth International Conference on Theory and Applications of Satisfiability Testing held in Lisbon, Portugal in May, 2007. There were 32 entries from 14 different research laboratories/Universities, including; Carnegie Mellon University, University of California – Los Angeles, University of British Columbia, Universite de Picardie Jules Verne, Delft University of Technology and Queen's University Belfast

SAT (short for Propositional Satisfiability) is the most basic part of logic, and solvers for it represent a core technology for artificial intelligence. The competition challenges programmers to solve logical problems from a wide range of domains including random, planning and scheduling, diagnosis and digital circuit verification.

The winning solver, gNovelty+, was developed by Dr Duc Nghia Pham and Dr Charles Gretton from NICTA's SAFE Agents team at the Queensland Research Laboratory.

The externally funded Intelligent CCTV activity in the SAFE Sensors Work Package has made considerable progress towards its goals. During the first quarter period, the legal negotiations with the Port of Brisbane and Queensland Rail were satisfactorily concluded. These lengthy negotiations were to enable confidentiality and privacy issues to be resolved to the satisfaction of all parties.

Following agreement with the Port of Brisbane on the provision of live video feed from the Port, work continues on establishing the communications link which is a key element of the SAFE Sensors project. The link is expected to be established in August 2007. This will enable NICTA researchers to access live video images from the Port of Brisbane and to undertake vision research on Port data.

The SAFE Demonstrator was shown to Emergency Management Queensland (EMQ) personnel. EMQ showed great interest in a more reliable messaging system, reinforcing the

research directions of the SAFE Information work package. The SAFE Demonstrator was also shown at TechFest, winning the Best Demonstration award.

Preparations have commenced for the SAFE project annual review, to be held in early September. This review will be conducted with external, as well as internal, reviewers.

Research Awards and Recognition

- Guillaume Jourjon, Emmanueal Lochin and Patrick Senac received the Best Paper Award in the Multimedia Communications and Home-networking Symposium at the IEEE International Conference on Communications 2007.
- In February, Roy Timo won the Mike Miller paper Award from the University of South Australia ITR, for his paper entitled '*Source coding for a noiseless broadcast channel with partial receiver side information*'.
- Jinbo Huang won the bronze medal in one of the categories of the 2007 International SAT Competition, held in conjunction with the International SAT Conference in Portugal.
- Patrick Haslum won The International Conference on Automated Planning & Scheduling (ICAPS) Dissertation Award 2007. See <http://abotea.rsise.anu.edu/icaps07/index.php?page=phdaward>
- Raymond Wong, Bill Shui, Franky Lam from the mContext project won the inaugural CeBIT.AU Early Innovators Award at CeBIT, Sydney 2007.
- Conrad Sanderson won the most cited paper for Digital Signal Processing through Elsevier. The paper was called '*Identity verification using speech and face information*'.
- Duc Nghia Pham and Charles Gretton from NICTA's SAFE Agents team won the Gold Medal for the Random SAT Category at the International SAT 2007, with their solver gNovelty+.
- Asad Pirzada, Marius Portman and Jadwiga Indulska all won the AsSC Best Paper Award at CORE (Computing Research and Education).
- Van Chhieng, Ryan Choi and Raymond Wong from the database project at Kensington have won the best paper award at the IEEE Consumer Communications and Networking Conference (CCNC 2007).
- The GiFi project lead by Stan Skafidas received the Merit Award in the Research & Development category of the Australian Information Industry Association annual iAwards for the best Australian information and communications technology (ICT) innovations, announced 30th May. This project includes a significant student contribution, making this a particularly pleasing result.

COMMERCIALISATION

NICTA's commercialisation program aims to facilitate technology transfer and create channels to market for NICTA research. In order to be successful and achieve maximum impact, commercialisation at NICTA needs to be a considered activity, tempered both by allowing time for the right technologies to be developed and also by market needs. Over the first half of 2007 we have focussed on developing the NICTA entrepreneurial culture.

The key outcomes of the reporting period were:

- The preparation of the commercialisation guidebook;
- Development of the project life-cycle pipeline;
- Introduction of the Commercialisation Register; and
- The spin-out of Audinate completed.

New Venture Creation

Currently there are three NICTA spin-out companies; Audinate; OKL; 7-ip

The first paid employees of Audinate started in January 2007. The company has strengthened the core team through hiring experienced industry people; a further five people have been recruited to join the five people who moved from NICTA. Audinate formalised a relationship with Dolby Live Sounds Group in 2007 and delivered the first Dante enabled product to Dolby. Further products are expected to be available to customers from October this year. Audinate also signed licensing agreements with other companies

Audinate has attracted industry interest through recent features in *ProSound Magazine*, *LiveSound International*, *ProAV Magazine* and *System Contractor News*.

Commercialisation Pipeline

Sixteen projects from the current portfolio have been identified as significant commercialisation opportunities. During the first half of 2007 three mechanisms were established to enhance the management of the existing pipeline.

Commercialisation Register:

A Commercialisation Register has been implemented, tracking the commercialisation status of all projects in detail, including factors such as phase on the life-cycle pipeline, commercialisation staff allocation, issues and actions associated with the listed project. The Intellectual Property (IP) status of each project is also tracked, in terms of ensuring that the IP strategy, IP inventory, prior art search, and any filed patents are established and maintained.

The central role of the commercialisation register is to capture the project phase in the overall commercialisation lifecycle, allocate commercialisation staff, organise priorities, and to highlight any escalation issues. Having this information held in the register ensures a common perspective and highlights any misunderstandings or conflicting concerns.

8-phase Commercialisation Process:

A full 8-phase commercialisation pipeline has been defined to include all steps in a project life-cycle, including:

- a. Pre-project business area strategic planning to project conception and proposal.

- b. The 4 steps covering early stage engagement with market prospects, IP development and consolidation phases.
- c. The 4 steps covering opportunity development, market validation, investment/engagement, and co-investment as outlined in the Guidebook.

Every project has been given an initial placement on this pipeline, allowing determination of required commercialisation activities and support relevant to that phase.

Project Summaries:

Project 1-page summaries were developed during Q2 to capture key project information and help focus researcher attention on the more commercialisation-related aspects of projects, such as IP position, competitive position and risks. Guidelines for assessing competitive position and risk, at early, mid and late stages of a project life-cycle have been defined to underpin this.

Commercialisation Guidebook

The Commercialisation Guidebook was updated in the first half of 2007. The revisions made to the Commercialisation Guidebook emphasise the importance of all paths to commercialisation, the role licensing typically plays for any commercialisation, and that only the final step in the Guidebook is unique to spinouts. This message is being reinforced at all levels, including in the CEO messages internally. The Guidebook revisions also focus on the importance of tracking and managing IP throughout a project life-cycle.

The Commercialisation Guidebook will be launched internally in the second half of 2007 before being updated and launched externally as a NICTA publication later in 2007.

Commercialisation Development Program

The Essentials of Entrepreneurship course was delivered to provide information and skills in entrepreneurship and commercialisation. The course is closely linked to NICTA's *Commercialisation Guidelines* and mirrors the NICTA commercialisation steps.

The Essentials of Entrepreneurship learning course allows research staff and students to become familiar with key commercialisation ideas and concepts, the entrepreneurial process, the players, and most importantly, its jargon. All the courses are presented as highly interactive and practical workshops. The courses were delivered by leading academics and professionals, with extensive experiences in the fields of innovation and entrepreneurship.

Title	When held	Where held	Number of Staff Attending	Number of Students Attending
Essentials of Entrepreneurship Workshop I	19 - 22 February 2007	ATP, KRL, CRL, VRL, QRL	48	29
Essentials of Entrepreneurship Workshop II	12-15 March 2007	ATP, KRL, CRL, VRL, QRL	30	25
Essentials of Entrepreneurship Workshop III	16-19 April 2007	ATP, CRL, VRL, QRL	35	27

The Essentials of Entrepreneurship commercialisation training program is a general introduction to the world of entrepreneurship. It was designed for NICTA researchers interested in understanding the entrepreneurial process. The key learning outcomes from the course are based around building the knowledge and understanding of the key elements of success in terms of business concept identification and assessment, market focus, intellectual property, planning, funding and operation.

PEOPLE

NICTA has demonstrated that it has the capacity to recruit researchers with outstanding records of research excellence, though it needs to be more proactive in recruiting researchers who also have potential to excel in commercialisation and entrepreneurship.

NICTA believes that the emphasis on hiring researchers with the right cultural fit is just as important as providing training and support once they are part of the organisation. The growing maturity of NICTA's research leaders has driven some changes to the organisation's focus on use-inspired research, and further leadership development will reinforce this focus.

Key outcomes during the reporting period were:

- Internal Awards program is complete and launched in July 2007 for the second half of the year; and
- Delivery of many training courses including the Leadership Development Program, EEO training and management skills.

NICTA Impact Awards

The NICTA Impact Awards is a program to recognise and reward employees who are making an outstanding contribution to NICTA's vision and values. The awards are peer nominated and accessible through two awards:

- Research: A. Richard Newton Excellence in Research Award
- Operations: Operational Excellence Award

The nominations for both awards close in December 2007, with the winners announced in March 2008.

Training Courses

Training activities have supported the organisation in the areas of management, presentation skills and workplace diversity. In particular there has been an uptake of commercialisation training especially those who are proposing to spin out later in the year. In the future, this will need to be complemented by more extensive training for research staff at the research concept stage.

During the first half of 2007, NICTA delivered training courses for staff and students which included:

Course	Description
Introduction to Intellectual Property	<p>“Presented by Peter Lightbody, NICTA's IP Counsel, this workshop is a primer for students, researchers and aspiring entrepreneurs on how NICTA's intellectual property (IP) is categorised and protected, with particular emphasis on inventions. It will cover the legal and commercial impact of IP and related internal processes at NICTA.</p> <p>At the end of the engaging 2.5 hour workshop you will have a basic understanding of a range of important IP issues including NICTA's IP processes, patents and research collaborations. Did you know that NICTA has a scheme for sharing the benefits of IP commercialization with its researchers? If you want to understand the scheme or have questions about eligibility there will be an opportunity for discussion.</p>

<p>Equal Employment Opportunity (EEO) Staff Awareness Training</p>	<p>NICTA is committed to providing a harassment and discrimination free workplace for its employees, students and visitors and creating a workplace that respects and celebrates diversity.”</p> <p>This course provided students with awareness training to compliment the NICTA EEO policy.</p>
<p>Stepping Forward – a Workshop for Women at NICTA</p>	<p>“As part of NICTA’s Workplace Diversity Plan, Stepping Forward – a Workshop for Women at NICTA, will be held for female staff and students.</p> <p>The key outcomes of the workshop were to:</p> <ul style="list-style-type: none"> • Provide participants with the contextual information required to make more informed decisions in their work life, • Enhance women’s repertoire of tools and strategies to draw from when developing career strategies, and • Inspire, motivate and support women to achieve their aspirations. <p>The workshop is presented by Deborah May, an executive coach who has developed and facilitated workshops in the areas of career development, communicating assertively, negotiations, time management, report writing and change management.”</p>
<p>NICTA Research Leadership Development Program – Leading Research Teams</p>	<p>The second module of the NICTA Research Leadership Development Program – Leading Research Teams was successfully held in May 2007. This program is attended by Lab Directors, Program and Project Leaders and supports the building of a leadership talent pipeline.</p>
<p>Investigating the Novelty of Your Research (Prior Art Search)</p>	<p>“Knowing about what others have done or are doing in your area is most important for research success.</p> <p>The existence of patents in your research area affects both the ability to use your research and the focus of your research. Understanding the ‘patent landscape’ is an important element for all of NICTA’s research projects.</p> <p>This workshop will introduce practical ‘use inspired’ tips on how to find and read patents effectively and efficiently.</p> <p>Key Learning Points:</p> <ul style="list-style-type: none"> - Locate and use some of the most useful databases to search for the novelty of your project - Develop your own efficient and effective use of key words for searches - Identify which patent categories best apply to your project - Learn new classifications and aids - Pick up some useful record keeping and reporting templates and resources. <p>The workshop will utilise real time exploration of relevant databases. “</p>

Research Ranking

A ranking of NICTA’s researchers based on a citation index was undertaken. This is to be followed up with a ranking of the research groups and develop measures to calibrate excellence other than citations. This process will then be integrated with NICTA’s performance management system.

Staffing Levels

Staffing levels and distribution by site and function are shown in the following table:

Projected Headcount (FTE) for 2007 by Quarters						
	March Projected	March Actual	June Projected	June Actual	Sep	Dec
Researchers						
ATP	28	28	21	28	23	23
Kensington	27	27.5	27	27	26	25
Canberra	45	42	43	42	43	42
Victoria	38.4	29.2	47.4	33.8	47.4	47.4
Queensland	10.8	10	10.8	10	10.8	10.8
Total Researchers	149.2	136.7	149.2	140.8	150.2	148.2
Seconded (Contributed) Researchers						
ATP	4.8	4.80	4.8	4.8	4.8	4.8
Kensington	5.6	5.60	10	5.6	10	10
Canberra	10.45	12.20	10	12.2	10	10
Victoria	10	10	10	10	10	10
Queensland	6.3	9.20	6.3	9.2	6.3	6.3
Total Contributed researchers	37.15	41.8	41.1	41.8	41.1	41.1
Research Support (Research Engineers, Programmers, Assistants)						
ATP	19.44	18.87	16.27	18.27	15.7	15.7
Kensington	30.96	18.16	13.9	17.3	10.4	8.4
Canberra	12.7	19.43	11.7	20.43	10.7	10.7
Victoria	9	14	10	16	10	10
Queensland	2	3.4	2	4.4	2	2
Total Research Support	74.1	73.86	53.87	76.4	48.8	46.8
Administration						
ATP	4	5	4	3.71	4	4
Kensington	6	7	6	7	6	6
Canberra	8	8	8	9	8	8
Victoria	1	1	1	1	1	1
Queensland	4	5	4	5	4	4
CHO	77.39	71.63	75.89	73.54	75.39	74.89
Adelaide	3	4	3	4	3	3
Total Administration	103.39	101.63	101.89	103.25	101.39	100.89
Seconded (Contributed) Administration						
ATP						
Kensington						
Canberra						
Victoria	5.65	5.65	5.65	5.65	5.65	5.65
Queensland						
Total Contributed administration	5.65	5.65	5.65	5.65	5.65	5.65
Total Staff Projections for 2007 (excl contributed staff)	326.69	312.19	304.96	320.45	300.39	295.89
Total Staff Projections for 2007 (incl contributed staff)	369.49	359.64	351.71	367.9	347.14	342.64

EDUCATION

During 2007, NICTA aims to establish education priorities that complement the individual laboratory and co-located university relationships that underpin NICTA's contribution to improving research training in Australia. The organisation's objectives are national in intent and focus.

The key outcomes in the reporting period were:

- 9 Phd completions in the reporting period;
- Internships with National Institute for Informatics (NII) in Japan and Canon Research Laboratories (CISRA) Sydney have been established;
- NICTA's Summer Scholars Program completed; and
- NICTA was gold sponsor of the National Computer Science School (NCSS) held in January.

Research Training Network

The Research Training Network (RTN) was established and made good progress in the reporting period. All partner Universities have agreed to the implementation of a nationally coherent Study Plan. The study plan provides a framework for research students to work with their supervisors to plan their research and their leverage of NICTA provided opportunities for enhancement. Study plans have been implemented progressively across all the universities, and are required of all students commencing with NICTA in 2007.

A committee consisting of University and NICTA representatives (NICTA-Universities Curriculum Committee) has been established and is chaired by a University academic. The mandate of the curriculum committee spans the approval of advanced courses, cross-university accreditation and quality assurance. The committee approved four courses to be offered in Semester 2, 2007. Two of these courses are currently being offered. The chair of the committee is developing a formal benchmarking process.

The "brokerage service" for internships with external organizations is now operating. To date, the education group has brokered internships with two organizations, one with the National Institute of Informatics (NII) in Japan, and the other with the Canon Research Laboratories (CISRA) in Sydney. VRL student Eric Bae accepted a 3 month visit to Infosys in Bangalore, and Jeremy Nicholson is spending 8 months at Saarland University, Germany. Xiaonan Ji, a PhD student working in the ACT, commenced a 3 month internship at Microsoft Beijing in March. Xiaonan was a recipient of a 2006 Microsoft Research Asia Fellowship in recognition of his outstanding research potential.

A joint application with TU Dresden, Germany, to the European Commission program 'Erasmus Mundus' for the exchange of European Masters students in Computational Logic was accepted. The first students in this program will be sent in August to pursue their research work under supervision of NICTA researchers.

In addition, NICTA is providing internship opportunities for students in different laboratories, and in its non-research departments. It is anticipated that there will be a total of 10 new internships in 2007. The program is open to all NICTA enhanced PhD and master's students.

Secondary Outreach Program and Recruitment of Students

NICTA participates actively in the secondary outreach programs of its university partners. It also provides direct support to a range of national and regional programs, such as the Australian Capital Territory (ACT) and the University of New South Wales (UNSW) careers fairs, through selected sponsorships and public showcasing of technology developed within NICTA.

To facilitate the recruitment of students, NICTA provides a number summer scholarships (approximately 80 annually), hosts and supervises summer scholars during the November-February period, and showcases NICTA to all summer scholars and additional invited students through a Summer Scholars Showcase – an event held over two days. In 2006, a majority of students (95%) indicated that they would choose to work with NICTA if they decided to pursue higher studies in ICT.

In addition to the above, NICTA co-sponsored and supported the National Computer Science Summer School (NCSS) hosted by the University of Sydney, providing regional scholarships, tutors and speakers. NCSS offers an exciting client-focused experience to year 11 high school students drawn from all Australian states and territories, together with some of their ICT teachers who also attend.

As the first step in NICTA's support of the ARTEMIS Orchestra competition for secondary students across Australia, NICTA sponsored and entered the "RoboFiddler" in the inaugural international competition held in Berlin during June. The "RoboFiddler" has its origins in a project conducted last year by The University of Adelaide. The team won second place, and the platform is now being considered for use in the ARTEMIS Orchestra competition by all secondary students.

During the reporting period Victoria Research Laboratory, in conjunction with the University of Melbourne Women into Engineering Program, hosted a visit of Year 11 students from Penleigh Grammar, McKinnon Secondary College, and MacRoberston Girls Secondary College.

Additionally, the Canberra Research Laboratory hosted a "Young Innovators" event as part of the Innovation Festival. This event involved a group of gifted primary students attending the CRL to discover what NICTA is about. NICTA is working with Multimedia Victoria's current ICT Skills promotion by providing students for publicity profiles and participation in state wide school roadshows.

At the end of the reporting period, NICTA was providing 297 students with financial support for their studies and 118 of those students were receiving full scholarships.

Students	Sydney	Canberra	Victoria	QLD	Total NICTA
Full Scholarships	35	40	39	4	118
Partial Scholarships	106	34	31	8	179
Total	141	74	70	12	297

	NSW	ACT	VIC	QLD	Total NICTA
NICTA-endorsed PhD students	121	76	83	17	297
Additional PhD students under supervision	20	18	-	-	38
Visiting students	3	-	1	-	4

There were 297 NICTA-endorsed PhD students at 30 June. Nine NICTA-endorsed PhDs were awarded, bringing the total number to 37 since the program began.

NETWORKS AND LINKAGES

Linkages activity is an extension of NICTA's research, education and commercialisation work. It comprises the wide variety of channels through which NICTA works to expand its opportunities to enhance Australia's ICT research and its successful exploitation.

The primary strategies for nurturing national excellence in ICT research are to build high-quality partnerships, interactions and linkages with a range of organisations including SMEs, Australian and international research institutions, multinational corporations, and ICT users and producers.

NICTA's main objective in the area of linkages for 2007 is to begin developing industry clusters around NICTA programs and projects. The organisation has taken a number of steps to begin this process and plans to focus on firms committed to developing research as a competitive edge.

Outcomes for the reporting period were:

- Formalising ties to the Idealist Program;
- Launch of the embedded systems cluster; and
- Completion of agreement with the Chinese Academy of Sciences.

European Commission

Collaboration with European Commission representatives is continuing with work underway to investigate the feasibility of expanding the scope for collaboration. Details for a joint workshop scheduled for the end of October on Managing Complexity is progressing with the aim of establishing a future research program in societally significant aspects of complexity.

