BOARD PAPER SUBMISSION

For Information

Author	Toby Walsh
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1 Overview

This paper provides a summary of the NICTA research portfolio during Q3 2010.

2 Research Objective

The NICTA Strategic Plan RESEARCH objective is to carry out research that is recognised for its excellence in advancing knowledge and generating breakthrough, user-focused technologies.

Our strategies are to:

(a) Review our research activities to the highest standards of international excellence (Toby Walsh)
(b) Focus our research efforts to maximise impact (Toby Walsh)
(c) Choose projects and partners that allow us to both advance knowledge and underpin the development of globally competitive products, processes and services (Toby Walsh)
(d) Provide NICTA researchers with world-class facilities and equipment (Phil Robertson)
(e) Raise funds and other contributions that ensure the longevity of NICTA's operations so that it can achieve its mission (Phil Robertson)

To deliver against our strategies, activities have been grouped under the following four categories in the 2010 Roadmap:

ι. Execute on existing projects to deliver world-class outcomes
ιι. Develop Theme research and future projects to world-class standards
ιιι. Improve research planning and execution processes
ιϖ. Drive new initiatives for research collaboration and strengthening areas of lab competency and impact

3 Issues

Due to the closure of the Cognitive and Organisational Systems Engineering (COSE) COMLEX subproject in QRL, the re-shaping of the Cognitive Engineering group is in action and has required a lot of attention.

Contributed staff David Hill will leave the ANU in Q4 to take the position of Energy Australia Chair at the University of Sydney. This has the potential to increase NICTA's linkages in the Smart Grid area. However, involvement of David in NICTA from the University of Sydney is yet to be negotiated.

The resignation of Liam O'Brien, who was the driver of NICTA's Service Migration Assessment (SMAT-AUS), is leaving the e-government team vulnerable in an area of strong potential for external engagement. A couple of strategies are being envisioned, including collaboration with CSIRO where Liam is joining.

3.1 Highlights and achievements

Prizes and Awards

Name	Lab	Award	Details	Awarding Body
Peter Stuckey	VRL	*Google Australia Eureka Prize for Innovation in Computer Science	Peter Stuckey won the prize for his new approach to combinatorial optimisation.	Australian Museum Eureka Prizes
Geoff MaIntyre	VRL	Australian Genome Research Award	-	Australian Society for Medical Research Victoria
John Judge	NRL	AIIA State iAwards	e-Learning category for the National Computer Science School	Australian Information Industry Association (AIIA)
John Judge	NRL	National AIIA i-Award, e-learning		Australian Information Industry Association (AIIA)
John Judge	NRL	Engineering Excellence Award		Education and Training, Sydney Division
Mark Reed	CRL	AIIA State iAwards	ACT Research and Development Category	Australian Information Industry Association (AIIA)
Mark Reed	CRL	iAward National Merit Award	InterfereX: Enabling efficient and low impact Femtocell Access Points for the 3G/WCDMA Market	Australian Information Industry Association (AIIA)
Antonio Robles-Kelly	CRL	Top Cited Article 2005-2010	Estimating the Surface Radiance Function from Single Images	Graphical Models - Elsevier
Duc Nghia Pham	QRL	Best Paper Award	Partial Weighted MaxSAT for Optimal Planning	The 11th Pacific Rim International Conference on Artificial Intelligence
Geoff MaIntyre	VRL	Best Presentation Award	"is-rSNP: A novel technique for in-silico regulatory SNP detection"	The 18th Annual International Conference on Intelligent Systems for Molecular Biology
Etienne Le Sueur, Aaron Carroll and Bernard Blackham	NRL	Won the Asia Pacific section of the Lantronix Design Competition	e4 Power Meter project	Lantronix Design Competition
Christian Drescher	NRL	Best Student Paper award	A translational approach to constraint answer set solving	International Conference on Logic Programming (ICLP)
Razibul Islam	VRL	3rd place in Best Poster competition	Simplified Millimeter-wave Radio-over-fiber System Using Optical Heterodyning of Low-cost Independent Light Sources and RF Homodyning at the	University of Melbourne UpSkills Poster Competition

			Receiver.	
Worapan Kusakunniran	NRL	Best biometrics student paper	Multi-View Gait Recognition based on Motion Regression using Multilayer Perception	20th International Conference on pattern Recognition held in Aug. 2010, Istanbul Turkey
Yan Shvartzshnaider	ATP	Best Poster	Persistent Content-based Publish/Subscribe Service On Top Of DHT	Future Internet Symposium 2010
Sarah Bull (winner) Priscilla Kan-John (finalist) Cindy Wang (finalist)	CRL	2010 Google Australia – New Zeland Anita Borg Memorial Scholarship	Rewards strong academic achievements and leadership in female undegraduate and graduate students	Google

*I would like to make special mention of the 2010 Google Australia Eureka Prize for Innovation in Computer Science awarded to Peter Stuckey. Peter received the award for his development of the 'lazy clause generator' which greatly improves the speed of complex decision making. This award recognises Peter's standing as a world-leader in the field of constraint programming and optimisation and is testament to the depth of talent within the lab and the quality of the engagement with the University of Melbourne.