Embedded Systems Cluster

Embedded Systems Australia has been launched as a new industry cluster whose members are collaborating to strengthen the embedded systems and related industries in Australia. The initial cluster consortium is representative of prominent companies, industry associations, NSW government and ICT research. The members are: Australian Electrical & Electronic Manufacturers' Association (AEEMA), BCS Innovations, CISRA (Canon), Cochlear, Google, iTech, Invetech, Machinery Automation Robotics, Microsoft, NICTA, NSW Department of State & Regional Development, Resmed, VAST, and the Warren Centre. Consultants Sinclair Knight & Merz have also lent valuable support. The cluster chairman is NICTA's CTO of Embedded Systems Dr Chris Nicol.

The cluster's first project is to undertake an Australia-wide capability mapping survey. This will help identify key industry strengths and potential collaboration partners. Meanwhile, the cluster members are undergoing the challenging process of creating a generic project collaboration agreement acceptable to all members.

Future projects for the cluster include:

- Technology road mapping for Australia
- Collaborative industry projects
- Promotion of embedded systems skills in secondary schools

Research Collaboration with the Chinese Academy of Sciences

NICTA has signed a research collaboration agreement with the Chinese Academy of Sciences through expanding links with the Institute for Computer Technology (CAS-ICT). Three NICTA staff visited CAS-ICT in November 2006 and drafted an initial research project. A core component of this partnership is a focus on staff and student exchanges. Various members of CAS-ICT have in the meantime visited NICTA and given research presentations identifying additional research collaboration opportunities.

Two applications were lodged under the International Science Linkages Program under DEST for project support under recent MOUs completed with the following agencies:

- Chinese Academy of Sciences - Institute of Computing Technology for a joint project in the area of context aware mobility
- Tsinghua University for a joint project in multimedia signal processing for video analysis in surveillance

Other Significant Linkages:

Early in the year the Empirical Software Engineering (ESE) program hosted a special seminar/short course, with support from the Australian Government Information Management Office (AGIMO) on Process Definitions for Business and Government. This seminar was presented by Professors Leon Osterweil and Lori Clarke, from the University of Massachusetts Amherst, currently visiting researchers with the ESE program. This presentation was extremely well-received, with around 200 industry participants registering for the seminar.

The ESE team also completed the first phase of a project with LIXI to produce a Reference Architecture and Implementation Guide, including code samples, to allow web services-based business-to-business interactions between lenders and property valuers. This was made available to LIXI members in March 2007, and adoption of the material by the industry is expected to increase gradually over the coming year.

Statistical Machine Learning (SML) staff worked closely with Symbolic Machine Learning and Knowledge Acquisition (SMLKA) Smart Roads project, integrating our road traffic controller into the Paramics traffic simulator, and running on data provided by the Roads and Traffic Authority (RTA).

For Vision Science, Technology and Applications (VISTA), the research contract has now been signed between the ANU Centre for Mental Health Research and the Automated Anatomical Structure Extraction for Diagnosis and Population Norms (AASEDP) project to investigate the automated diagnosis of Alzheimer's disease.

A significant research linkage was established with the University of Maryland. Prof. Rama Chellapa visited the QRL for one week to liaise with the NICTA researchers on CCTV, current work and future directions. A highlight of this visit was a workshop with industry organisation on the value of CCTV, current NICTA research and the future of CCTV. This was attended by over 20 industry representatives plus NICTA researchers.

The new *Meet the Founder* seminar series has been set up, with Rosmin Robertson of Kingfisher International launching the series in July. The *Meet the Founder* Series is intended to:

- disseminate a wider understanding of the role played by Australian entrepreneurs in the development of knowledge-based companies and their contribution to Australia's economic future;
- illustrate the alternative pathways entrepreneurs pursue in taking an idea to market;
- showcase and celebrate Australian entrepreneurial success stories; and
- contribute to fostering a more entrepreneurial culture in Australia.

Future speakers include the founders of Emotiv Systems, Dynamic Hearing and MYOB.

Big Picture Seminars were presented by Paul Henry (AT & T Labs), Barry Jones and George Farley. In April, NICTA VRL hosted a meeting of the AIIA's Industry Leadership Group Meeting, which was followed by a tour of TNL.

Research proposals have been transmitted to the Water in Dry Lands Cooperative Research Project (WIDCORP) and the Centre for Informatics and Optimisation (CIAO) at the University of Ballarat for participation in the Grampians Mallee-Wimmera Pipeline Project as part of the WIN project. Discussions are also underway between the WIN project, the M3-BIORES research group of the Catholic University of Leuven and the CRC for Spatial Information for real-time fusion of hyper spectral and in situ data in catchments areas. In March a visit was made to the National Centre of Efficient Irrigation Engineering & Technology Research in Shannxi Province, China.

External Communications

Techfest

During March 2007, VRL hosted the NICTA Techfest which was attended by 250 NICTA staff and students and 150 industry and government representatives. For the first time, NICTA research was presented under the Themes and Business Areas which was well-received by external visitors. Professor Frederick Mendelsohn, Director of the Howard-Florey Institute gave an exciting and inspiring talk about the challenges in neuro-engineering and opportunities for ICT to contribute to those problems in the Life Sciences.

CeBIT

NICTA was once-again involved in the annual CeBIT Australia exhibition at Darling Harbour, Sydney in May. NICTA had a substantial presence at the exhibition within the future parc area of the show.

We had a great stand which featured work from across the organisation. These included two of our spin-out companies Open Kernal Labs and Audinate exhibited in addition to a couple of NICTA's projects working through the commercialisation process: Goanna and mContext. Two of our new Business Areas, Intelligent Transport Systems and Safety and Security were also showcased at the event.

We estimate that over 1000 people visited the NICTA stand, while we made linkages for future collaboration or follow-up with approximately 100 people.

CSTACI

A meeting with Commonwealth State and Territory Innovation and Industry officials was held at the Canberra Laboratory during the reporting period. The end result was a very strong response from members of the visiting group (23) involved in medical and life sciences research to work in the medical imaging field. Work in the InterfereX project was well

received and there was positive feedback on the view that NICTA had developed about its place in the national innovation system.

a) Summary Activity Report

This section details progress and performance against the milestones specified in the Annual Activity Plan 2007 that were due for delivery by 30 June 2007.

During the reporting period, 26 milestones were expected to be completed. Five milestones were not met over the six-month period;

Q2: Complete development of capability documentation

This project is continuing based on the completion of the definition of Research Themes and Business areas. It is now feasible to develop a succinct and useful statement of our capabilities.

Q2: Survey of student identification with NICTA

This milestone will no longer be pursued as the survey of students will be carried out as part of a general staff survey in order to promote integration and reduce operating overheads.

Q2: Establish an 'ICT in Life Sciences' Innovation Network

The milestone was not met by the end of June but the program is now underway. The network is being led from the Victorian laboratory.

Q2: Develop research linkage plans for the research themes

This milestone was not met by the end of June and is currently in progress. Research Theme linkage plans will be finalised before the end of the calendar year.

Q2: Complete linkages analysis for Business application areas

This milestone was not met by the end of June and is currently in progress. Business application linkage plans will be finalised before the end of the calendar year.

The table on the following pages shows the milestones scheduled for delivery in the first two quarters of 2007 and their status.

Summary Activity Report: Performance against Milestones January to June 2007

Strategy	Activity	Milestones	Due	Outcome
PEOPLE				
Maintain world-class researcher teams	Demonstrate research excellence	Deliver a quality assessment of NICTA research teams	Q2	<p>This milestone was met: The Scientific Director has undertaken a ranking of NICTA's researchers based on a citation index. This will form a component of the benchmarking activity underway. The results obtained are based on citations and will be set alongside other measures of performance.</p> <p>As an extension of this milestone we are assessing how to integrate this process with NICTA's performance management system.</p>
Develop a strong achievement culture	Culture analysis and improvement	Institute Internal Award Program	Q1	This milestone was met: The in July 2007 for the second half of internal award program is complete with implementation the year.
RESEARCH				
Focus our research efforts to maximise impact	Setting and promulgating of research themes for funding period	Research Council established	Q1	This milestone was met. The Research Council has been established and will next meet on 3 September 2007.
		Major research themes defined	Q2	This milestone was met: All research projects fall into one or more defined Themes. Themes are the methods we use to package our projects. Our themes are: Embedded Systems; Making Sense of Data; Managing Complexity; and Networked Systems.
	Develop and publish information on NICTA's research mission	Complete development of capability documentation	Q2	This milestone was not met: This is in progress and being developed around the reorganisation of NICTA research under Themes. The Themes will provide the structure for the capability documentation. Descriptive statements of each Theme including objectives have been finalised. The rework of this material into a suitable capability statement will be completed by the end of 2007.
	STaR	Assessment of the effects of improved user interface for traffic incident management together with the client	Q2	This milestone was met: Novel User Interface design for Traffic Incident Handling has been carried out. The Star-UI team has reviewed some TIM (Traffic Incident Management) process and system issues, conducted user studies (interview, workshop, and questionnaire) and analysis on RTA's Incident Input Form to elicit user requirements. A series of meetings have been held with the RTA to jointly design the new incident input form.
Conduct research to the highest standards	Research Management	All new projects assessed via the	Q1	This milestone was met: The PVR method and guidelines were finalised in Q1. Seven applications were received on Monday 19 March. As per the guidelines the various PVR

Strategy	Activity	Milestones	Due	Outcome
of international excellence		Project Value Rating (PVR) method		panels provided written assessment for each project to the May RMCC meeting. The RMCC recommended to the CEO funding for four or the seven projects. The CEO approved the same four projects for funding and term sheets are currently being developed. The next round of project applications were received on Monday 25 th June, the outcomes of which were not available for the close of Q2.
		Build comprehensive view of research portfolio using the PVR dimensions	Q2	<p>This milestone was met:</p> <p>We have now collated information about NICTA's project portfolio against the following dimensions:</p> <ul style="list-style-type: none"> • Scale (staff, budget, duration) • Alignment with <ul style="list-style-type: none"> - NICTA's Themes and Business Areas - Degree of risk - Technology Readiness Level - Reason for doing the project - Path to impact - Collaborations <p>This data will be presented during August (Q3) at ISAG/IBAG.</p>
		Implement competitive funding process	Q2	This milestone was met: Project applications are now considered only three times per year. At each assessment round, projects compete against one another for funding approval.
EDUCATION				
Build an enhanced PhD program in partnership with universities	Research Training Network for enhanced PhDs	Rules and framework for mobility developed	Q2	<p>This milestone was met: Rules and framework for mobility developed. All partner Universities have agreed to the implementation of a nationally coherent Study Plan that provides a framework for research students. A committee consisting of University and NICTA representatives (NICTA-Universities Curriculum Committee) has been established which is chaired by a University academic. The mandate of the curriculum committee spans the approval of advanced courses, cross-university accreditation and quality assurance.</p> <p>The committee approved four courses to be offered in Semester 2, 2007. Two of these courses are currently being offered.</p>
	Extension to Non-Partner Universities	Framework established for outreach to non-partner Universities	Q2	This milestone was met: Framework established for outreach to non-partner Universities. A framework document has been written. Discussions are taking place with UTS to pilot this through their CAPSTONE (final year) project students.

Strategy	Activity	Milestones	Due	Outcome
	Students uptake of the Research Training Network	Survey of student identification with NICTA	Q2	This milestone was not met: NICTA's policy is to ensure that students are integrated with researchers and professionals at every turn. A separate student survey was not conducted during the reporting period. Instead it was determined that a combined survey all NICTA People would be carried out in Q3. This will address the level of identification with NICTA of all staff and students. This survey has subsequently been carried during the period taken to finalise this report.
	Acceptance of NICTA Enhanced PhD	All partners implementing NICTA enhancement and study plans	Q1	This milestone was met: Study Plans and their implementation across NICTA were reviewed during Q1. The review showed that study plans are implemented at the University of Sydney, University of Melbourne, and the Australian National University. The University of NSW will implement study plans from 2008. The Queensland universities (Griffith, UQ, and QUT) have also agreed to implement study plans; the final details of these are yet to be resolved, pending the second round funding arrangements for the QLD laboratory.
Attract outstanding students to NICTA and to ICT generally	Enhanced ICT Research Training through improved quality of intake of students	Financial and in-kind support provided each year for secondary student outreach activities	Q1	<p>This milestone was met:</p> <p>59 undergraduate students participating in NICTA's Summer Scholars Program across all of the labs completed their research projects in January. Several of the labs invited students to participate in a poster session where they were able to share the results of their projects and ultimately compete for the Best Summer Scholar prize in that Laboratory. NICTA consequently sponsored the "best" students from the QRL, ATP and Neville Roach labs to attend Techfest in Melbourne and be part of the Education booth.</p> <p>NICTA was a gold sponsor of the 2007 National Computer Science School (NCSS) for senior secondary school students, held in January 2007 at The University of Sydney. Approximately 80 students from all states and territories participated in the NCSS, including several students from regional Australia sponsored by NICTA. http://www.ncss.edu.au/sponsors.html</p> <p>During Q2 NICTA continued its support of primary and secondary outreach initiatives by hosting a number of events in the labs during Q2:</p> <ul style="list-style-type: none"> - the "Young Innovators" event involved a group of gifted primary students and was held on 23rd May at the Canberra Research Labs as part of the Innovation Festival. - The Victorian Research Lab hosted visits by several group of secondary students, including a group from Singapore.
	Stimulate student pipeline	Consistently attend and assist partner universities in marketing on	Q1	<p>This milestone was met: NICTA has assisted partner universities in marketing on open day exhibitions and graduate fairs. Planning began for the Australian Science Festival and careers fairs held later in the year. http://www.sciencefestival.com.au/asf/?cat=14</p> <p>During Q1, NICTA also sponsored a team of students from Adelaide University to represent</p>

Strategy	Activity	Milestones	Due	Outcome
		open day exhibitions, graduate fairs, and on some international trips		Australia in the inaugural Artemis Orchestra Competition held in Berlin. The team developed a robot which plays the violin (called the RoboFiddler). They placed second at this event. NICTA staff also supervised a large number of summer students as reported above.
LINKAGES				
Develop an integrated plan for NICTA's industry linkages with clear targets that embed the project in the relevant ecosystem to enhance the likelihood of market adoption of research results	Innovation Networks	Develop Innovation Network Program in Embedded Systems	Q1	This milestone was met: In collaboration with AEEMA, The Warren centre and DSRD, NICTA has led an initiative to establish the <i>Australian Embedded Systems Cluster</i> . An <i>Embedded Systems Roundtable Forum</i> was held in March 2007 to discuss the formation of a cluster (or similar collaboration) amongst key representatives of industry and research organisations. The Embedded Systems Australia has now been launched as a new industry cluster whose members are collaborating to strengthen the embedded systems and related industries in Australia. The initial cluster consortium is representative of prominent companies, industry associations, NSW government and ICT research. The organising committee have subsequently elected NICTA's CTO, Chris Nicol, as the chair of the initial cluster.
		Establish an 'ICT in Life Sciences' Innovation Network	Q2	This milestone was not met: This milestone was not met by June 30, but has been subsequently met. A program for members of the network has been prepared and implementation is now underway. The network is organised by the NICTA Victorian laboratory. It will support the development of a research program in life sciences. The Forum will bring together researchers from the medical research and engineering and computing communities and business and government to explore the exciting developments and opportunities at the convergence of medical science and ICT. The Forum will facilitate new relationships and collaboration and play a key role in better informing the community of this important and emerging field of technology that has implications for the future of healthcare.
	External Communication	Techfest delivered	Q1	This milestone was met: NICTA's third annual Techfest was held on 5-6 March in Melbourne. This two-day event was attended by over 150 external visitors, and featured a large proportion of NICTA's innovative research in the form of demonstrations and posters. This year's exhibitors were displayed within a Business Area or Theme. The new setup helped reinforce NICTA's new research strategy and gave external visitors an understanding of NICTA's strategic direction.

Strategy	Activity	Milestones	Due	Outcome
				Overall, feedback on Techfest 2007, both from internal and external participants, was very positive.
		CeBIT Australia	Q2	<p>This milestone was met: NICTA was once again involved in the annual CeBIT Australia exhibition at Darling Harbour, Sydney on 1- 3 May. NICTA had a substantial presence at the exhibition within the <i>Future Parc</i> area of the show.</p> <p>A new stand featured work from across the organisation. Two of our spinout-companies Open Kernel Labs and Audinate exhibited. In addition two projects working through NICTA's commercialisation process: Goanna and mContext were also on display. Two of our new Business Areas, Intelligent Transport Systems and Safety and Security, were showcased.</p> <p>It's estimated over 1,000 people visited the stand, including about 100 with whom we collected details for future collaboration and/or linkages. http://www.cebit.com.au/</p>
Develop strong cooperative relationships and joint projects for national and international benefit with: <ul style="list-style-type: none"> National & International research institutions Major ICT users & domain areas 	National and international research institutions	Develop research linkage plans for the research themes	Q2	<p>This milestone was not met: This milestone is lagging and is tied to decisions about how Themes will be managed and led. Theme Leaders have been appointed:</p> <ul style="list-style-type: none"> Managing Complexity, Professor Rob Evans Networked Systems, Dr Terry Percival Embedded Systems, Dr Chris <u>Nicol</u> Making Sense of Data, Professor Bob Williamson <p>This milestone will be met by 31 December 2007.</p>
		Establish a liaison role with EU ICT research programs	Q1	<p>This milestone was met: Arrangements have been concluded for participation in the Idealist Network. This will establish NICTA as a central contact point for facilitating collaboration between Australian and European research interests under the 7th Framework (2007-2013).</p> <p>The arrangement has been established with participation of FEAST and the Delegation of the European Commission. NICTA will receive notice of partner searches and be able to post partner searches on behalf of Australian researchers related to calls under the 7th Framework http://www.ideal-ist.net/.</p> <p>Collaboration with the European Commission Representatives is continuing with work</p>

Strategy	Activity	Milestones	Due	Outcome
				underway to investigate the feasibility of expanding the scope for collaboration under the Framework program. Details for a joint workshop scheduled for the end of October on managing Complexity is progressing with the aim of establishing a future research program in societally significant aspects of complexity.
		Establish linkages to 'Top ICT' research centres in preparation for benchmarking	Q2	<p>This milestone was met:</p> <p>International linkages which were initiated or progressed during the reporting period were:</p> <ul style="list-style-type: none"> • Centre National de la Recherche Scientifique (CNRS) Toulouse, France, participates in the Supercom project • Centre de Recherche Scientifique en Informatique de Lens, University of Artois, Lens, France • Laboratoire Mathematique Informatique et Genome of INRIA in a semantic search engine for patents as part of the EPIPAGRI project, it is also planned to involve Canberra startup Cambia. • PowerSet, the Silicon Valley based Natural Language Search Company. Topics of mutual interest are ranking and named entity extraction.
	Major ICT users and domain areas	Complete linkages analysis for Business application areas	Q2	<p>This milestone was not met: This milestone is lagging as it was dependant on the finalisation of Business Area Plans. The Business area plans were presented to ISAG/IBAG in August. Suggestions raised by ISAG/IBAG are now being incorporated into the Business Area plans and the linkage component of these.</p> <p>The completion of the Business area plans and associated linkage plans will be met over the remainder of 2007.</p>
COMMERCIALISATION				
Ensure that NICTA has a clear, fast and flexible Intellectual Property (IP) Framework, set of Commercialisation Processes and Guidelines that facilitate efficient transfer of research results into use	Enhance existing pipeline model	Tools and methods for pipeline analysis completed	Q2	<p>This milestone was met:</p> <p>Three mechanisms have been established during Q2:</p> <ol style="list-style-type: none"> 1. Commercialisation Register has been implemented, tracking the commercialisation status of all projects in detail, including factors such as phase on the life-cycle pipeline, commercialisation staff allocation, outstanding issues and actions, etc. The IP status of each project is also tracked, in terms of whether it has an IP strategy, and IP inventory, a Prior art search, or any filed patents. <p>Supporting material for developing IP strategies, IP inventories, and IP searching has been incorporated in the Commercialisation Guidebook and presented in a series of workshops.</p>

Strategy	Activity	Milestones	Due	Outcome
				<p>2. A full 8-phase commercialisation pipeline has been defined to include all steps in a project life-cycle, including:</p> <ol style="list-style-type: none"> a. Pre-project business area strategic planning to project conception and proposal. b. The 4 steps covering early stage engagement with market prospects, IP development and consolidation phases. c. The 4 steps covering opportunity development, market validation, investment/engagement, and co-investment as outlined in the Guidebook. <p>Every project has been given an initial placement on this pipeline, allowing determination of required commercialisation activities and support relevant to that phase. The Sweet-16 projects have been reviewed, with several projects being dropped from the list and others bought on as they have reached the appropriate phase of the pipeline.</p> <p>3. Project 1-page summaries were developed during Q2 to capture key project information and help focus researcher attention on the more commercialisation-related aspects of projects, such as IP position, competitive position and risks. Guidelines for assessing competitive position and risk, at early, mid and late stages of a project life-cycle have been defined to underpin this.</p>
	Staffing and tools	Collaborative software tools rolled out to foster communication and integration between research and commercialisation unit	Q2	<p>This milestone was met:</p> <p>Two collaborative and information sharing mechanisms have been instigated:</p> <ol style="list-style-type: none"> 1. The Commercialisation Register outline above provides on-line shared access to up-to-date details on the commercialisation status of every project 2. Wiki sites have been set up for the commercialisation team to share information, and also by each of the Business Area strategic planning teams for sharing market and technology information, and road maps as they are developed.
	Training and awareness	Introduce first module in the commercialisation program	Q1	<p>This milestone was met: A program was introduced and trialled in Q1, 2007. This program was designed and delivered by the Macquarie Institute of Innovation.</p> <p>This program has been developed to ensure participants become familiar with key commercialisation ideas and concepts, the entrepreneurial process and the jargon used in the commercial world. This course is designed to provide participants with the key</p>

Strategy	Activity	Milestones	Due	Outcome
				<p>ingredients for commercial success. The course is necessary because it develops the skills of NICTA staff and students who are interested in understanding the entrepreneurial process and the steps required in planning a new venture.</p> <p>Improvements to this program are required and are being introduced.</p>

b) Consistency with the Intellectual Property Policy

NICTA's Intellectual Property (IP) Policy is administered by the Intellectual Property Committee, which is chaired by the General Counsel. The Intellectual Property Committee operates for the purposes of:

Providing:

- Advice on IP matters to the Chief Executive Officer and the Director, Business Development

Determining:

- Ownership of IP in cases referred to it
- Appropriate protection strategies for IP
- Appropriate commercialisation strategies for IP

Reviewing:

- This policy and other practices concerned with IP
- Procedures and protocols
- The implementation of an education strategy for staff and students to ensure they are aware of IP rights, this policy and the relevant procedures and protocols.

As an employer, NICTA owns IP created by full-time and part-time staff in the course of their employment. NICTA is not the owner of IP created by staff members outside the course of their employment. NICTA does not claim ownership of copyright in scholarly works but does require that all works make appropriate acknowledgement of the support provided by NICTA.

NICTA has made provisions to support its researchers attending other institutions as visiting scholars and researchers. Travel approvals ensure NICTA visiting researchers are aware that the policies of the host institution may apply and require consideration of any formal agreement between NICTA and the other institution regarding IP ownership and disclosure. Travel agreements for inbound visitors explicitly state the agreed terms for treatment of IP, with the preferred arrangement that NICTA will be owner of any IP generated by visitors.

Where contractors are engaged, the general terms of engagement are that NICTA will be the owner of any IP generated. Where circumstances mean that NICTA will not own the IP, it is a requirement of engagement that NICTA is granted a licence, on suitable terms, to use the IP.

In the case of research joint ventures, IP ownership is addressed through the mechanisms of contracts and the IP register to ensure clarity of ownership of background IP and certainty over the use and control of IP generated through the collaboration. The potential impact of joint ownership is considered as part of any collaborative project negotiation.

NICTA makes no claim over the copyright subsisting in a student's thesis. Students are recognised as the owners of any IP they generate. In general, NICTA students are asked to assign their IP to NICTA, however students remain free not to do so. If a student chooses not to assign IP when it is considered appropriate to do so, the student is required to select an alternative research project. NICTA received extensive legal and taxation advice in 2003 to ensure that its actions with respect to the assignment of student IP are governed by protocols that are not unconscionable.

NICTA's publications procedure and project application procedure exist for the identification of IP. Notification is to the Manager, Commercialisation and Intellectual Property Office and Director, Business Development respectively. The publications procedure is presently the subject of a detailed review aimed at establishing a more

streamlined and effective approval and recording process which is consistent across all of NICTA's laboratories.

NICTA maintains an open approach to the publication of research results that aims to respect and preserve both the freedom to publish and the opportunity to maximise commercialisation. Given NICTA's economic impact and national interest stance, early publication of research results under an open policy will always be preferred, except where:

- The IP was specifically generated through significant investment to support a 'family' of existing NICTA IP
- Further development within NICTA can be shown to enhance the commercialisation potential, value and benefit to Australian industry

There were no circumstances arising between 1 January 2007 and 30 June 2007 that led to any departure from the terms of the IP Policy.

c) Proposed Activities

The proposed activities over the remainder of the period required to perform the activity, milestones and performance indicators in the Annual Activity Plan 2007 are set out in this plan.

There have been no significant problems in implementing the milestones over the first half of the year and no need for any remedial action. No significant new activities are proposed to be undertaken that were not anticipated in the AAP 2007 or that would require prior approval from the Members.

d) Adverse Issues

There are no major adverse issues likely to affect NICTA's achievements under the Annual Activity Plan 2007.

e) Details of Asset Disposals

Asset Disposals for the year to date to 30 June 2007 are shown in the table below.

	<u>Net Book Value</u>	<u>Proceeds</u>	<u>Profit</u>
FIXED ASSETS	\$	\$	\$
- Computer Equipment	0	0	0

f) **Public Acknowledgements**

Acknowledgement of Australian Government support for NICTA is given in all interviews and is carried into all public presentations and publications. Australian Government support is acknowledged on the NICTA website, on NICTA exhibition stands and in all press releases.

The form of acknowledgement used under the first Deed has been replaced by that identified in the second Funding Agreement. The following table identifies all known media reporting of NICTA's activities during the reporting period.

NICTA MEDIA – January to June 2007

Date	Title	Writer	Media
23-Jan-07	Operating system education gets \$100K boost	Gedda, Rodney	ComputerWorld Australia Online
30-Jan-07	NICTA embeds tech head	Broekhuysse, Paul	Australian
30-Jan-07	Weather dollars pump database	Woodhead, Ben	Australian
30-Jan-07	Weather dollars pump up water watch database	Woodhead, Ben	Australian
6-Feb-07	Providing the answers	Jones, Mark	Financial Review
8-Feb-07	Morning - 11.38am	Sloan, Alex	Radio - ABC 666 - Canberra
14-Feb-07	Stanhope considers trade base in India	Kanchan, Dutt	Canberra Times - Business News
19-Feb-07	we must spread the high-tech marketing gospel	Mudge, Craig	Financial Review
20-Feb-07	David Skellern	Jenkins, Chris	Australian
20-Feb-07	IT diary	Staff Writer	Australian
20-Feb-07	research partnership	Lebihan, Rachel	Financial Review
27-Feb-07	Diary	Staff Writer	Australian
27-Feb-07	People shortage gets CIO attention	Foreshew, Jennifer	Australian
27-Feb-07	People shortage gets CIO attention	Foreshew, Jennifer	Australian Online
27-Feb-07	Yoicks! It's another virtual world	Skeen, Dan	Sydney Morning Herald
27-Feb-07	Yoicks! It's another virtual world	Skeen, Dan	The Age
27-Feb-07	Yoicks! It's another virtual world	Skeen, Dan	The Age Online
28-Feb-07	New ad technology might keep tabs on consumers	Salleh, Anna	Yahoo Online News
1-Mar-07	An Open Letter to the Prime Minister of Australia	Contributing Writer	the-funneled-web.com
1-Mar-07	Inland Afternoons - 2.50 pm	Buchanan, Alison	Radio - ABC - New England North West NSW
1-Mar-07	Inland Afternoons - 2.50pm	Buchanan, Alison	Radio - ABC Central West NSW
1-Mar-07	Inland Afternoons - 2.50pm	Buchanan, Alison	Radio - ABC - Riverina Wagga
1-Mar-07	Inland Afternoons - 2.50pm	Buchanan, Alison	Radio - ABC - Western Plains NSW
1-Mar-07	Inland Afternoons - 2.50pm	Buchanan, Alison	Radio - ABC Central West - Cumnock
6-Mar-07	All in a week's work	Uldrich, Jack	The Motley Fool
6-Mar-07	Aussie video surveillance technology leaves rivals for dead.	Pauli, Darren	ComputerWorld Australia Online
6-Mar-07	E-rescue plans for coping with disasters	Foreshew, Jennifer	Australian
6-Mar-07	Federally funded researchers at NICTA are gearing up for several new e-government	Staff Writer	The Age Online

	related projects		
6-Mar-07	IT diary	Staff Writer	Australian
6-Mar-07	NICTA gears up	Miller, Nick	Sydney Morning Herald - Next
6-Mar-07	NICTA gears up	Miller, Nick	The Age
7-Mar-07	hatchlings leave their incubator	Jones, Mark	Financial Review
7-Mar-07	Tiny gigabit wireless chip nears completion	Kotadia, Munir	ZDNet Australia
8-Mar-07	NICTA bug killing tool heads for beta trials	Kotadia, Munir	ZDNet Australia
9-Mar-07	E-commerce standards for lending industry	Pauli, Darren	ComputerWorld Australia Online
9-Mar-07	NICTA demos 'intelligent road' system	Kotadia, Munir	ZDNet Australia
10-Mar-07	New ads keep an eye out for you	Reed, Fred	Washington Times Online
12-Mar-07	Cash injection for e-lab	Grose, Simon	Canberra Times
12-Mar-07	HK set to become world digital city	Contributing Writer	news.gov.hk
13-Mar-07	Fixing Leaks	Woodhead, Ben	Australian
13-Mar-07	Fixing leaks	Woodhead, Ben	Australian Online
13-Mar-07	IT diary	Staff Writer	Australian
13-Mar-07	NICTA's sensors to track the trickles	Woodhead, Ben	Australian
13-Mar-07	Political threat to water sensor	Woodhead, Ben	Australian
14-Mar-07	Early Afternoons - 1.54 pm	Levi, Scott	Radio - ABC Central Coast - Gosford
27-Mar-07	Developers want water role	Woodhead, Ben	Australian Online
27-Mar-07	Diary	Staff Writer	Australian
27-Mar-07	Private sector wants toe in water	Woodhead, Ben	Australian
1-Apr-07	Carbon trading opens up opportunities for IT	Mack, Merri	Voice & Data
1-Apr-07	Driving down loan processing times	Staff Writer	Mortgage Professional Australia
1-Apr-07	Pooling knowledge for water reform	Priestley, Angela	Image & Data Manager
2-Apr-07	ICT an industry of opportunities for AIIA CEO	Tay, Liz	ComputerWorld Australia Online
3-Apr-07	IT diary	Staff Writer	Australian
10-Apr-07	IT diary	Staff Writer	Australian
16-Apr-07	Technology centre strengthens ICT research	Staff Writer	Canberra Times
17-Apr-07	IT diary	Staff Writer	Australian
18-Apr-07	NICTA spin-off opens US head office	Winterford, Brett	ZDNet Australia
18-Apr-07	NICTA spin-off opens US head office	Winterford, Brett	Builder AU Online
19-Apr-07	THE TYRANNY OF DISTANCE	Morris, Peter	Business Review Weekly
24-Apr-07	IT diary	Staff Writer	Australian
28-Apr-07	Australia missing tech opportunities	Tellzen, Roland	Australian Online
28-Apr-07	Australia missing tech opportunities	Tellzen, Roland	Weekend Australian
1-May-07	CONFERENCES, EXHIBITIONS, COURSES AND EVENTS	Staff Writer	Australian
1-May-07	Down to business at big show	Tellzen, Roland	Australian Online
1-May-07	Getting down to business at the big show	Tellzen, Roland	Australian
1-May-07	IT diary	Staff Writer	Australian
1-May-07	New South Wales	Staff Writer	Australian Anthill
1-May-07	NICTA demonstrates its research at Techfest	Staff Writer	Voice & Data

	2007		
1-May-07	Optical net researcher chases cash	Foreshew, Jennifer	Australian Online
1-May-07	Optical net researcher chases cash	Foreshew, Jennifer	Australian
1-May-07	Simulation - new growth industry for national security	McKeague, David	Australian National Security
3-May-07	CeBIT: OpenOffice + Linux = Mac	Gibson, Nick	ZDNet Australia
8-May-07	Bot contest for ruler of roads	Kennedy, Stuart	Australian Online
8-May-07	Bot contest for ruler of the roads	Kennedy, Stuart	Australian
8-May-07	IT diary	Staff Writer	Australian
8-May-07	No Header - Please submit items in a	Staff Writer	Australian
8-May-07	The critical mass in ICT research	Mendham, Tim	Fast Thinking
10-May-07	CeBIT 2007 Australia: Report	Field, David	Australian PC Authority Online
11-May-07	Alliance for Embedded Security, Advanced Graphics and High-performance Multi-Media	Contributing Writer	ITWire
11-May-07	Enhanced MPEG-4 with leading GUI & Multi-Media platform for embedded systems	Staff Writer	ITWire
11-May-07	Leading GUI & Multi-Media Platform for Embedded Application Development	Staff Writer	ITWire
11-May-07	Security, Advanced Graphics & high-Performance Multi-Media in Embedded Systems	Contributing Writer	ITWire
15-May-07	Funds threat on river control	Woodhead, Ben	Australian
15-May-07	IT diary	Staff Writer	Australian
15-May-07	It's web take 2.0	Howarth, Brad	Sydney Morning Herald Online
15-May-07	It's web take 2.0	Howarth, Brad	Sydney Morning Herald
15-May-07	Office buildings	Staff Writer	City Chronicle
15-May-07	River control funds threat	Woodhead, Ben	Australian Online
15-May-07	web 2.0	Howarth, Brad	The Age
17-May-07	Standards Convey the E-Message	Staff Writer	idm.net.au (Image & Data Manager)
21-May-07	Promising start	Staff Writer	Canberra Times
21-May-07	School	Staff Writer	The Age
22-May-07	Eco-networking	Woodhead, Ben	Australian
22-May-07	Eco-networking resources	Woodhead, Ben	Australian Online
22-May-07	Spreading the net	Staff Writer	Sydney Morning Herald Online
23-May-07	Technology group shatters united front	Bajkowski, Julian	Independent Financial Review
28-May-07	Communicating Billboards: Signs that can see	Arora, Rupali	msnbc.com
30-May-07	eWAY, Saasu win awards	Staff Writer	Australian Reseller News
31-May-07	Wireless prototype to ease road congestion, detect bottlenecks	Rossi, Sandra	ComputerWorld Australia Online
1-Jun-07	Academia / Research	Staff Writer	Engineers Australia
1-Jun-07	Big Computer	Staff Writer	KIJK Magazine
1-Jun-07	Engineering experience	Staff Writer	Engineers Australia
1-Jun-07	NICTA tests wireless traffic control solutions	Marshall, Tim	Communications Day
1-Jun-07	Quick Connections	Staff Writer	Voice & Data
1-Jun-07	Robot car contest	Staff Writer	Engineers Australia

5-Jun-07	Lack of ICT skills and industry support puts Australia in grave danger	Rossi, Sandra	ComputerWorld Australia Online
5-Jun-07	Modern research facility promotes collaboration	Staff Writer	Canberra Times
6-Jun-07	After pain, some gain	Guest Writer	Canberra Times
6-Jun-07	Pray for rain to hold on to this surplus	Foley, Megan	Canberra Times
6-Jun-07	Tourism misses out on the spoils	Foley, Megan	Canberra Times
7-Jun-07	National crisis: ICT skills shortage	Staff Writer	ScienceAlert Online
7-Jun-07	Where your money's going	Staff Writer	Canberra City News
8-Jun-07	NICTA creates smarter signals	Rust, Len	The Rust Report
9-Jun-07	Google getting plenty of graduates while NICTA CTO laments shortage	Beer, Stan	ITWire
9-Jun-07	M'sian Students Win Int'l Acclaim	D'Cruz, Neville	Bernama.com
10-Jun-07	Four Malaysian students win acclaim with RoboFiddler	Malaysia	The Star
10-Jun-07	Outback Online's Peer-to-Peer Gaming Protocol	Wallace, Mark	3pointD.com
10-Jun-07	The research and development can pull the violin robot Big Ma Liuaio lives Berlin to seize the prize	Staff Writer	China Press
11-Jun-07	Higher	Staff Writer	The Age
12-Jun-07	A car that doesn't need a driver	Staff Writer	Sydney Morning Herald Online
12-Jun-07	Diary	Staff Writer	Australian
12-Jun-07	Leading GUI and embedded HW suppliers partner for OEM's of multi-media devices	Staff Writer	ITWire
12-Jun-07	Researchers put minds to mapping Alzheimer's	Dearne, Karen	Australian
13-Jun-07	Australian robot plays the fiddle on European stage	Rossi, Sandra	ComputerWorld Australia Online
13-Jun-07	Australian robot plays the fiddle on European stage	Rossi, Sandra	Techworld Online
13-Jun-07	Australian Robot Plays The Fiddle On European Stage	Rossi, Sandra	LinuxWorld.com.au
13-Jun-07	Australian robot plays the fiddle on European stage	Rossi, Sandra	CIO Online
13-Jun-07	Driverless car approaching	AAP	news.com.au
13-Jun-07	Violin-playing Robot impresses in Euro contest	Rossi, Sandra	PC Advisor Online
14-Jun-07	Drivers take a back seat	Staff Writer	Geelong Advertiser
14-Jun-07	Driving without a driver	John, Katelyn	Hobart Mercury
18-Jun-07	Skill shortage is putting the Australian IT industry in peril	Rossi, Sandra	ComputerWorld Australia
18-Jun-07	Sydney researchers drive change to smarter cars	John, Katelyn	Canberra Times
20-Jun-07	Open source developer wins e-commerce tender for Nth Queensland tourism	Rossi, Sandra	ComputerWorld Australia Online
24-Jun-07	Smart car ideas put local drivers on long road to the future	Cauchi, Stephen	The Age
24-Jun-07	Smart cars put local drivers on road to future	Cauchi, Stephen	The Age Online
26-Jun-07	Brave new technology moving into fast lane	John, Katelyn	Newcastle Herald
27-Jun-07	Fading promise of the information revolution	Letter to the Editor	ABC News - Online
27-Jun-07	No header: Good Australian Robot plays the	Staff Writer	ComputerWorld Australia
27-Jun-07	Open source win for Nth QLD tourism	Rossi, Sandra	ComputerWorld Australia
27-Jun-07	Sheryle Moon	Guest Writer	ComputerWorld Australia

g) *Variations to the Agreement*

No changes are emerging that may necessitate any variations to the second Funding Agreement.

General Purpose Un-audited Accounts

FINANCIAL ACCOUNTS – PART 1 – SUMMARY

Income Statement		1Jan07- 30Jun07 Actual	AAP Forecast 31-12-07
	Note	\$000's	\$000's
Revenue from ordinary activities	1	44,031	86,430
Expenses:			
Employee benefits expense	2	(19,940)	(67,813)
Depreciation and amortisation expense		(2,386)	(4,712)
Other expenses from ordinary activities		(6,667)	(21,231)
Profit from ordinary activities before income tax expense		(15,038)	(7,326)
Income Tax Expense		0	0
Net Profit/(Loss)		(15,038)	(7,326)
Balance Sheet			
	Note	\$000's	\$000's
Current Assets			
Cash	3	25,892	11,604
Other Current Assets	4	2,108	1,214
Total Current Assets		28,000	12,818
Non-Current Assets			
Property, plant and equipment	5	8,936	20,727
Intangible assets – Software & Patents	6	550	843
Other Non-Current Assets- Prepayments		17,200	17,200
Total Non-Current Assets		26,686	38,770
Total Assets		54,686	51,588
Current Liabilities			
Trade and employee benefits	7	4,338	11,289
Deferred Revenue		0	296
Total Current Liabilities		4,338	11,585
Non-Current Liabilities			
Leaseback Liability		0	11,250
Accrued lease expense		1,390	2,123
Total Non-Current Liabilities		1,390	13,373
Total Liabilities		5,728	24,958
Net Assets		48,958	26,630
Equity		48,958	26,630

Statement of Cash flows		1Jan07-30Jun07 Actual	AAP Forecast 31-12-07
	Note	\$000's	\$000's
Cash flows from operating activities			
Receipts		39,697	86,017
Interest received		360	638
Payments to suppliers and employees		(35,130)	(81,498)
Income taxes paid		0	0
Net cash inflow from operating activities		4,927	5,157
Cash flows from investing activities:			
Payments for property, plant and equipment		(696)	(15,214)
Net increase (decrease) in cash held		4,231	(10,057)
Cash at beginning of the financial year		21,661	21,661
Cash at the end of the financial period		25,892	11,604

Note 1. Revenue		\$000's	\$000's
Details of revenue receipts are as follows:			
- Contribution from members		7,816	13,581
- Dept of Communications Information Technology and the Arts		10,138	24,449
- Australian Research Council		23,970	23,970
- Other revenue		1,747	2,561
-Interest received		360	638
-In-Kind Contributions		0	21,231
Total		44,031	86,430

Note 2. Employee Benefits Expense/Payments to suppliers and employees

This excludes In-kind contributions for the year to date as the amounts are only received on an annual basis from the Universities. The AAP amount includes expected In-kind contributions.

Note 3. Cash

The cash at the end of period is in line with NICTA's activity strategy and is explained as follows:

- An amount of \$5.3 million is for the development of commercial prototypes from research product.
- The balance of approximately \$20.6 million is sufficient to fund activities until the next major funding receipt forecast to be in September 2007. The monthly organisation cash requirements are forecast to be approximately \$4 million per month in 2007.

Note 4. Other Current Assets

	\$000's
- Trade Receivables	1,039
- Prepayments (Current)	132
- Deposits and Credit Card Accounts	729
- GST Receivable	0
- Interest Receivable	208
Total	2,108

Note 5. Property, Plant and Equipment

	Net Book Value \$000's
- Computer Equipment	1,049
- Office Equipment	312
- Furniture & Fittings	672
- Leasehold Improvements	2,620
- Research Equipment	3,131
- Capital Work-In-Progress	1,152
Total	<u>8,936</u>

Note 6. Intangible Assets

	\$000's
- Software	550
- Patents and Trademarks	0
Total	<u>550</u>

Note 7. Trade and Employee Benefits

	\$000's
- Trade Payables and Accrued Expenses	1,933
- Provision for Annual Leave	2,405
- GST Payable	0
Total	<u>4,338</u>

FINANCIAL ACCOUNTS – PART 2 – DETAIL

Detailed below is a presentation of the income statement of NICTA for the six months to the end of June 2007. A comparison against the full-year forecast is provided.

Income Statement	<u>Notes</u>	January – June Actual 2007	January – December Budget 2007
Revenue			
Grants / funding		41,924	62,000
Other revenue		1,747	2,561
Interest		360	638
In-kind contributions		0	21,231
Total Revenue		44,031	86,430
Less: Expenses			
Direct Employment Costs			
Salaries & On-Costs		15,666	33,522
In-kind contribution expenses		0	21,231
Contractors/Temp		464	1,134
Appointment & Recruitment Costs		156	245
NICTA Fellows		0	1,068
Scholarships		2,943	4,183
University Contributed Staff Support		441	2,075
Visiting Staff Costs		270	584
Total Direct Employment Costs		19,940	64,042
Other Overheads			
Depreciation		2,386	4,712
Consulting		650	5,201
Other	1	38	205
Entertainment		74	215
Facilities		146	1,322
General Operational Costs		944	6,431
IT Costs		853	1,335
Library Costs		0	175
Rent		2,223	5,271
Travel		1,114	3,068
Total Other Overheads		8,428	27,935
Centralised Admin Costs			
Advertising		3	0
Audit		37	180
Bank Charges		10	12
Communications		352	513
Insurance		91	450
Legal & Regulatory		132	624
Total Centralised Admin Costs		625	1,779
Net Position (Loss)		15,038	(7,326)

Balance Sheet

	<u>Notes</u>	<u>Actual</u> <u>30-Jun-07</u>	<u>Budget</u> <u>31-Dec-07</u>
Current Assets			
Bank		25,892	11,604
Receivables		1,039	24
Other Debtors		0	420
Prepayments		132	120
Other Current Assets		937	650
Total Current Assets		<u>28,000</u>	<u>12,818</u>
Non Current Assets			
Fixed Assets		20,058	33,094
Less: Provision for Depreciation		(10,572)	(12,367)
		<u>9,486</u>	<u>20,727</u>
Intangible Assets- Software&Patents		0	843
Prepayments	2	17,200	17,200
Total Non-Current Assets		<u>26,686</u>	<u>38,770</u>
Total Assets		<u>54,686</u>	<u>51,588</u>
Current Liabilities			
Payables		13	2,974
Other Creditors & Accruals		1,920	3,250
Deferred revenue	3	0	296
Provisions		2,405	5,065
Total Current Liabilities		<u>4,338</u>	<u>11,585</u>
Non Current Liabilities			
Leaseback Liability		0	11,250
Lease Liabilities		1,390	2,123
Total Non-Current Liabilities		<u>1,390</u>	<u>13,373</u>
Total Liabilities		<u>5,728</u>	<u>24,958</u>
Net Assets		<u><u>48,958</u></u>	<u><u>26,630</u></u>
Shareholder's Funds			
Retained Earnings		33,920	33,956
Current Year Earnings		(15,038)	(7,326)
Total Shareholder's Funds		<u><u>48,958</u></u>	<u><u>26,630</u></u>

Note 1. Other

This represents expenses that can not be classified under alternative expense categories, (e.g. minor capital equipment, research consumables, and sponsorship expenses).

Note 2. Prepayments

Consists of prepayments made for the NICTA Building in Canberra, which is still under construction, (\$10.7 million was funded from the ACT Government and \$6.5 million from Federal funds).

Note 3. Deferred Revenue

Consists of revenue received from members but not recognised as revenue until it is able to be allocated against expenditure incurred.

Un-audited Statement of Expenditure for DCITA and ARC Funds

National ICT Australia Limited

**Statement of Funds Expended - Dept of Communications, Information Technology & the Arts
For the year to date till 30 June 2007**

Revenue

Balance brought forward from 31 st December 2006	10,138,435	
Revenue – DCITA	0	
Interest – DCITA	173,314	
Total Revenue		10,311,749

Expenditure

Employment Costs

Salaries and Wages	4,558,604
Annual Leave Expense	379,106
Superannuation - Employer Contributions	443,975
Employee On Costs	296,327
Contractors	199,360
Recruitment Expenses	56,076
Other Employment Costs	18,216
Scholarships	1,492,449
University Contributed Staff	26,040
Visiting Research Costs	136,332
	<u>7,606,485</u>

Other Overheads

Consulting	143,628
Entertainment	33,212
Facilities	35,540
General Operational Costs	349,658
IT Costs	328,764
Rent	917,697
Library Costs	0
Travel	377,589
Industry Development	9,838
	<u>2,195,926</u>

Centralised Admin Costs

Advertising	1,642
Audit	1,585
Bank Charges	3,557
Communications	141,714
Insurance	39,283
Legal & Regulatory	33,279
	<u>221,060</u>

Capital Expenditure

Computer Equipment	169,383
Office Equipment	10,395
Furniture & Fittings	2,633
Leasehold Improvements	10,683
Software	63,230
Research Equipment	(19,201)
Capital WIP	51,155
Website Development	0
	<u>288,278</u>

Total Expenditure		10,311,749
Net Surplus/(Deficit)		0
National ICT Australia Limited		
Statement of Funds Expended - Australian Research Council		
For the year to date till 30 June 2007		
Revenue		
Balance brought forward from 31 st December 2006	0	
Revenue – ARC	23,970,000	
Interest – ARC	151,959	
Total Revenue		24,121,959
Expenditure		
<u>Employment Costs</u>		
Research Remuneration Expenditure	7,862,256	
Annual Leave Expense	657,624	
Superannuation - Employer Contributions	751,488	
Employee On Costs- Payroll Tax & Workers Compensation	476,298	
Contractors	289,649	
Recruitment Expenses	97,216	
Other Employment Costs	32,826	
Scholarships	1,837,426	
University Contributed Staff	275,413	
Visiting Research Costs	168,672	
	12,448,868	
<u>Other Overheads</u>		
Consulting	405,857	
Entertainment	46,320	
Facilities	91,039	
General Operational Costs	589,125	
IT Costs	532,854	
Rent	1,387,845	
Library Costs	0	
Travel	695,538	
Industry Development	23,904	
	3,772,482	
<u>Centralised Admin Costs</u>		
Advertising	1,622	
Audit	22,988	
Bank Charges	6,308	
Communications	219,551	
Insurance	57,000	
Legal & Regulatory	82,769	
	390,238	
<u>Capital Expenditure</u>		
Computer Equipment	156,365	
Office Equipment	20,351	
Furniture & Fittings	1,992	
Leasehold Improvements	8,082	
Software	53,359	
Research Equipment	146,767	
Capital WIP	138,628	
Website Development	0	
	525,544	
Total Expenditure		17,137,132
Net Surplus/(Deficit)		6,984,827

10. NICTA Research Project Portfolio

NICTA's research project portfolio will reduce during 2007 as projects are completed. Fourteen projects are scheduled for completion in 2007 as listed below. The number of active projects at the start of 2007 was 47.

Project Title	Completed
Image-Quality-Sensitive Watermarking of Medical Images (eHRC)	April 2007
Broadband to the User (B2U)	June 2007
Road Safety: Driver Drowsiness Detection (RSDDD)	June 2007
Multi-User Detection Algorithm (MUD)	June 2007

Project Title	Due for Completion
Component Architecture for Microkernel-based Embedded Systems (CAMKES)	Q3
Visualisation and Analysis of Large and Complex Networks (VALACON)	Q3
Smart Cars	Q3
Integrated ICT Solutions for Rural and Remote Access /Office in a Box	Q4
Probabilistic Temporal Analysis of Operating Systems Code (Potoroo)	Q4
Video Analysis and Content Management for Surveillance (VACMS)	Q4
Managing and Monitoring the Internet (MAMI)	Q4
XQoS Systems (XQoS)	Q4

New Projects

NICTA evaluates new project proposals against the criteria in the Project Value Rating (PVR) method three times per year. Submissions in Round 1 were in March with outcomes in June, Round 2 had submissions in June with outcomes in August and Round 3 submissions are due in September with outcomes in November.

This is a competitive process and in Round 1, two out of seven project applications were approved. These projects were:

- Body Area Network of Embedded Systems for Humans (BANESH)
- A renewal of the Multi-User Detection (MUD) project – now called Interferex2.

Both of these projects started in Q3.

In the 2nd round, six project proposals were received of which two are likely to be funded. In round 3 up to ten new applications are expected.

The following matrix maps projects active at the start of 2007 to the business application areas.

Project	Business Area Application					
	Bio-Medical and Life Sciences (BioMed)	Intelligent Transport Systems (ITS)	Safety and Security (SS)	Environmental Management (EM)	Mobile Systems and Services (MSS)	Software Infrastructure (SI)
Advanced Nonlinear Gradient Methods (ANGIE)	✓	✓	✓	✓	✓	✓
Ambient Networks Phase 2					✓	
Automated Anatomical Structure Extraction for Diagnosis & Population Norms (AASEDP)	✓					
Braccetto						✓
Broadband to the User (B2U)					✓	
Cancer Genomics (CG)	✓					
Characterisation, Diagnosis and Assurance of Health and Quality of Sensor Formations (SWARM)			✓			
Component Architecture for Microkernel-based Embedded Systems (CAMKES)						✓
Computer Colonic Polyps Detection based on CT Colonography (CTC)	✓					
Constraint Programming Platform (G12)						✓
Context Aware Mobility Project (CAMP)					✓	
Data Mining in Spatio-temporal Data Sets (DiMIST)		✓	✓			
Document Analysis and Understanding (DAU)			✓			
Dynamic Planning, Optimisation and Learning (DPOLP)			✓			✓
Formal Methods for Performance Evaluation for Wireless Network Analysis (FM for PEWNA)					✓	
Fundamental Limits of Wireless (FLOW)					✓	
Goanna						✓

	Bio-Medical and Life Sciences (BioMed)	Intelligent Transport Systems (ITS)	Safety and Security (SS)	Environmental Management (EM)	Mobile Systems and Services (MSS)	Software Infrastructure (SI)
Image-Quality-Sensitive Watermarking of Medical Images (eHRC)	✓					
Integrated ICT Solutions for Rural and Remote Access (OiB)					✓	
Interactive Information Discovery and Delivery (I2D2)						✓
L4.verified					✓	✓
Last Metre Problem (LaMP)					✓	
Learning and Representation (LEAR)			✓			
LIXI Business Processes (LIXI)						✓
Macro-programming for Wireless Sensor Networks (Macro)				✓	✓	
Mapping Genetic Components in Crops (MGCC)	✓					
Millimetre Wave Gigabyte Wireless (GiFi)					✓	
Managing and Monitoring the Internet (MAMI)					✓	
Multi-User Detection Algorithm (MUD)					✓	
NICTA Open SensorWeb Architecture (NOSA)				✓	✓	
Peer to Peer (P2P)					✓	
Probabilistic Temporal Analysis of Operating Systems Code (POTEROO)					✓	✓
Query under Uncertainty for a Secure and Sustainable Environment (QUSE)			✓	✓		
Requirements Engineering for Strategic Alignment (RESA)						✓
Road Safety: Drivers Drowsiness Detection (RSDDD)		✓				
Secure Embedded L4 (SeL4)					✓	✓
SAFE - Smart Applications for Emergencies			✓			
Smart Cars		✓				
STaR		✓				

	Bio-Medical and Life Sciences (BioMed)	Intelligent Transport Systems (ITS)	Safety and Security (SS)	Environmental Management (EM)	Mobile Systems and Services (MSS)	Software Infrastructure (SI)
Spectral Imaging and Source Mapping (SISM)			✓	✓		
Model-based Supervision of Composite Systems (SuperCom)		✓	✓			
Universal Storage Scheme (USS)					✓	✓
Validating Networks Semantics (VNS)					✓	
Video Analysis and Content Management for Surveillance (VACMS)			✓			
Visualisation and Analysis of Large and Complex Networks (VALACON)	✓	✓	✓	✓	✓	✓
Water Information Networks (WIN)				✓		
XQoS Systems					✓	

Advanced Nonlinear Gradient Descent (ANGIE)

Topic: Current machine learning techniques combined with optimisation algorithms have been very successful in managing data to date, however, their usefulness in managing very large sets of ongoing streams of data is limited.

Aim: To develop the methods and tools for the application of advanced gradient methods in the efficient online optimisation of very large non-linear systems, enabling commercial follow on products.

Duration: 2.58 years (2.3 FTE over 2.58 years).

Project Leader: Nicol Schraudolph.

Participants:

- Making Sense of Data group
- ETH Zurich
- IDIAP (Switzerland)
- Hamilton Institute, Ireland

Key points:

- Develop advanced stochastic gradient methods for online optimisation driven by large amounts of data
- Characterise mathematical properties of the developed methods, such as stability and convergence
- Initial applications of the developed methods in machine learning and computer vision.

Progress:

- Developed world's first stochastic quasi-Newton optimisation methods.
- Developed stochastic gradient methods for parameter estimation in conditional random fields.
- Invented an electronic camera modification that improves motion tracking performance.
- Developed a new exact parameter estimation method for non-planar graphical models.

Milestones:

Date	Milestone
30/06/2006	SMD stability and convergence analysis - local deterministic
30/06/2006	Online BFGS - proof of concept
30/06/2006	Visual tracking - experimental set-up working
31/12/2006	SMD stability and convergence - global deterministic
31/12/2006	Online BFGS - basic algorithm working
01/05/2007	Visual tracking - tracking with SMD and NEO
31/12/2007	SMD stability and convergence analysis - stochastic
31/12/2007	Online BFGS - trust-region enhancements
31/12/2007	Visual tracking - advanced features (occlusions, multi-cameram etc)
12/07/2006	Review point
01/01/2007	Review point

Automated Anatomical Structure Extraction for Diagnosis and Population Norms (AASEDP)

Topic: Current brain imaging techniques cannot detect the early signs of debilitating conditions such as Alzheimer's disease and dementia.

Aim: To produce mathematical models that are sensitive to the shape and other characteristics of brain tissue, which will be applied to a new set of diagnostic techniques for early detection of diseases.

Duration: 2.92 years (1.75 FTE over 2.92 years).

Project Leader: Paulette Lieby.

Participants:

- Making Sense of Data group
- Centre for Mental Health Research, Neuro-psychiatric Institute at the Prince of Wales Hospital.

Key points:

- Mathematical representation of hand-traced neuro-anatomical structures to permit their subsequent analysis
- Application of mathematical modelling to these structures to study their variability over population and time
- Determine discriminative attributes dividing the data into normal/pathology.

Progress:

- Representation of hippocampus as a genus 0 surface
- Consistent orientation of all MRI scans and corresponding tracings across the complete data set (approx 2 * 1000 scans)
- Statistical analysis and classification of hippocampal surfaces for sex
- Development and maintenance of a common development platform and data repository

Milestones:

Date	Milestone
31/07/2006	Computation of genus 0 surface
31/07/2006	Investigation of optimisation strategies
30/10/2006	Begin investigation of techniques for shape modelling
31/07/2007	Develop one or more methods that are able to characterise the surface shape of the hippocampus and discriminate for sex
30/06/2008	Refine the methods in M04 to attempt to discriminate for pathology
30/06/2008	CMHR collaborative investigation
31/07/2007	Investigate alternative supplementary funding models eg NHMRC.
30/06/2008	Establish effective methods of registration of hippocampi
30/06/2008	Investigate alternative shape representation (MDL)
30/06/2008	Develop alternative methods from M04 and M05 for shape discrimination (based on curvature)

Ambient Networks Phase 2

Topic: Ambient Networks is a global effort to create infrastructure to drive standardisation and remove the technical barriers that separate different wireless technologies.

Aim: To create network solutions for mobile and wireless systems beyond third-generation mobile communications (3G).

Duration: 5.25 years (1.6 FTE over 5.25 years).

Project Leader: Rokšana Boreli.

Participants:

- Network Systems group, Ericsson, NTT DoCoMo, Siemens, other consortia members.

Key points:

- Project will facilitate the incremental introduction of new services to the market and will stimulate sustainable growth in the world mobile communications sector
- International collaboration with global significance
- NICTA contribution covers two significant work packages: WP B Mobility and WP F Smart Multimedia Routing
- Research topics provided for one PhD student and a number of MSc project students.

Progress:

- EU Phase 2 project commenced in January 2006
- NICTA extension project submitted to RMCC September 2006 – Ambient phase 2 in progress.

Milestones:

Date	Milestone
31/05/2007	First draft integrated mobility functions
30/09/2007	First draft integrated mobility functions
31/12/2007	Mobility support: system specification, implementation and evaluation
30/09/2006	Draft design of SATO and ASI components
30/09/2006	Cross layer Transport Optimisations
30/09/2006	First integration of SATO and ASI components
31/05/2007	Theme Report
31/12/2007	System design of SATO and ASI
31/01/2008	Final system design of SATO and ASI
31/01/2008	Implementation and evaluation of SATO and ASI
30/09/2008	Optimisation of performance and final validation of architecture
30/09/2008	Standardisation of mobility and related protocols
31/12/2008	Beta trials and preparation for deployment
31/12/2009	Integration across WW

Hxl Braccetto

Topic: Organisations are looking to improve the way employees interact and create environments that encourage effective collaboration and knowledge sharing, even across large distances.

Braccetto intends to develop technologies that will support humans in their interactions with each other, their environments, information and technology. Insights and intellectual property developed by the project will be evaluated for use in areas such as national security, emergency management and distributed scientific research, to benefit the Australian economy through commercialisation.

Aim: The scientific aim of the research within the Hxl Braccetto project is to undertake research into distributed environments that support intense collaboration (for distributed creative teamwork).

Duration: 2.92 years (5.3FTE over 2.92 years)

Project Manager: Belinda Kellar

NICTA Project Leader: Markus Rittenbruch

Participants:

- Making Sense of Data group
- Embedded Systems group
- Network Systems group
- DSTO
- CSIRO

Key points:

- *First version of TeamNets established and tested.* TeamNets is used to support simultaneous work on software applications between sites in conjunction with tightly linked high-quality, multi-party telepresence technology. TeamNets has been evaluated in a domain experimentation in the field of national security.
- *First version of model of awareness for creative teamwork proposed (by June 07).* Driven by theories of human interactivity, the project is developing new models of computer human interaction for distributed creative teams of experts. The models will be evaluated through a series of experiments and through studies in real world settings. New concepts will be implemented from these models to improve criteria such as productivity, performance and team effectiveness between remote co-workers.
- *First version of sensing and evaluation framework developed.* The TeamScope system supports researchers in the collection and analysis of data during the evaluation of collaborative activities

Progress:

- MPG capabilities: Initial technical development in Mixed Presence Groupware
- Modelling: Initial verification of theories and models of awareness for creative teamwork
- New concepts for new awareness tools
- Initial sensing and evaluation framework

Milestones:

Date	Milestone
30/06/2007	Phase I MPG Capabilities
30/06/2007	Phase I Experimentation
30/06/2007	Phase I Modeling
30/06/2007	Phase I Community & Industry Linkages
30/06/2008	2008 Phase II MPG Capabilities
30/05/2008	2008 Phase II Experimentation
30/06/2008	2008 Phase II Modeling
30/06/2008	2008 Phase II Enhancement
30/06/2008	2008 Phase II Community & Industry Linkages
30/06/2009	2009 Phase II MPG Capabilities
30/06/2009	2009 Phase II Experimentation
30/06/2009	2009 Phase II Modeling
30/06/2009	2009 Phase II Community & Industry Linkages

Broadband to the User (B2U)

Topic: The potential for applications such as video streaming to be exploited by home and office users is currently hampered by local infrastructure that is unable to support the bandwidth required. The B2U Project is working towards solving this problem through the design and integration of gigabit wireless and passive optical networks to provide gigabit data rates to the network user.

Aim: To develop innovative next-generation, high-data-rate passive-optical and millimetre-wave wireless network technology for gigabit-per-second data rates to fixed and mobile users.

Duration: Three-and-a-half years (2.3 FTE over 3 years).

Project Leader: Tom Chae.

Participants:

- Agilent Technologies
- France Telecom.

Key points:

- Development of an integrated high-speed PON/wireless testbed capable of Gigabit speeds
- Development of a low-cost EPON solution based on an upstream repeater
- Development of improved dynamic bandwidth allocation schemes for the provision of QoS in the PON
- Development of subsystems for next generation WDM PON.

Progress:

- Project completed
- Commercialisation of B2U – PON in the pipeline.

Milestones:

Date	Milestone
30/06/2005	Demonstration of delivery of video, voice and data over EPON testbed.
31/12/2005	Demonstration of novel dynamic bandwidth allocation (DBA) schemes
30/06/2006	Lab demonstration of low cost regenerator based EPON.
30/06/2007	Demonstration of Integrated WLAN/PON
31/12/2006	Demonstration of alternative wireless extensions from fixed fibre network
31/05/2007	Demonstration of multifunctional regenerator for low cost EPON
30/06/2007	Demonstration of Integrated PON with 60GHz wireless network
30/06/2007	Demonstration of novel next generation subsystem
31/12/2006	Demonstration of novel WDM PON

Cancer Genomics (CG)

Topic: Micro-array technology offers significant opportunities for progress in the diagnosis, early detection, prediction of response to treatments and resistance to drugs, and general understanding of the biology of cancer.

Aim: To develop software tools enabling conversion of genetic profiles of tissue into clinically useful knowledge to assist oncologists and pathologists.

Duration: Three years (2.5 FTE over 3 years).

Project Leader: Dr Adam Kowalczyk.

Participants:

Peter MacCallum Cancer Centre.

Key points:

- Add to the understanding of the origin and treatment of cancer
- Algorithms and software tools will support prediction of individual responses to therapy and improve selection of treatments
- It will develop expertise in genomic medicine aimed at ultimately bringing into clinical practice techniques for personalised treatment for patients based on individual genetic profiles.

Progress:

2007 Activities:

- Discovery and development of IT methodology for discerning of biologically meaningful and medically useful knowledge from microarray profiles of tissue, with a focus on cancer diagnosis and treatment:
 - Learning from a very small number of samples (VSS-learning)
 - Kernel machines and regularisation techniques
 - Learning from structured data
 - Feature Selection.
- Development of practical algorithms and development of software tools for operational testing, demonstration and operational implementation of the discovered solutions.
- Application of the results to cancer research and clinical oncology. Here we have identified a few separate sub-projects which will generate separate streams of data (this list will inevitably proliferate):
 - Carcinoma of Unknown Primary
 - Response to Chemoradiotherapy for Oesophageal Cancer
 - Cancer Cell Micro-environment
 - Gastric Cancer
 - Ovarian Cancer
 - Sarcoma
 - Breast Cancer.

Milestones:

Date	Milestone*
06/06	Prototype IT platform Genomic Test Bench (GTB)
06/06	Initial benchmark of utility of sub-gene features
06/06	Plan for development of dedicated algorithms
06/07	Test of functionality of GTB concept
06/07	Beta testing of GTB

*Milestones address only the development of the IT platform

Characterisation, Diagnosis and Assurance of Health and Quality of Sensor Formations (SWARM)

Topic: One of the current priority areas for military and defence is the use of autonomous vehicles or agents, often in formation, and more often than not moving, to execute various missions. The requirements of autonomy and formation (i.e. agents must in some way interact with one another) have generated a need to study information and control architectures that can underpin the ability to achieve the desired tasks. Some similar needs arise in considering sensor networks, which will be stationary in many cases, though often detecting moving agents.

Aim: To develop techniques for securing some level of robustness. The emphasis of the project is the development of graph theoretic and other formal tools to characterise, diagnose and assure the health and quality of a formation or a sensor network.

Duration: 2.92 years (1.95 FTE over 2.92 years).

Project Leader: Brian Anderson.

Participants:

- Managing Complexity
- DSTO

Key points:

- Positive comments from last two managers on the DSTO side.
- International plenary speaker invitations for 06 and 07 in area related to project
- Aggregate of publications from this and any associated program research
- Significant number of joint papers between Canberra and Sydney. Joint project with DSTO.

Progress:

- The milestones scheduled for dates up till now have all been achieved.
- More than 50 relevant publications by project members published/accepted/submitted
- Positive evaluations of NICTA work by DSTO end-user have been obtained.

Milestones:

Date	Milestone
31/10/2006	Characterisation of Health of General Formations/Sensor Networks/SWARMS - 2 publications submitted
31/10/2007	Characterisation of Health of General Formations/Sensor Networks/SWARMS - 2 publications submitted based on completion of most work.
30/09/2008	Characterisation of Health of General Formations/Sensor Networks/SWARMS - 2 publications submitted based on completion of most of the work
31/10/2006	Specific tasks related to the DSTO/NICTA emitter localisation scenario - 2 publications submitted
31/10/2007	Specific tasks related to the DSTO/NICTA emitter localisation scenario - 2 publications submitted
31/10/2007	Collection of real world specification and demonstration vis simulation of applicability of tools developed to meet the specification
30/09/2008	Specific tasks related to the DSTO/NICTA emitter localisation scenario - 2 publications submitted
30/09/2008	Use of real world data to actually test and improve real system performance
31/10/2006	Quality of Formations and their control - 2 publications submitted
31/10/2007	Quality of Formations and their control - 2 publications submitted
30/09/2008	Quality of Formations and their control - 2 publications submitted

Component Architecture for Microkernel-based Embedded Systems (CAMKES)

Topic: Embedded systems are evolving to networked 'open' systems of significant functionality. This exposes them to many of the classical security risks that face server and desktop computers.

Aim: To develop component architecture that, in the long-term, will lead to the creation of a new component technology that will increase reliability and decrease the cost of embedded applications.

Duration: 1.5 years (4.0 FTE over 1.5 years).

Project Leader: Ihor Kuz.

Participants:

- Embedded Systems group.

Key points:

- Improved methodology for developing embedded systems
- An important step towards the ERTOS Program's objective of fully verified embedded systems
- Significant commercialisation opportunity in the large and growing embedded systems market.

Progress:

- Project completed July 2007.
- New work package CAMKES – Next Generation submitted to the RMCC Sept 2007.

Milestones:

Date	Milestone
01/04/2005	Requirements specification
01/12/2005	Prototype of CAMKES framework + demonstrator application
31/08/2006	Final project review and end of project report
31/08/2006	Release v.1.0 of component architecture software
31/07/2007	Final project review and end of project report
31/07/2007	Implementation of dynamic component model
31/07/2007	Integration into ERTOS' OS

Computer Colonic Polyps Detection based on Computed tomographic Colonography (CTC)

Topic: Colon cancer is a significant cause of death globally. Currently, the only definitive examination of the colon is a fibre optic colonoscopy. This is an invasive, expensive and risky procedure. Computed tomographic colonography is potentially less costly and invasive, but still impractical due to the time required to review hundreds of images/patient studies.

Aim: To develop computer aided detection/localisation algorithms to examine the large amount of CTC data in order to appreciably decrease the false positive rate affecting existing algorithms.

Duration: 3.25 years (0.3 FTE over 3.25 years).

Project Leader: Dr Abd-Krim Seghouane.

Participants:

- Making Sense of Data group
- Canberra Imaging Group

Key points:

- Techniques will build three-dimensional models based on 2D and 3D scans to identify anomalous growths
- Improved algorithm will support optimal screening strategies for colorectal cancer to increase the rate of polyp detection
- Procedure will reduce the radiologist examination time with an expected impact on the cost of the diagnosis
- Will reduce the need for invasive procedures.

Progress:

- Improved the centreline computation in term of accuracy and computation time.
- Developed a method for polyps segmentation and visualization
- Developed a primary method for polyps classification

Milestones:

Date	Milestone
30/10/2006	Image segmentation and colon reconstruction
31/12/2007	Polyps characterisation and candidates detection
31/12/2008	Candidates classification and test on real data

Constraint Programming Platform (CPP)

Topic: The information processing revolution has enabled organisations large and small to capture and access accurate and up-to-date information about all their activities and resources.

Aim: To develop a pioneering software platform for solving large-scale industrial combinatorial optimisation problems and to enable this information to be used in optimised decision making and resource allocation.

Duration: 5 years (12.6 FTE over 5 years).

Project Leaders: Peter Stuckey (Vic), John Slaney (ACT), Toby Walsh (Kens).

Participants:

- Making Sense of Data group
- Monash University

Key points:

- Alpha release of G12 software technology platform incl. Zinc modelling language, compiler & mercury backend.
- Completion of initial Cadmium system prototype
- Development of finite domain solver in Mercury

Progress:

- A high percentage of the proposed milestones have been completed on time.
- Industrial application 1 will be completed this year and has been delayed largely from commercial changes in the business partner involved.

Milestones:

Date	Milestone
19/03/2007	Industrial application 1
01/01/2007	Debugging support
01/07/2007	Solver visualisation
01/10/2007	Default mapping
01/10/2007	MIP search
01/10/2007	Constraint behaviour language
01/04/2007	Alpha Release
01/01/2008	Industrial application 2
01/04/2008	Soft constraints
01/04/2008	Master-subproblem decomposition
01/04/2008	Special modelling 1
01/07/2008	Algorithm visualisation
01/10/2008	Logical transformation
01/10/2008	Advanced propagation
01/04/2008	Beta Release
01/10/2008	Local search
01/04/2009	Industrial application 3
01/04/2009	Robust solutions
01/10/2009	Online optimisation
01/10/2009	Population search
01/10/2009	User environment
01/10/2009	Algorithm comparison

01/04/2010	Real time problems
01/04/2010	Productisation
01/04/2010	G12 Release
01/04/2010	Platform interchange
01/04/2010	Industrial application 4

Context Aware Mobility Project (CAMP)

Topic: Mobile users have access to a range of devices, such as mobile phones, PDAs, and laptops during the course of their day. This, combined with a multiplicity of access technologies such as Wi Fi, UMTS, Bluetooth, and GPRS creates a broad range of potential channels across which data may be carried to and from mobile users.

A context aware system for managing applications and mobility will select and maintain the best technologies to deliver a service given the current context. Use of semantic web technologies for context management and decision making allows us to create a standards based solution which has a higher potential to be deployed.

Aim: NICTA, in collaboration with Ericsson, is developing solutions to fully harness the multitude of connectivity options available to users of future mobile networking technologies.

Duration: 3 years (2.9FTE over 3 years)

Project Leader: Max Ott

Participants:

- Network Systems group
- Ericsson

Key points:

- Engaged major international partner
- Ericsson's recent technology roadmap has fully embraced NICTA's proposed approach.

Progress:

- Demonstrated feasibility of approach in restricted environment.
- Ericsson Research indicated that parts of our solution will become part of the solution for the Research Divisions 'Grand Challenge'

Milestones:

Date	Milestone
31/12/2006	Initial test bed design and implementation including support for mobility management protocols Mobile IPv6, NEMO and HIP
31/03/2007	Evaluation of the appropriateness of technology combinations, strengths and weaknesses of mobility management protocols using Scenario 1 to demonstrate the system.
30/09/2007	Initial design specification of a context management framework
31/12/2007	Initial implementation of the context management system and integration of the context management and mobility management systems.
28/02/2008	Evaluation of the initial integrated system architecture using Scenario 2 to demonstrate the system.
30/06/2008	Improved design of the integrated system architecture based on M05
31/12/2008	Final implementation of the integrated context aware mobility system architecture based on M06
31/12/2008	Evaluation of the final system using Scenario 3 to demonstrate the system.
31/03/2009	User candidate applications/effectiveness of overall system
31/05/2009	Evaluation of the overall project outcome, project closure

Data Mining in Spatio-Temporal Data Sets (DMiST)

Topic: Data mining in spatio-temporal data sets.

Aim: To develop efficient tools to answer pattern questions in very large data sets related to the movement of objects.

Duration: 3.0 years (2.4 FTE over 3 years).

Project Leader: Joachim Gudmundsson.

Participants:

- DSTO.
- Making Sense of Data group.

Progress:

- Delivered algorithms, and software, that can detect patterns in large sets of trajectory data. To date, it has not been possible to detect these patterns in large data sets. Typical examples are flocks, meetings and leadership.
- Together with DSTO we have developed a software package to easily combine the different tools, which is a necessity to perform complex analysis on large data.
- A prototype was deployed in December 2006 within clients computing environment.

Milestones:

Date	Milestone
30/05/2006	Collaboration plan with DSTO
26/06/2006	Project staff recruitment
20/07/2006	Project progress report
30/11/2006	First algorithm tool designed
30/11/2006	First scientific paper produced
31/12/2006	Project review + progress report
30/06/2007	Project progress report
30/11/2007	Main algorithm tools implemented
30/11/2007	Second algorithm tool implemented
31/12/2007	Project review + progress report
31/05/2008	Complex patterns clearly defined
31/05/2008	Efficient algorithms for 6 basic patterns implemented
30/06/2008	Project progress report
30/10/2008	Possibilities to generalise
30/11/2008	Algorithms developed for the complex patterns
30/11/2008	New spin off projects
30/11/2008	Toolbox delivered and evaluated
31/12/2008	Final project review + end of project report

Document Analysis and Understanding (DAU)

Topic: The information revolution has led to the explosive growth of unstructured documents available for analysis. This data glut leads to the need to understand this data and transform it into knowledge.

Aim: The project aims to use state-of-the-art non-parametric statistics and natural language processing for large-scale document analysis.

Duration: 2.92 years (0.9 FTE over 2.92 years).

Project Leader: SVN Vishwanathan.

Participants:

Making Sense of Data group
The Distillery.

Key points:

- The design and development of state-of-the-art document understanding and analysis algorithms with statistical tools for:
 - Authorship attribution
 - Named entity tagging
 - Document comparisons
 - Document retrieval
 - Determining the veracity of documents
- Strong collaboration with a research-oriented SME
- Addresses aspects of Safeguarding Australia
- Will support up to one PhD students and one postdoctoral researcher.

Progress:

- Conditional random fields a state of the art machine learning algorithm for names entity recognition is currently deployed in the Distillery product.
- One NICTA postdoctoral fellow and one Distillery software engineer are currently working on this.

Milestones:

Date	Milestone
31/12/2005	Test datasets and quantified performance goals
30/06/2006	Publication submitted to a leading conference/journal
31/05/2007	Publication submitted to a leading conference/journal
31/05/2007	Publication submitted to a leading conference / journal
31/08/2007	Plugging a CRF model into GATE
30/09/2007	testing of the CRF module in GATE
31/10/2007	Plugging a CRF training component into GATE
30/11/2007	Testing the CRF training component
31/12/2007	Incorporating hand annotations into CRF training
31/12/2007	Packaging and signing off
31/03/2008	Exploration of further research opportunities

Dynamic Planning Optimisation and Learning (DPOLP)

Topic: Automated operations (military) and business planning algorithms and tools.

Aim: To integrate methods from Artificial Intelligence planning, optimisation, and machine learning in order to advance the state of the art in automated planning for the military and industry. Particularly under the “fog of war” or other uncertainties.

Duration: 4.92 years (2.45 FTE over 4.92 years).

Project Leader: Jussi Rintanen.

Participants:

- Managing Complexity group
- University of Adelaide
- Defence Science and Technology Organisation (DSTO)
- University of South Australia
- University of Aarhus (Denmark).

Key points:

- 46 international publications and counting.
- World’s first look at quantum planning.
- Interactions across 5 institutions.
- KRR now one of the world’s top planning groups.
- Important factor in attracting ICAPS’07.
- Prov. patent covering interface aspects.

Progress:

- Produced 3/6 of the world’s concurrent probabilistic planners.
- Integrated and delivered 2 of these planners into DSTO prototype system for automated military operations planning. Also provided 2 additional non-probabilistic planner to DSTO.
- 1st and 3rd place at 2006 International Planning Competition (probabilistic track).

Milestones: Defined by annual workshop of participants.

Date	Milestone
31/05/2007	Workshop
30/11/2007	Workshop
31/12/2007	Annual report
30/05/2008	Workshop
31/08/2008	Final project report

Formal Methods for Performance Evaluation for Wireless Network Applications (PEWNA)

Topic: The technological constraints imposed by hardware in wireless networks and their intended applications give rise to significant challenges and unpredictable network behaviours that the design of network and application protocols must accommodate.

Aim: To apply formal methods techniques to a new application area of wireless networks to advance both wireless network protocol engineering and formal methods.

Duration: 4.0 years (1.5 FTE over 4 years).

Project Leader: Ansgar Fehnker.

Participants:

- Embedded Systems group
- Network Systems group
- Annabelle McIver NICTA Fellow (Macquarie University).

Key points:

- Will improve network protocol designer understanding of the ramifications of design by providing a formal modelling framework
- Automated tools to support protocol design that give access to formal modelling and verification, thus exploring a wider range of network behaviour than current state-of-the-art technology
- Underpins the development of trusted wireless networks.

Progress:

- Collaboration with Matthias Fruth from the University in Birmingham led to a joint concept paper outlining the front-end CaVi. Accepted for presentation at MeMot, a workshop on fault tolerance.
- Presentation and demonstration of CaVi at Nicta techfest.
- Lodewijk van Hoesel defended in June also his PhD thesis at the University of Twente on MAC protocols for wireless sensor networks. It contains joint-work with Angelika Mader and Ansgar Fehnker.
- Joint paper with Angelika Mader and Lodewijk van Hoesel was accepted at IFM.

Milestones:

Date	Milestone
01/09/2005	Non-probabilistic worst-case analysis
31/12/2005	Probabilistic analysis for various QoS measures
31/12/2006	Develop and implement a modeling notation and editor
31/12/2006	Implement a translator from the modelling language to the input language of existing model checkers, and evaluate it on two case studies
30/06/2007	Integrate proof-based methods (such as validated abstractions) with model checking and demonstrate its effectiveness on QoS properties.
30/06/2007	Extend the counterexample-guided abstraction approach to "probability 1" reachability and demonstrate it experimentally.
31/12/2007	Further evaluation and development of M4, M5 and M6 with further case studies.
31/12/2006	Develop web presence for the FM PEWNA project

Fundamental Limits of Wireless (FLOW)

Topic: Wireless technology is vulnerable to interference from buildings, geographic features and other radio signals.

Aim: To increase our understanding of the constraints imposed on wireless communications.

Duration: 2.92 years (1.2 FTE over 2.92 years).

Project Leader: Leif Hanlen.

Participants:

- Network Systems group.
- University of South Australia.

Key points:

- Investigation of the constraints on wireless communications
- Medium to long-term view of wireless futures
- Links to wireless research in USA and Sweden.

Progress:

- Reviewed by RMCC and recommended for commencement
- Coursework elements completed
- Project plan under final negotiation with partners
- Agreement in place with the University of South Australia
- Agreement in place between NICTA and the Australian Institute of Sport (AIS).

2006:

- Twenty-one publications, including seven journal articles
- Two patent disclosures
- Interaction with the AIS interaction through rowing and swimming.

Milestones:

Date	Milestone
31/01/2006	Preparation of coursework
29/11/2006	AiS in agreement to scope of project plan.
31/07/2006	List of research outcomes and papers produced
31/07/2006	Address writing questions posed in the scientific challenges section of the project application
31/01/2007	Formal industry agreement in place with either Locata or another entity
31/01/2007	18th month review point
30/06/2008	Journal submissions of work
31/12/2007	Completion of MIMO testbed (UniSA)
30/06/2008	Application of MIMO channel tracking theory to testbed

Goanna

Topic: Static analysis can increase trustworthiness of a larger set of software components by checking basic correctness properties. However, current approaches in static analysis are mostly unsuitable for the analysis of a production-quality operating-system kernel.

Aim: To reduce the number of software deficiencies in system software through the use of fully automated techniques in static analysis.

Duration: 1.42 years (4.1 FTE over 1.42 years).

Project Leader: Ralf Huuck.

Participants:

- Embedded Systems group
- Managing Complexity group

Key points:

- Development of a unique analysis approach from the ground up that is vastly different to what people have done for the last 30 years
- Implementation of a proof of concept that showed top performances in run-time and precision of the analysis
- Unique solution to add more checks

Progress:

- Met all the set milestones on time, partially over exceeding the predicted results

Milestones:

Date	Milestone
30/09/2007	Implementation of counter examples, framework for precision enhancement, optimisation XPath implementation
31/10/2007	Toll gate review
31/03/2008	End of project review
31/03/2008	Implementation of precision enhancement, implementation of inter-procedural analysis, implementation of inter-language C/C++ assembly analysis, completed specification language.

Image-Quality-Sensitive Watermarking of Medical Images

Topic: Development of new mathematical and algorithmic techniques for medical image watermarking and experimental validation of their suitability.

Aim: This project proposes the development and pilot implementation of a novel technique for embedding hidden watermark information in medical image data files.

Duration: Two years (0.4 FTE over 2 years).

Project Leader: Chris Scott.

Participants:

- NICTA Queensland Laboratory, E-Health Research Centre, the University of Queensland, Queensland University of Technology.

Key points:

- Development of mathematical and algorithmic techniques for medical image watermarking
- Determining the suitability of the developed techniques through experimental validation.

Progress:

- Project completed and reviewed jointly by NICTA and E-Health Research Centre April 2007.

Milestones:

Date	Milestone
01/02/2006	Review project scope and sub-projects
01/08/2006	Review investigations of watermarking methods
01/11/2006	Review revised watermarking methods
30/04/2007	Final evaluation and reporting

Integrated ICT Solutions for Rural and Remote Access (Office in a Box)

Topic: Portable satellite communications systems are becoming a more acceptable means of providing voice and data connectivity as the bandwidths available increase.

Aim: To develop integrated hardware and software for a complete and secure voice and data communications system serving rural and remote users.

Duration: 3.33 years (3.37 FTE over 3.33 years).

Project Leader: Roksana Borelli.

Participants:

- Network Systems group.

Key points:

- Significant rural and remote communications infrastructure project
- Will support a demonstrator for satellite communications to SMEs and xDSL for SOHO and SMEs.

Progress:

2007

- 7-ip spin out – Single device to speed set up of remote office data and voice infrastructure and increase quality on high-latency wireless networks (e.g. satellite, WiMax)

Milestones:

Date	Milestone
31/12/2007	Phase 3: Commercialisation of the OiB concepts
31/03/2006	Market Validation Grant
28/02/2007	Satellite communications exhibition, Satellite 2007
31/03/2007	Proof of Concept
31/08/2007	IP agreement with NICTA
30/11/2007	Review

Interactive Information Discovery and Delivery (I2D2)

Topic: Web search services which perform linguistic and geospatial analysis of queries and content can greatly enhance users' ability to access the information they need.

Aim: To develop new natural language processing technologies for extracting, analysing and presenting the information locked up in large bodies of text and speech data on the web and to demonstrate the developed intellectual property (IP) on an Australian news media demonstrator.

Duration: 2.92 years (4.3 FTE over 2.92 years).

Project Leader: Lawrence Cavedon.

Participants:

- Making Sense of Data group

Key points:

- Major milestones have been achieved.
- Following on from the mid-project review, the I2D2 project is currently being re-focused to become part of the proposed larger *ICT for Life Sciences Project* following the identification of a new partnership with Peter Mac and the hold on new projects at the ABC, potentially shifting I2D2 into NLP/IR support for biomedical researchers & data mining.

Progress:

Major technical achievements:

- Probabilistic information retrieval for geographic IR
- Integration of multiple sources for grounding named entities
- Algorithm for orthogonal re-clustering of text documents
- Genomic IR engine
- UIMA components for flexible document-processing pipeline

Milestones:

Date	Milestone
30/06/2006	Phase I Data acquisition and preparation
30/06/2006	Phase I Geographic IR system
30/06/2006	I2D2 Demonstrator v1
31/12/2006	Phase I Platform Architecture
31/01/2007	Phase I Summarisation engine
15/07/2007	Bseline Bio-Retrieval engine
30/09/2007	Experimental Search Platform for PeterMac
30/09/2007	Research plan for Bio Text Mining
31/12/2007	Search Platform architecture
31/01/2008	Phase II Summarisation engine
31/03/2008	Interactive information access interface
31/07/2007	Version 1 Genomic Search engine (for TRECH)
30/09/2007	Integrate advanced genomic search capabilities into search engine used by PeterMac
30/09/2007	Future research plan defined

L4.verified

Topic: Embedded systems are vital infrastructure elements in information and communications technology. They drive mobile phones, entertainment devices, cars, toys, appliances, smart cards, medical devices, network switching gear, sensors, industrial robots and many other applications.

Aim: To provide a mathematical, machine-checked proof of the functional correctness of the L4 microkernel, the minimum set of interfaces that are used by the operating system, with respect to a high-level, formal description of its expected behaviour.

Duration: Three years (2.9 FTE over 3 years).

Project Leader: Dr Gerwin Klein.

Participants:

- ERTOS, FM, LC.

Key points:

- Will develop a model of the kernel that is suitable for formal reasoning about software components to be built on top, and to verify the implementation of the kernel itself
- A successful proof will constitute a major scientific breakthrough in the areas of operating systems and formal methods
- Provide the basis for achieving genuinely trustworthy systems and supporting industrial interest in a formally verified kernel.

Progress:

- The project is on track.
- Most tool and library milestones have been finished ahead of schedule.
- The mid term verification milestone is behind schedule. Appropriate measures have been taken to mitigate the effect on project end date and outcome.
- All other technical milestones are fully on schedule.

Milestones:

Date	Milestone
31/10/2005	Application program interface
15/09/2007	First refinement
30/04/2006	Hardware model
30/04/2007	Hardware model
31/07/2006	Tool prototypes
31/10/2007	Tools finished
31/10/2007	Security Mechanisation
30/04/2007	Security
30/04/2008	Final system
30/11/2007	Follow up project plan

Last Metre Problem (LaMP)

Topic: Information and communications technology (ICT) can be an extension of the human senses.

Aim: Getting information to and from people in a transparent way without restricting mobility or forcing them to change habits.

Duration: 3.42 years (1.0 FTE over 3.42 years).

Project Leader: Sven Nordham (WATRI).

Participants:

- Network Systems group.
- Western Australia Telecommunications Research Institute (WATRI).

Key points:

- Making wireless technology users free of any technologically extended environment (hardware)
- A rigorous technology-based assessment of the future possibilities surrounding the last metre problem that identifies where technologies may become feasible
- A hardware demonstrator for audio technologies with commercial prospects over a five to 10-year period
- Strategic framework for research across Australia in a global context.

Progress:

- Preliminary planning workshop completed in February 2004
- Planning, research directions and IP considerations resolved at July 2004 workshop
- Formal project agreement in place
- Several sub projects have been selected and are progressing for different application spaces
- Hardware testbeds have been developed for wireless and speech technologies
- Collaborative work being conducted between WATRI and WSP by making alternate research visits to Perth and Canberra.

Milestones:

Date	Milestone
2006	Identify feasible short-term research with commercial potential Secure the intellectual property (IP) rights Publish research findings Hardware testbed implementations
2007	Commercialise results Demonstrators on developed systems Publish research findings

Learning and Representation (LEAR)

Topic: Decision making in a military context is often characterised by a complex environment.

Aim: To develop innovative learning algorithms to underpin support tools for decision making in uncertainty.

Duration: 5 years (0.3 FTE over 5 years).

Project Leader: Bernhard Hengst.

Participants:

- Making Sense of Data group
- Managing Complexity group
- DSTO

Key points:

- Investigating automation of the battle space to support decision making for national and military strategic courses of action
- Basic research in using hierarchical reinforcement learning for decentralised planning and control with uncertainty in a concurrent (multi-agent) adversarial settings
- Applied research in implementing these methods to build a tool for decision support and simulation, and related domains such as entertainment (online video games).

Progress:

2006:

- Implemented initial version of navigation control that allows air-based agents to reach targets and avoid ground-based defenders
- Implemented a more sophisticated navigation approach based on a variable resolution, continuous state representation
- Explored techniques borrowed from robot motion planning in high-dimensional continuous state spaces (probabilistic roadmap methods)
- Hired full-time research engineer
- NICTA/DSTO workshop, joint with DPOLP project held in Kioloa in May
- NICTA/DSTO workshop held December 2006 in Sydney.

2007:

- Agreed with DSTO to discontinue this project because this research topic had moved to DSTO Canberra in a reorganisation and was no longer in their remit.

Milestones:

Date	Track 1 milestones: Simulator Development (DSTO)	Track 2 milestones: DSTO and NICTA	Track 3 milestones: Fundamental Research (NICTA)
2004	Produce first version of aerospace strategy tool	Apply existing machine learning using agreed features	Extend existing hierarchical reinforcement learning and test on prototype
2005	Add unmanned aerial vehicle and land interaction	Engineer multiple agent controllers	Include partial observability and multi-goals
2006+	Develop model complexity to include non-physical models Conduct periodic reviews to determine priorities and further research		

LIXI Business Processes (LIXI)

Topic: Transactions worth more than \$100 billion are carried out in the Australian lending industry each year. Lending processes are complex and add to the cost of the transaction for lenders and borrowers.

Aim: To improve lending processes and reduce the marginal costs of loan transactions through the analysis of data related to lending practices, leading to enhancement of LIXI standards.

Duration: 2.92 years (1.7 FTE over 2.92 years).

Project Leader: Paul Mackie.

Participants:

- Lending Industry XML Initiative.
- Making Sense of Data group.
- Managing Complexity group.

Key points:

- Will establish the grounds for how formal processes can be defined to improve business performance in the Australian lending industry
- Will establish the grounds for how formal software processes can be defined to achieve processes that are powerful and usable
- World-class software engineering applied to enhance the effectiveness, efficiency and competitiveness of this key Australian industry.

Progress:

- LIXI Process Handbook v1.0, delivered March 2006
- LIXI Formal Loan Approval Process model v.1.5, delivered Sept. 2006
- LIXI Valuations Reference Architecture and Guide, delivered March 2007

Milestones:

Date	Milestone
31/08/2005	Initiation
30/04/2008	Process Model Development
30/04/2008	Reference Architectures
31/12/2007	Formal Industry Case Study
30/04/2008	Solutions Development

Macro-programming for Wireless Sensor Networks

Topic: Programming models and platforms for wireless sensor networks (WSN).

Aim: This project aims to overcome the difficulties associated with WSN programming by introducing the right abstraction models and tools to program WSN at the global, network level.

Duration: 2.58 years (0.65 FTE over 2.58 years).

Project Leader: Athanassios Boulis.

Participants:

- University of Western Australia.
- Embedded Systems group.
- Network Systems group.

Key points:

- Developing abstractions and services to program wireless sensor networks at a global (macro) level.

Progress:

- Castalia simulator for Wireless Sensor Networks enhanced and released as an open source software.
- Investigation of communication parameters effect in statistical data delivery in real deployments.
- Comparison and analysis of simulation results with real deployment results in statistical data delivery.
- Publication of an article in the Theory to Practice Wireless Sensor Network workshop.

Milestones:

Date	Milestone
31/07/2006	Study existing algorithms
31/12/2006	New algorithms
31/08/2006	Communication methods
30/12/2006	Programming model
31/03/2007	Node-level representation
30/09/2007	Global - local compilation
31/12/2007	Implementation of the node-level representation
31/07/2007	Model revision
31/03/2008	Integrate application development and simulation environment
31/03/2008	Real platform testing
30/04/2008	Overall integration

Mapping Genetic Components in Crops (MGCC)

Topic: Genomics is an information science dependent on the deployment of advanced techniques in computing to achieve optimal analysis of phenomena of large data sets, such as physical characteristics and disease conditions (phenotypes).

Aim: To apply machine learning technology to the mapping of genotype–phenotype characteristics so that knowledge of the whole genome DNA profiles of crops can be applied to the selection of parents for improved breeding lines.

Duration: Three Years (0.8 FTE over 3 years).

Project Leader: Dr Adam Kowalczyk.

Participants:

- Diversity Arrays™ Technology, Canberra

Key points:

- Applies a powerful predictive tool – machine learning – to better understand genetic variation in plants
- Will support increased effectiveness in crop improvement strategies for a range of plants
- Addresses specific ecological issues important for Australian agriculture such as crop resistance to salinity and drought
- Building national expertise in plant genomics and molecular breeding.

Progress:

2007 Activities:

- Delivery to the research partner of a prototype system for interpreting genetic data to identify significant trait markers in crops.

Milestones:

Date	Milestone
06/05	Introductory review
01/06	Initial software tools adaptation/development
01/06	Determination of breeder needs
04/06	Benchmarking of selected algorithms
04/06	Development of medium-term project plan
04/07	Test of the α -version of the predictor
04/08	Extension to sugar cane and bacterial flora

Millimetre Wave Gigabit Wireless (GiFI)

Topic: Millimetre-wave radios will experience very challenging propagation issues, including multi-path propagation, a rapidly changing transmission environment, and high attenuation by walls and windows as well as atmospheric absorption. The creation of a transmission system in CMOS operating in the 60-GHz band requires research on all levels from algorithms, channel modelling, simulation, architecture development and implementation to physical device modelling.

Aim: To develop novel remote frequency (RF) technologies and baseband algorithms for a complete transceiver design for emerging millimetre-wave communication systems.

Duration: 2.92 years (6.15 FTE over 2.92 years).

Project Leader: Stan Skafidas.

Participants:

- Embedded Systems group
- Network Systems group
- DSTO, IBM, Princeton University, Peregrine Semiconductor, Synopsys, Cadence Design Systems, Suss Microtech, Anritsu, Agilent Technologies, MOSIS, UTAC.

Key points:

- Worlds First 60GHz T/R Switch on Bulk 130nm CMOS
- Worlds First Integrated BPF on CMOS
- Worlds First Double Balanced Gilbert Cell Mixer
- Design of LNA,PA,Mixer,T/R Switch,VCO, BPF,Frequency Dividers
- Devices Layed, Fabricated and Tested

Progress:

- All major milestones to date have been achieved with the project on track for timely completion

Milestones:

Date	Milestone
Gigabit Optical Access	
04/05	Finalise project plan and development timetable
02/06 (est)	Low-cost PON technology demonstration
09/06 (est)	Prototype PON completed
12/06	Demonstration of multi-functional repeater for low-cost PON implementation
06/07	Demonstration of next-generation PON subsystems
07/07(est)	Integrated 60 GHz/PON testbed completed
12/07 (est)	Converged access network demonstrator

Managing and Monitoring the Internet (MAMI)

Topic: As future core networks become more optical, more dynamic and more reconfigurable, it will be essential to probe and measure the Internet at many different levels to facilitate a secure and resilient network infrastructure.

Aim: To develop technology for monitoring Internet performance and providing critical information to network management functions, and to contribute valuable IP to the Australian optical communications industry.

Duration: 3.42 years (6.15 FTE over 3.42 years).

Project Leader: Trevor Anderson.

Participants:

- Making Sense of Data group
- Network Systems group
- Sprint
- further industry partners under consideration.

Key points:

- Development of two monitoring technologies with strong commercial potential.
 - Optical Signal to Noise monitor (POC Sept 07)
 - Multi Impairment monitor (Demonstrator)

Progress:

- Project has delivered all agreed milestones. A 6 month extensions has been granted to complete proof of concepts.

Milestones:

Date	Milestone
31/05/2005	Completion of Project Plans
31/05/2005	Class 1 Monitor Lab Prototype 1
30/06/2005	Test Active probing in a Carrier Network
31/12/2005	Impairment of Identification Strategies
30/09/2005	Demonstration of Optical Performance Monitor
31/10/2005	Characterisation of Internet traffic through Active Probing
31/12/2005	Report on Simultaneous Identification of Multiple Impairments
30/03/2006	Integration of monitor with TNL testbed
30/06/2006	Development of Second Generation Optical Monitor
	Demonstration of QFactor Estimator
31/12/2006	Active Probing Software Tool
30/06/2007	Demonstration of Reconfigurable Networking with Monitoring
31/07/2007	Finalisation of licensing agreement for ONSR monitor (Optimum)
31/12/2007	Completion of Business Development Plan
31/12/2007	Development of Delay Tomography technique with application to VOIP
31/12/2007	Continued development & testing of OSNR monitor as per licensing agreement
12/12/2007	Field testing of multi impairment monitor (dependent on access)

Multi-user Detection Algorithm (MUD)

Topic: The challenge for third-generation mobile communications (3G) is to develop high-performance signal processing architectures to maximise coverage and capacity.

Aim: To develop a real-time, high-capacity demonstrator, research problems, integrate solutions into the design, evaluate performance and functionality and compare the results to a conventional receiver design.

Duration: Three years (3.4 FTE over 3 years).

Project Leader: Dr Mark Reed.

Participants:

- Embedded Systems group
- Network Systems group

Key points:

- Capacity and coverage boost for 3G/4G systems
- Encouraging simulation results show potential for a 50 per cent increase in cell size, a 200 per cent increase in cell size and a 200 per cent increase in subscriber capacity.

Progress:

- Project restructured to InterfereX2 which commenced July 2007.

Milestones:

Date	Milestone
31/03/2005	WSP - Tx/Channel implementation in MATLAB
31/03/2005	To implement the Transmitter and Channel in MATLAB based on the system specifications
01/03/2007	RTOS - Specifications and interface document
30/04/2005	To specify functionality of GUI and higher level software/operating system to support prototype.
30/04/2005	WSP - Develop specifications and interface document
30/04/2005	To specify functionality of the physical layer, in terms of data rates and channels to be supported.
01/04/2007	RTOS - Software architecture description
30/06/2005	To describe software architecture to be used and interfaces, provide skeleton architecture and show working
31/07/2005	WSP - RX implementation in MATLAB
01/08/2005	To implement the receiver in MATLAB based on the system specifications
31/07/2005	WSP - VHDL implementation of Tx/Chan
31/07/2005	To implement the transmitter and channel in VHDL and compare with test vectors against the MATLAB reference code - (done - successfully demonstrated)
01/04/2007	RTOS OS familiarity and implementation/porting
01/04/2007	To describe operating system and show working skeleton, identifying changes needed and data structure architecture
31/10/2005	Single User Real-Time OFDM transmitter (lab demo) (Low IF analogue output signals, 4 data rates, no RS encoding.)
31/07/2006	Single User Real-Time OFDM receiver and channel model (Low

	IF analogue input signals, Acquisition, Tracking of signals, Multi-state Chan. Est. Channel with multi-path and mobility - 300km/hr), protocol stack with video applications.
31/12/2006	Multiuser Real-Time OFDM Tx/Rx lab demo with IC technology (2 user system), using custom built hardware (140Meg IF analogue signals). Protocol stack with single applications (video/data/voice)
30/06/2007	MIMO-OFDM Tx/Chan/Rx lab demo with IC technology, 2 users, up to 4x4 antennas, custom hardware, protocol stack integrated with mixed applications (video, voice)
31/12/2007	MIMO-OFDM field trials (driving demo), custom hardware IF-RF front end, antennas, custom hardware, protocol stack integrated with mixed applications.

NICTA Open SensorWeb Architecture (NOSA)

Topic: As sensor network deployments begin to grow there is an increasing need to overcome the obstacles of connecting and sharing heterogeneous sensor resources. Common data operations and transformations exist in deployment scenarios, which can be encapsulated into a layer of software services that hide the complexity of the underlying infrastructure from the application developer. In parallel, there is considerable research activity underway on distributed algorithms for in-network processing of data in sensor networks, in order to maximise their lifespan. The NOSA project is conducting research into distributed algorithms for sensor networks, and developing a layer of software services that can support the deployment of these algorithms in practical applications.

Aim: To develop a framework and tools for building applications on a distributed computing infrastructure, with a focus on developing applications for wireless sensor networks.

Duration: 2 years (3.35FTE over 2 years)

Project Leader: Chris Leckie

Participants:

- Network Systems group

Key points:

- Developed baseline software services (Observation & Measurement Service, Sensor Collection Service, Sensor Repository Service, Web Notification Service).
- Developed and demonstrated use of NOSA core services for a sensor fusion application for heterogeneous sensor networks, e.g., Crossbow and NICTOR sensors.
- Developed suite of distributed algorithms that minimise communication overhead in sensor networks for common tasks in network management and query optimisation.

Progress:

- Developed data model for describing sensor capabilities
- Constructed functionality for ad-hoc and on-demand queries
- Model requirements of Water Information Networks project completed
- Developed services for data dissemination between heterogeneous sensor networks
- Developed prototype Sensor Planning Service

Milestones:

Date	Milestone
31/08/2006	Develop SensorML data model
31/12/2006	Investigate WIN requirements
31/12/2006	Undertake auto-sending modeling
31/08/2007	Data dissemination
28/02/2008	Develop prototype Sensor Planning Service

Peer to Peer (P2P)

Topic: Both Multiverse Technologies and Big World Technologies provide a platform to enable massively multi-player online applications. Their offering is very similar to our potential product offering. However, a key difference between NICTA's offering and their offering is that, NICTA offers a distributed platform for MMO applications which is server-less. Both Big World and Multiverse provide a platform that is based on a client-server architecture. A server-less platform would scale to unlimited number of users and have no dependencies on the network/server infrastructure.

Aim: Investigate decentralised techniques to manage the network and data in order to provide complex applications efficiently and economically.

Duration: 4.92 years (2.5FTE over 4.92 years)

Project Leader: Santosh Kulkarni

Participants:

- Network Systems group

Key points:

- Unique distributed spatial indexing techniques have been developed by the team to efficiently index millions of users in a virtual world
- A distributed network engine for MMO applications is currently being developed.
- As the network engine is based on a P2P architecture, the technology can scale to unlimited number of users.

Progress:

- Development of P2P sharing for computational grids.
- Development of new efficient data structures for P2P in regards to nearest neighbours and distance joins.
- Developed a distributed network engine for MMO applications. A prototype was successfully tested on the PlanetLab network in October 2006. Proof of concept phase successfully completed July 2007.

Milestones:

Date	Milestone
31/10/2006	Testing the alpha game prototype on the Telstra Network
30/04/2007	Development of streaming middleware services for a complete P2P game experience
31/10/2007	Improving the latency requirements with efficient load balancing and data indexing techniques on P2P networks
30/04/2008	Improving the reliability of the gaming experience with high-levels of dynamicity in a P2P network
31/10/2008	Beta testing on the Telstra testbed
30/04/2009	Improving the virtual world security over a P2P platform
31/12/2009	Release of the first version of the P2P Massively Multiplayer Online Game (MMOG) in a large scale

Probabilistic Temporal Analysis of Operating Systems Code (POTEROO)

Topic: Embedded systems often have strict real-time operating requirements that must be met. In order to satisfy these, the kernel's temporal behaviour must be well understood. This takes the form of a model of the worst-case execution time (WCET) of each component of the kernel's functionality.

Aim: To extend an existing WCET method and toolset to allow analysis of kernel code, provide a timing model for the L4 microkernel, reduce significantly the overestimation inherently introduced by the tool and provide a consistent means to estimate the pre-emption delay.

Duration: 2.75 years (0.7 FTE over 2.75 years).

Project Leader: Stefan Petters.

Participants:

- Embedded Systems group

Key points:

- Reduction of overestimation compared to previous work of up to 98% dependent on the target architecture
- Integration of static analysis and measurement based analysis, as proposed in extension proposal very promising
- world first kernel with memory protection analysed for its WCET

Progress:

- Toolset implemented, subject to some debugging
- Analysis of kernel on track

Milestones:

Date	Milestone
31/12/2007	Manual analysis of a 'slice' of the kernel
31/10/2005	CFG parser (XML interfaces)
30/09/2007	C++ source code parser
31/01/2006	Trace parser (refinement)
30/03/2006	Timing program generator
31/05/2006	Separation of concerns (usability, parametrise method)
30/06/2006	Trace generation mechanisms for Xscale
30/09/2007	Analysis of kernel
30/09/2007	Validation of results
30/09/2007	Hypothesis-based dependency refinement
30/09/2007	Loop dependency refinement
30/09/2007	Pre-emption delay analysis
12/10/2007	Function describing of cache misses of a given input program
30/11/2007	Coverage analysis with counter examples and evaluation of results
30/09/2005	Progress report
31/12/2007	End of project review

Query under Uncertainty for a Secure and Sustainable Environment (QUSE)

Topic: Digital forensics aims to reconstruct the causal sequence of intrusion or unauthorised entry into digital systems.

Aim: To perform research and development of generic, robust, expressive and efficient models, algorithms/prototypes to interpret and query (incomplete) data under uncertainty applied to two domains: digital forensics and environmental management.

Duration: 3 years (2.0FTE over 3 years)

Project Leader: Nianjun Liu.

Participants:

- Making Sense of Data
- DSTO

Key points:

- There are three sub-projects involving partners from governmental and industrial agencies.
- The first one focuses on summarization and querying of digital forensic data with the aim of detecting digital crime. This is a joint project with the DSTO.
- The second involves work with the ACT Planning and Land Authority (ACTPLA) on exploring intelligent land planning and decision support related to relational spatial data used in town planning.
- The third is with the Australian Department of Agriculture, Fisheries and Forestry, Bureau of Rural Sciences, where the aim is to develop tools for querying and decision support for Australian Environmental GIS Spatial Mapping Data and focused on land use management.

Progress:

- QUSE has met the milestones of the joint project with DSTO by annual external reviews for the in last two years.
- The system (algorithm and application) of investigating digital forensics by Dynamical Bayesian Network has been delivered to DSTO, and joint-project is in Phase 3 (2007-2008).
- The other two joint projects with ACT Gov and Australian Bureau of Rural Science will officially commence in mid-2007 with detailed milestones and deliverables from the partners.

Milestones:

Date	Milestone
15/10/2007	Building and learning domain-driven model from temporal -spatial data/databases
15/10/2008	Developing model query algorithms that will support general uncertainty queries on the models about spatial-temporal data
15/10/2009	Querying uncertainty from large spatial-temporal data

Requirements Engineering for Strategic Alignment (RESA)

Topic: Requirements engineering modelling frameworks and methodologies in aligning business strategy with its supporting ICT.

Aim: The objective of the RESA project is to develop a software tool that supports a scientifically validated requirements engineering methodology for the strategic alignment of organisational ICT.

Duration: 3.17 years (2.6 FTE over 3.17 years).

Project Leader: June Verner.

Participants:

- Commonwealth Bank
- Nomura Research Institute, Japan
- NTT, Japan
- Managing Complexity group

Key points:

- Developing a framework and methodology for business-IT strategic alignment
- Methodology elicits an organisation's competitive business strategy and context and progressively decomposes this into requirements for the IT systems the organisation needs to support its strategy.

Progress:

- Developed methodology
- Tested methodology in multiple industry case studies
- Results reported in both scientific literature and confidential technical reports
- Developed prototype software tool
- Tested software tool
- Submitted two invention disclosures with 6 distinct inventions
- Provisional patent application lodged with 12 claims
- Requirements spec for Alpha POC completed

Milestones:

Date	Milestone
31/03/2006	Completion of stage 1
01/04/2007	Completion of stage 2
01/04/2008	Completion of stage 3
31/12/2008	Completion of stage 4

Road Safety: Driver Drowsiness Detection (RSDDD)

Topic: Monitoring driver alertness based on measuring eyelid closure has some practical difficulties in development as a commercial product.

Aim: To develop a metric for driver fatigue from measurements derived from action and image sensors.

Duration: 1 year (0.5 FTE over 1 year).

Project Leader: Abd-Krim Seghoune.

Participants:

- Seeing Machines

Key points:

- Aims to develop data for the development of a metric for human drowsiness and head movement
- Technology developed will support the realisation of Active Driver Assistance Systems
- Provide strong differentiator to SME technology and overcome inherent difficulties with current technology.

Progress:

- Project completed June 2007.

Milestones:

Date	Milestone
28/02/2006	Overview of existing literature
	Discussion and selection of a model to develop a first approach
	Development of an interface for the sensor unit
	Implementation of the chosen model
	Simulation of the chosen model with the sensor signals as inputs rather than simulated signals
30/06/2006	Synchronising the DSS and the sensor unit
30/06/2006	Create the experiment which will allow the validation of the model
30/06/2006	Validation of the model
31/10/2006	Test in real environment if model shows sufficient promise and project partner agrees
30/06/2007	Final analysis of data and project report completion

Secure Embedded L4 (seL4)

Topic: Strong security is a fundamental requirement for many current and emerging embedded application devices, including personal digital assistants, mobile phones and set-top boxes. The L4 microkernel provides a minimal and efficient basis for constructing operating system software for a broad range of systems, from single-purpose embedded devices to multi-processor servers.

Aim: To provide the secure software base (L4) upon which further secure software layers (system and application services) can be composed to form a trustworthy embedded system.

Duration: 3.08 years (1.4 FTE over 3.08 years).

Project Leader: Dr Kevin Elphinstone.

Participants:

- Embedded Systems group.

Key points:

- The L4 microkernel provides a minimal and efficient basis for constructing operating system software for a broad range of systems, from single-purpose embedded devices to multi-processor servers
- Will support the provision and use of data that users and service providers may wish to control access to and usage of
- Will enable the safe use of third-party applications whose origin, quality and functionality is not directly or even indirectly controlled by the embedded-device supplier
- Aims for a high degree of assurance through mathematical rigour by formally modelling the kernel's programming interface, and formally verifying the implementation of the modelled interface.

Progress:

- Developed a novel kernel modelling methodology using functional programming to facilitate prototyping and formal modelling of an operating system.
- Have a prototype kernel written in both a functional programming language and in 'C' for performance.
- Have a proof of security properties of a model of the API (proof of implementation is in L4.verified).
- On track to complete project at the end of the year.

Milestones:

Date	Milestone
28/02/2006	Initial API
31/08/2006	Initial implementation and performance evaluation
31/01/2007	Initial
31/12/2007	IPC Trad, Kmem, Exc and Int work packages complete
31/12/2007	IPC Sem, CSpace, VSpace and Sys Mon work packages complete
31/12/2007	Sys Batch, Snch and Async work packages. Mature native seL4 and Iguana/seL4 implementation

Strategic Project: Smart Applications for Emergencies (SAFE)

Topic: The SAFE project is a major focus of the Queensland Research Laboratory and addresses the national priority of "Safeguarding Australia" which was a key driver in the establishment of the Lab in Queensland.

Aim: SAFE aims to develop new technologies, systems and services that provide significant improvements to the devices, systems, information and human processes that enable the management and mitigation of, and response to, natural disasters and man-made emergencies. The research project is being undertaken in collaboration with the Queensland Government as a key stakeholder.

Duration: 2.92 years (21.95 FTE over 2.92 years)

Project Manager: Charlie Robinson

Participants:

- Making Sense of Data group
- Embedded Systems group
- Network Systems group
- Managing Complexity group
- Queensland State Government

Key points:

- Project is developing a Demonstrator to showcase research outcomes to industry and end-users.

SAFE Sensors

Topic: Hardware and software computer vision and pattern recognition technologies to enhance video surveillance for counter-terrorism, personal and property security, and vehicle monitoring.

Aim: Main focus is on technologies for intelligent CCTV surveillance. This includes advanced non-intrusive identity management systems such as robust real-time face recognition and appearance modelling.

Duration: 3 years (2.45 FTE over 3 years).

Project Leader: Brian Lovell.

Participants:

Praetorian Systems, Iomnicent, Sun Microsystems, Axis, Sony, Telstra, Queensland Transport.

Key points:

- Achieved recognition of faces from CCTV cameras installed in a major railway station.
- Developed techniques for the reliable detection of faces with large pose angles.
- Two patents filed.
- Awarded grant for 634k from Prime Minister and Cabinet.
- Military grade surveillance system has been established in QRL in partnership with commercial collaborator.
- First images from Smart Camera for surveillance.
- New projects from Dept of Attorney General at contract stage.

Progress:

- All milestones achieved on schedule

Milestones:

Date	Milestone
30/09/2006	Review of existing work and smart camera architectures
31/10/2006	Review of existing work on location services
30/04/2007	Construction of smart sensor prototype
31/12/2007	Development of novel location services
30/06/2008	CV algorithms for development on smart sensor platforms
31/12/2007	Smart camera demonstrator
30/06/2008	Multiple camera smart camera demonstrator

SAFE Information

Topic: Crisis information management.

Aim: This research covers the management of critical information and warnings with emergency systems and modelling behaviour during incident management.

Duration: 3 years (4.5 FTE over 3 years).

Project Leader: Renato Iannella.

Participants:

- QLD Department of Emergency Services (DES).

Key points:

- Developed information models for Cyclone and Tsunami warnings and machine representations.
- Developed information model for resource messaging during crisis recovery (as editors of an OASIS international standards specification)
- Developed demonstrator showcasing new emergency standards, such as the Emergency Data Exchange Language
- Developed information models for situational reports used by crisis response centres.
- Developed pattern-based spatiotemporal object movement prediction algorithms

Progress:

- All scheduled milestones are on target

Milestones:

Date	Milestone
31/12/2006	Scenario requirements
30/06/2008	Formal representation of information
30/06/2008	Information integration
30/06/2008	Information framework and architecture
30/06/2008	Spatio-temporal information integration

SAFE Agents

Topic: Addresses formal modelling and understanding of dynamically changing environments in emergency and disaster services.

Aim: The research aims to formally represent and efficiently reason with meaningful knowledge from natural and human engineered emergencies. The focus is on developing an automated system that will assist in making timely, informed and intelligent decisions that accommodate the resource and other constraints inherent in emergency situations.

Duration: 3 years (3.3 FTE over 3 years).

Project Leader: Prof. Abdul Sattar.

Participants:

- QLD Department of Emergency Services (DES).

Key points:

Major international awards for scientific achievements:

- *Gold medal* on the Random SAT category in the SAT 2005 International Competition (in collaboration with NICTA's L&C program)
- *Distinguished paper award* for "Building Structure into Local Search for SAT" at IJCAI 2007
- *Gold medal* on the Random SAT category in the SAT 2007 International Competition (second time in succession)

Progress:

- Milestone 3.1 has made excellent progress on technical results (see above achievements)
- Milestone 3.3 has reduced scope, and its encoding of temporal networking is completed, the work is under revision by AI Journal after reviewer's feedback.
- Milestones 3.2, 3.4, and 3.5 are related to Students PhD theses topics, and making steady progress.
- Our work on the SAFE Demonstrator is now focusing on modeling and optimisation for evacuation planning.

Milestones:

Date	Milestone
30/06/2008	Solving Decision Problems M3.1
30/06/2008	Representation & Reasoning with Ontologies M3.2
30/06/2008	Reasoning with Spatio-temporal information M3.3
30/06/2008	Handling Over-Constrained Problems M3.4
30/06/2008	Cooperating Cognitive Agents M3.5

SAFE Networks

Topic: Dynamic and autonomic reconfiguration and self-healing of communication networks and emergency services applications running on these networks.

Aim: Our aim is to enable emergency services applications such as real-time audio and video communication to operate reliably in hostile conditions using self-healing mesh networks and context awareness.

Duration: 3 years (3.85 FTE over 3 years).

Project Leader: Jadwiga Indulska.

Participants:

- Department of Emergency Services.

Key points:

- Developed routing protocol allowing dynamic adaptation and reconfiguration for hybrid multi-radio wireless mesh networks.
- Developed methods for context information distribution and caching and for fault tolerant context management systems

Progress:

- Milestone 5.3 Autonomic network/communication reconfiguration (60% achieved)
- Milestone 5.2 Scalable and resilient management of context information (60% achieved)

Milestones:

Date	Milestone
30/06/2007	Model of context information M5.1
31/12/2007	Scalable and resilient management of context information M5.2
30/06/2008	Autonomic network/communication reconfiguration M5.3
30/06/2008	System Monitoring M5.5

Smart Cars

Topic: To be useful, driver assistance technologies must be scaled up to deal with the cluttered and busy environment of urban roadways.

Aim: To develop driver assistance technologies that will extend their applicability from the relatively simple environment of highway conditions to the more complex environment of arterial and tributary roadways.

Duration: 2.92 years (4.6 FTE over 2.92 years).

Project Leader: Lars Petersson.

Participants:

- Making Sense of Data group
- Embedded Systems group
- CSIRO ICT Centre

Key points:

- Aims to develop technologies that will support highly reliable methods of moving object detection, vehicle detection, road environment detection and sign detection
- Demonstrates benefit of linking fundamental research to applied research.

Progress:

- Implementation of novel object detection engine in embedded HW that runs at >70Hz on 1024x768 images.
- HW demonstrator with FPGA, DSP and camera developed.
- Demonstrated on-line road sign recognition as well as pedestrian detection from a moving vehicle.
- Distributed system for analysing vast amounts of imagery to build content data base.

Milestones:

Date	Milestone
31/03/2006	Demonstrate a system in which traffic signs can be detected reliably both day and night
	Demonstrate algorithms using a prototype for detecting other vehicles on the road
	Demonstrate algorithms for detecting other traffic hazards such as pedestrians and bicycles
	Pedestrian detection will be demonstrated in daylight
30/09/2007	Demonstration of FPGA hardware acceleration, including implementation of image-processing algorithms
	Demonstrate traffic sign detection capability, with hardware acceleration running on the vehicle
	Demonstration of other vehicle awareness to keep track of the position and velocity of other vehicles on the road
	Demonstration of reliable detection of objects moving across the field of view of cameras in front of vehicle
	Demonstration of methods for reliable road detection in moderately complicated situations
	Demonstration of a sophisticated use of FPGA hardware, interfacing with host computer, to accelerate many of the image process algorithms developed
	Definition of a suitable ASIC

Strategic Project: Smart Transport and Roads (STaR)

Topic: New intelligent transport systems technologies.

Aim: To use intelligent sensors and wireless mesh communications to support developments in traffic control algorithms and multimodal user interfaces to ease congestion and extend the life of Australia's investment in roads infrastructure.

Duration: 3 years (17.05 FTE over 3 years)

Project Manager: Geoff Goeldner.

Participants:

- Making Sense of Data group
- Embedded Systems group
- Network Systems group
- Managing Complexity group
- NSW Roads and Traffic Authority (RTA).

STaR Sensors and Surveillance (STaR Sense)

Aim: To demonstrate the feasibility of adding video sensor and surveillance for traffic control and to develop new technologies and IP in image/video processing for traffic monitoring

Project Leader: Jian Zhang

Key points:

- Testbed set up and video feeds for algorithm testing
- Combination of Sensing, Modelling and Adaptive Control
- Software (Vcapture) in use by RTA
- Analysis of competitor solutions

Progress:

- Technical Scope completed
- Initial test data acquisition and camera positioning analysis completed
- Resolution and Frame Rate of video capture and integration completed
- Queue length estimation completed
- Traffic Flow estimation completed
- Research strategy development completed:.

Milestones:

Date	Milestone
	Technical scope report and white paper
01/07/2006	Technical scope document
	Initial test data and acquisition and camera positioning analysis
01/07/2006	Collect initial test (video) data set including a comprehensive range of road traffic cases
01/07/2006	Install initial test bed cameras
01/07/2006	Data acquisition from test bed
01/07/2006	Determine feasible camera positions at various traffic junctions
15/11/2006	Technical report: Theoretical geometry analysis for road traffic monitoring
	Resolution and frame rate of video capturing & integration
01/09/2006	Determine cost/resolution trade-offs for cameras

Queue length estimation and vehicle counting (limited conditions) Stage 1	
01/11/2006	Develop and demonstrate algorithm for background modeling
15/11/2006	Develop and demonstrate algorithm for vehicle tracking
01/11/2006	Develop a shadow remove algorithm
Traffic flow estimation	
01/11/2006	Develop and demonstrate algorithms to extract low level features from collected training data
01/11/2006	Develop and demonstrate statistical models for traffic flow rate measurement
Stationary vehicle detection on M4 Motorway: Stage 1	
20/04/2007	Develop algorithms for stationary vehicle detection; Video data collection for stationary vehicle detection on M4
Research category development	
01/11/2006	Research strategy development tasks
Stage 1 Tech Show and Demonstration	
15/11/2006	Demonstrate Traffic Flow Rate Measurement (limited conditions)
15/11/2006	Demonstrate queue length estimation and vehicle counting (limited conditions)
20/04/2007	Demonstrate stationary vehicle detection on M4
Stage 2 Refinement of models	
31/05/2007	In conjunction with STaR Control team, estimate vehicle size and counting traffic volume based on computer vision technology
31/05/2007	Detection of presence and location of vehicles at the intersection stop line
Stage 2 refinement & half year review	
30/11/2007	Demonstrate and publish mid-term whitepaper
30/10/2007	Work on 3 layer of video traffic detection including algorithms development
New technologies	
30/11/2007	Demonstrate solutions of stationary vehicle detection (M4 Motorway Granville Viaduct video processing unit)
31/12/2007	Feature based vehicle and pedestrian detection
01/09/2007	Develop a 3-D calibration initial method for RTA
Third half year review	
01/03/2008	Develop test-bed with multiple cameras working on single/multiple object tracking and statistical estimation of traffic flow
01/03/2008	Demonstrate ability to traffic monitoring with multi-cameras; detect events at local computer and generate and transmit XML based meta data
Third annual review	
30/08/2008	Demonstrate prototype intelligent traffic surveillance system platform
30/08/2008	Combine all developed algorithms to build a NICTA sensor and surveillance demo platform
30/07/2008	Plan future research and development for video detection and analysis
New research strategy: Stage 2 (from 2008 - 2010)	

STaR User Interface (STaR UI)

Aim: To research and develop automatic cognitive load measurement technologies based on user's multimodal behaviours, with a focus on intelligent transportation system (ITS) applications.

Project Leader: Fang Chen

Key Points:

- Designed and developed novel cognitive load analysis systems with multimodal interfaces and for ITS applications on basis of user studies using User-Centred Design methodology.
- Validated correlation between specific features of multimodal interaction and physiological signal measurements as relevant indicators of changes in users' cognitive load over tasks of increasing difficulty.
- Two major advances have been achieved for RTA in the design of new user interfaces for traffic incident recording and for accessing the contacts database used by RTA Traffic Management Centre operators.
- Published 45 papers on peer reviewed journals and conferences. 7 papers have been submitted and are currently under review.

Progress:

On track

Milestone:

Date	Milestone
New control room applications	
30/06/2008	Mock-up designs on contact database with multimodal capability
30/06/2008	CMCS data flow analysis report
01/07/2006	First round user studies on CMCS Incident Form
01/07/2006	New CMCS-UI Design Guidelines
01/08/2006	New CMCS UI Mockup and User Study and Analysis report
30/06/2008	Second round user studies on CMCS incident with Avalanche. (Jan 07 - Apr 07)
30/06/2008	RTA application with multimodal interfaces (Sep 07 - Jun 08)
Operators' cognitive load (CL) measurement system	
01/06/2006	Concept, scenario, task and software framework design of first round user experiments on cognitive load modelling (Apr 06 - Jun 06)
31/08/2008	Data analysis for first round user experiment (Jul 06 - Mar 07)
31/07/2008	Mock-up designs and second round of user studies (Feb 07 - Jun 07)
31/08/2008	A proof-of -concept demonstrator for cognitive load measurement (Feb 07 - Aug 07)
31/08/2008	User study data analysis and recommendation of relevant cognitive indices and multimodal interaction patterns for TMC environment (Jun 07 - Feb 08)
31/08/2008	User evaluation and recommendations for adaptive interface. Report. (mar 08 - Aug 08)
31/08/2008	Prototype of Multimodal Platform (Sep 07 - Apr 08)

STaR Traffic Scheduling and Control (STaR Control)

Aim: Research and prototype flexible real-time traffic control algorithms using more advanced traffic models with information available from various traffic sensors (test-bed for L2 and G12)

Project Leader: Benhard Hengst

Key Points:

- Design of Traffic Control problem based on Generalised Bayesian Filter and RL/CP optimisation
- Real-Time Predictive Optimizer for Signal Group Traffic Control using RL/MDP function approximation
N06 041-INV
- End-of-Queue Measurement and Traffic Flow Rate Estimation for Adaptive Traffic Control using variable gain Kalman Filter N07 012-INV
- Formal model of the constraints in traffic light scheduling
- Constraint Programming/Dynamic Programming scheduling method
- Benchmarking Performance Measures for Micro-simulation experiments

Progress:

- Design of control system architecture
- Traffic simulator for single intersection
- SG controllers for single intersection
- Implementation of GOBA+ controller
- Standard Simulator

Milestones:

Date	Milestone
31/10/2005	Design of control system architecture
30/09/2005	Traffic simulator for single intersection
30/06/2006	Traffic models for single intersection
31/07/2006	Signal group constraint models
31/07/2006	SG controllers for single intersection (Looping Tree and GOBA+ design)
30/09/2006	Year 1 report
30/09/2006	Brief for Year 2
31/12/2006	Implementation of GOBA+ controller
31/12/2006	Technical report / Conference paper
30/06/2007	Performance Evaluation
31/07/2007	Schedule Verification
30/04/2007	Constraint based SG
31/07/2007	Network Coordination
31/07/2007	Vision model update
30/09/2007	Analytic SG Control
30/09/2007	Probabilistic CA
31/12/2007	Project Review
30/06/2008	Improved CS controller
30/06/2008	Model based SG Control

STaR Communications (STaR Comm)

Aim: To develop an economical, reliable, low-latency, and secure communication platform for a city-wide traffic management systems.

Project Leader: Max Ott

Key Points:

- Deployed pilot testbed and demonstrated communication across 5 mesh hops between a curb-side controller and a Regional Controller in the NPC lab.
- Developed improved multipath routing algorithm which limits self-interference from traffic over adjacent paths.
- Developed an algorithm to detect inconsistent routing behaviour in the network.

Progress:

- Pilot testbed deployed and fully functional since January 2007.
- Technical reports and demos are completed as scheduled

Milestones:

Date	Milestone
05/11/2005	Develop indoor mesh testbed
31/01/2007	Construct street mesh testbed
31/01/2007	Evaluate existing mesh routing
01/10/2007	Complete Multipath Routing Trial
20/12/2007	Complete Byzantine Routing Trial
20/12/2007	Complete Fault Detection Trial
31/07/2008	Demonstrate Final Routing solution
31/07/2008	Develop Business Plan
31/07/2008	Visibility and Recognition

Spectral Image Source Mapping Systems (SISMS)

Topic: New spectral imaging technologies have opened up the possibility for computer vision to directly infer properties of materials from their spatial spectral signatures.

Aim: To develop techniques that can accomplish automated or semi-automated interpretation by using algorithms that can bind signal processing, computer vision, graphics and machine-learning methods to enable us to map the material properties of objects onto and into 3D Computer Aided Design (CAD) models.

Duration: 4.92 years (2.5 FTE over 4.92 years).

Project Leader: Antonio Robles-Kelly.

Participants:

- Making Sense of Data group
- ANU

Key points:

- Offers significant new sensor systems for forensics, biometrics and surveillance capable of identifying very specific material sources and unique human characteristics more robustly than current normal colour video
- Research leading to a new class of relatively cheap, non-invasive methods for material analysis, human and veterinary diagnosis and agriculture monitoring
- Provides strong theoretical basis to spectral decoding, feature extraction, inverse modelling of spectral images and multi-camera imaging for integration with 3D CAD.

Progress:

- Started the development of a new spatial spectral feature encoding.
- Commenced comparison of preliminary results to current popular robust feature extraction models
- First results for material identification and recognition have been completed.
- Obtained the first results on a new hyperspectral absorption recovery method.
- The project has published more than twenty peer reviewed, high quality research papers in international conferences and journals.
- One MoU and one umbrella agreement have been signed and a major collaborative effort with the CRC on National Plant Biosecurity is underway.

Milestones:

Date	Milestone
31/12/2007	Subproject 1 - SmarTraps
31/12/2008	Subproject 2 - Early Detection of Plant Pathogens
31/12/2009	Subproject 3 - Spectral Mapping for Human Performance and Health
31/12/2009	Subproject 4 - Spectral Multi-camera tracking for Sentient Environments

Model-based Supervision of Composite Systems (SuperCom)

Topic: A new generation of autonomous composite systems constructed from simple components organised into a highly configurable and modular architecture is emerging with important social, environmental and economic potential. Autonomy in these systems – web and grid services, energy distribution systems, industrial plant control systems, telecommunications and computer networks – will depend on adequate supervision tools that will confer the ability to self-diagnose and self-organise (assemble, reconfigure) for optimal performance.

Aim: Develop theories, efficient algorithms and tools for the supervision of composite systems represented by discrete-event models, drawing on and adding to the fields of discrete-event systems, model-based diagnosis, A1 planning, and symbolic model checking.

Duration: 2.92 years (1.95 FTE over 2.92 years).

Project Leader: Dr Sylvie Thiebaux.

Participants:

- Managing Complexity group.

Key points:

- Will help improve the quality of service in composite systems through online monitoring systems and decision support to the supervision operator
- Offers reduced supervision costs as networks evolve
- Utilises model-based reasoning to support accurate diagnosis and principled reconfiguration plans.

Progress:

- A spectrum of methods for model-based diagnosis of dynamic systems with increased efficiency.
- Efficient methods for diagnosability analysis of such systems.
- Methods for generating a restoration plan for a dynamic system.
- Software platform and demonstrators implementing these methods.
- Ongoing: application to monitoring mail services

Milestones:

Date	Milestone
Work package 1	
30/11/2005	Decentralised models
30/11/2005	Functionalities
Work package 2	
01/06/2008	Reconfiguration
01/06/2008	Implementations
Work package 3	
01/10/2007	Diagnosis
01/10/2007	Diagnosability analysis
01/04/2008	Implementation
Work package 4	
01/01/2009	Sensible integration policies
01/01/2009	Synthesis of diagnosable composite system
01/01/2009	Implementation
Work package 5	
01/04/2007	Demonstrator
01/01/2009	Refined methods

01/01/2009	Prototype software
01/01/2009	Integration

Universal Storage Scheme (USS)

Topic: Extensible Markup Language (XML) is a useful information storage format as it has the flexibility to describe complicated data.

Aim: Develop a unified, succinct way of representing XML which uses space efficiently but can still be easily searched for information.

Duration: 3 years (3.0 FTE over 3 years).

Project Leader: Raymond Wong.

Participants:

- Making Sense of Data group
- Managing Complexity group
- Database start-up.

Key points:

- A succinct XML representation storage scheme has been defined and is practically optimal;
- Efficient query & update operators for the storage scheme are defined and built;
- Extensive benchmarking has been done;
- Linkages between the succinct XML storage and other APIs have been developed.

Progress:

- Proof-of-concept prototype completed
- Key patent application filed
- A complete software library has been built
- The project is positioned for & undergoing commercialisation
- Research outcomes published in top conferences and several best paper or best student awards have been obtained.

Milestones:

Date	Milestone
31/12/2005	XLM information storage
30/06/2006	1st prototype of XML storage
31/12/2006	Sub-optimal solutions of storing XML
30/06/2007	1st prototype of updatable succinct XML storage system
31/12/2007	Optimisation of updatable succinct storage
31/03/2008	Final report and demonstration

Validating Networks Semantics (VNS)

Topic: The existing global information infrastructure is extremely complex. It rests on network protocols (TCP, UDP, IP, with their sockets API). The infrastructure is very poorly understood with a consequent risk that the infrastructure we build today will be inadequate for the future.

Aim: To develop a formal specification for the important TCP/IP protocols that underlie the modern internet.

Duration: 2.92 years (0.6 FTE over 2.92 years).

Project Leader: Dr Michael Norrish.

Participants:

- Network Systems group
- Managing Complexity group
- University of Cambridge

Key points:

- Models will be expressed with a higher-order-logic proof assistant
- Readily usable by middleware designers and implementers
- Validating the models against the deployed implementations
- Integrating the models with programming language semantics, thereby supporting automated reasoning about executable distributed programs
- Using them as a basis for pre-hoc design work for future protocols, especially proposals for congestion control based on resource pricing.

Progress:

- Milestone 1 was achieved in that time period.

Milestones:

Date	Milestone
01/10/2007	Validated
01/10/2008	Principles reimplementations
31/03/2009	Specification notation
31/03/2009	Translation investigation

Video Analysis and Content Management for Surveillance (VACMS)

Topic: Intelligent digital video monitoring and management systems offer the potential to overcome many of the problems of traditional surveillance systems.

Aim: To develop new techniques, technologies and intellectual property (IP) in video analysis and content management that can be applied to digital video surveillance.

Duration: 2.58 years (2.8 FTE over 2.58 years).

Project Leader: Jian Zhang.

Participants:

- Making Sense of Data group
- Embedded Systems group

Key points:

- Video content understanding and representation (semantic and non-semantic) for surveillance: Five papers are published including one best conference paper on event detection.
- Image/video processing and analysis: Five papers are published and two NICTA patents are filed. The second best performance to segment the video shots in TRECVID 2005 competition. The top three tracking performance in participation in ETISEO: Surveillance Video Understanding Evaluation
- Scalable video coding for different channel capacities. Three papers are published in Intel. Conf. on Image Processing
- Our prototype platform of intelligent video surveillance system has been demonstrated in NICTA Techfest 2005-07

Progress:

Major milestones have been achieved including

- Robust background modelling and motion detection
- Human activity analysis and event detection in surveillance
- Surveillance software platform development
- Collaborate with SAFE Strategic Project

Milestones:

Date	Milestone
30/06/05	<ul style="list-style-type: none">• Produce requirement documents• Define multimedia file system and schema to be used for content annotation• Motion detection algorithm• Design client and server architecture• Develop algorithms for motion detection algorithm stage 1• Develop algorithms for object tracking stage 1• Research and develop algorithm for low-level feature analysis of surveillance video• Algorithm for object tracking from video sequences• Demonstration of database search based on features extracted from low-level features• Demonstrate unattended object identification• Conduct image/video similarity measurement research as fundamental research topic

30/06/2006	<ul style="list-style-type: none"> • Research and develop novel algorithm for object-based surveillance video analysis stage 1 (e.g. segmentation, object tracking and face detection) • Supervised machine learning algorithms to support surveillance video analysis • Develop algorithms for motion detection algorithm stage 2 • Develop algorithms for object tracking stage 2 • Define attended events and abnormal events in VACMS project • Take part in the EU project – ETISEO for evaluation of video scene understanding for surveillance • Develop a surveillance video content summarisation framework
30/12/2007	<ul style="list-style-type: none"> • Research and develop novel algorithm for object-based surveillance video analysis stage 2 (e.g. segmentation, object tracking and face detection) • Develop algorithms for motion detection algorithm stage 3 • Develop algorithms for object tracking stage 3 • Integration and system testing • Demonstration of video content management system

Visualisation and Analysis of Large and Complex Networks (VALACON)

Topic: Visualisation can amplify understanding and create new insights into large and complex networks such as biological networks or social networks.

Aim: To design, implement and evaluate a new, integrated framework of graph drawing algorithms in 2D and 3D for visualisation of large, complex networks.

Duration: 3.17 years (3.0 FTE over 3.17 years).

Project Leader: Seokhee Hong.

Participants:

- Making Sense of Data group
- Managing Complexity group.

Key points:

- Design/implement/evaluate new algorithms/methods for good visualisation of large complex networks
- Design/implement/evaluate new interaction methods for effective navigation of large and complex networks
- Integration of visualisation with analysis methods
- Push the boundary of 3D graph visualisation research
- Develop research prototype visual analysis tool GEOMI.

Progress:

2007:

- Design/implement/evaluate new methods for visualisation of social networks
- Design/implement/evaluate new methods for visualisation of biological networks
- Design/implement/evaluate new methods for visualisation of sensor networks

Milestones:

Date	Milestone
31/12/2004	GEOMI v.1 released
31/12/2004	VALACON scale-free networks
30/06/2005	Visual Comparison of Large and Complex networks methods
30/06/2005	Visualisation of Directed Graphs methods
31/12/2005	GEOMI v.2 release
31/12/2005	VALACON Clustered Graphs
31/12/2005	VALACON Social networks
31/12/2005	VALACON biological networks
31/12/2006	Visualisation and Analysis of Time-series networks
30/09/2007	Design/Implement/Evaluate methods for visualisation and analysis of Dynamic networks
30/09/2007	Release Visual analysis tool GEOMI version 4
30/09/2007	Design/Implement/Evaluate methods for visualisation and analysis of Multiple networks
30/09/2007	Develop VALACON2 Project (Visual Analytics)

Water Information Networks (WIN)

Topic: Water-related ICT infrastructure consisting of networks of sensor platforms, actuators and software can be constructed to greatly enhance efforts to achieve sustainable usage of the world's fresh water resources.

Aim: To develop innovative sensor network technology, based on the NICTOR sensor network platform, that can enhance efficient management of water resources, improve farm productivity and support sustainable use of this critical national resource.

Duration: 3 years (6.65 FTE over 3 years).

Project Manager: Gavin Thoms.

Participants:

- Making Sense of Data group
- Embedded Systems group
- Network Systems group
- Managing Complexity group
- Melbourne Water Research Centre
- Rubicon Systems Australia
- Daintree Networks
- Chipcon
- DPI

Key points:

- Development of the NICTOR wireless sensor network system for monitoring and control of water in agriculture, horticulture & viticulture, Field and Pilot Trials completed.
- Development of gamma version of plant model based closed loop control for irrigation (successful testing in dairy & viticulture environments).
- Demonstration of compatibility of NICTOR systems with solenoid valves & flow sensors for high pressure irrigation in horticulture & viticulture environments.
- 5 farms under NICTOR control, 45 ha dairy farm by end 2007. Large rice farming district in 2008
- Development of alpha version of NOSA middleware platform for multiple NICTOR network operation.
- Development of theory of fundamental limits of closed-loop control over low data-rate networks

Progress:

- All major milestones to date under the STI grant and development of NICTOR have been achieved

Milestones:

Date	Milestone
15/10/2005	Completion of initial NICTOR design
15/01/2006	Commencement of 2005/2006 irrigation season initial WSN field trials
15/07/2006	Completion and evaluation of 2005/2006 irrigation season initial WSN field trials
15/07/2006	Identification of sites for pilot WSN field trials for 2006/2007 irrigation season
15/07/2006	Installation, testing, commissioning and operation of prototype 2nd Generation WSN for horticulture trials

15/10/2006	Installation, testing, commissioning and operation of prototype 2nd generation WSN for dairy and viticulture trials
15/01/2007	Completion of Implementation Plan for Demonstrators, incorporating results from field and pilot trials
31/08/2007	Commencement of demonstrator trials of NICTOR sensor networks and Smart Water Control Systems in horticulture, viticulture & dairy operations
31/08/2007	Re-engineering of prototype systems to satisfy essential adaptations
30/06/2008	Completion of Demonstrator trials of NICTOR sensor networks and Smart Control Water Systems
31/08/2007	Commercialisation agreement
31/07/2008	Commercial release of NICTOR product
31/12/2007	Expected funding announcement - NWC
30/06/2008	Expected funding announcement - GMWPP

XQoS System (XQoS)

Topic: End-to-end Quality of Service (QoS) across heterogeneous networks.

Aim: To design, develop and evaluate end-to-end QoS technologies and protocols intended to satisfy the requirements of QoS-aware applications (i.e. voice over IP, video-conferencing, video-streaming) over multiple and heterogeneous research, scientific and industrial networks.

Duration: 3 years (1.6 FTE over 3 years).

Project Leader: Sebastien Ardon.

Participants:

- Network Systems group.

Key points:

- XQoS system will be developed in the framework of the EuQoS European Project
- The EuQoS project will deliver a flexible and secure QoS Assurance System (EuQoS system) for heterogeneous networks
- NICTA is focused on the system design and implementation of the transport layer solutions.

Progress:

- IREEL educational platform design, implementation up and running (<http://www.ireel.npc.nicta.com.au>)
- Designed, implemented and validated the first DiffServ-compliant transport protocol
- Designed, implemented and validated the first reliable TFRC-based transport protocol

Milestones:

Date	Milestone
31/07/2006	WP1: QoS service mapping
30/11/2007	WP2: QoS-oriented transport services
15/11/2005	WP3: Experimental framework
30/11/2007	WP4: Education and standardisation
31/12/2006	WP6: NICTA representation in EuQoS project