Invited talks/keynotes

In this quarter, a total of 20 invited talks/keynotes were presented by NICTA staff. Toby Walsh (4), Gerwin Klein (4), Guido Governatori (3), Rob van Glabbeek (2), Penelope Sanderson (2), Max Ott (1), Stan Skafidas (1), Changbin Yu (1), , Brian Anderson (1), Ross Jeffery (1).

Noteworthy Appointments

Gernot Heiser was appointed to the ARC's ERA Research Evaluation Committee for Mathematical, Information and Computing Sciences.

Dr. Max Ott was invited to join the expert panel of the European Union PARADISO initiative.

3.2 New Research Initiatives

- The QRL Biosecurity research group led the project "**Automatic Identification and Screening of Red Imported Fire Ants**" in collaboration with Dr Craig Jennings of Biosecurity Queensland Control Centre, DEEDI, Queensland Government. This is an important external project, funded by both the Commonwealth Government and Queensland Government. The project could be extended in the future.

- The Advanced Surveillance (SAFE) team has started working on a new project with external support that will utilise the **checkpoint project for airport security**. This project will extend the automatic and unassisted enrolment of

individuals at one checkpoint and creates a temporary database that is used at the next checkpoint.

- VRL researchers will become official partners in the University of Melbourne's Science & Technology Initiative ***Radar on a Chip*** **grant** with a number of the GiFi team contributing expertise as a Theme activity. Lab Director Rob Evans is a member of the Steering Committee for the grant and this will enable him to take a more active research role in this exciting project, which also has the potential to inform the proposed *GreenCar* initiative.
- A National Science Foundation **(NSF) proposal**, in response to GENI solicitation was submitted by ATP researchers together with University of Massachusetts, University of North Carolina, U. of Texas, New York Polytechnic and Fraunhofer.
- The **revised Smart Transport and Roads (STaR) project** was approved by the RMCC. Based on recent interactions with the Road Traffic Authority (RTA), the project has updated its path to impact focusing on the ITS port in SCATS and a number of other new initiatives.
- The **Intelligent Fleet Logistics project** (follow on from the prior Atomic/G12 project) was approved by the RMCC. The project aims to deliver a transport management system (TMS), focusing on more strategic and tactical considerations, combining optimization with simulation and machine learning.
- The e-government team at CRL **started a new project with RPDE** (Rapid Prototyping, Development and Evaluation) in August. The project involves simulation and analysis of the ISR (Intelligence Surveillance and Reconnaissance) Integration Backbone and selection of SOA pilot projects. The total value of the project is $750K over six months.
- A **joint project "Workshop Explorer" with JDSC** (Joint Decision Support Center) in Fairban is in the final stages of approval and will extend the capabilities of the document analysis software developed by the ADA team. It will develop a tool that analyses the XML/text raw output of group workshop sessions and **helps identify when subgroups of participants have diverging issues or concerns**. The cash value of the project is $120K over nine months.

3.3 Research Progress

RMCC Project Updates

- The COSE PICTE (project term 1/9/2008 - 31/12/2011) team have completed the beta version of PICTE's Values Viewer software to assist prospective evaluation of ICT. Values Viewer is one component of the **PICTE software considered especially valuable by Queensland Health**.

- COSE ECHOMOD (1/9/2008 - 31/12/2011) has conducted field trials in September evaluating the **impact of advanced decision support tools** on the workload and **performance of air traffic controllers**. The trials examined effects of decision support, when air traffic controllers were placed under extremely demanding conditions. The results of these trials will allow Airservices Australia to evaluate the risks and benefits of the tool, and assess whether it is safe to deploy.

- Following on from the development of an initial interference model for wireless mesh networks in collaboration with Firetide. The Mesh Protocols (1/1/2010 - 31/12/2012) team performed an **extensive experimental validation of interference models** based on pair wise link measurements. The results highlight invalidity of key assumptions used in recently proposed models.

- G12 (5/2005 – 5/2010) is a platform for solving combinatorial optimization problems such as rostering and scheduling using advanced hybrid methods. This quarter saw the **first public release of G12** by VRL researchers, as a freely available academic version of the whole system for the linux and MAC OS X operating systems.
- The Water Information Networks (WIN) (7/2005-7/2008) team has deployed the *FarmNet* sensor network at Dookie Agricultural College. This **sensor network measures plant parameters** including soil moisture, sap flows in fruit trees and local micro climate. Remote sensing data from MODIS satellites is also available as a web service.
- The GiFi (10/2005 – 8/2009) team has completed a number of design and architecture tasks to **improve performance of the chip**:
    - The design of the next version of the 60-GHz RF transceiver has been finalised. It meets the WiGig standard and consumes around 650mW in transmitting and 350mW in receiving mode.
    - The design is for 65nm CMOS process, and includes a low-pass filter, a variable gain amplifier, an output buffer, and a received signal strength indicator.
    - A 60GHz Power Amplifier has also been designed for the 60-GHz transceiver.

- NRL Smart Transport & Road (STaR) (1/8/2005-30/11/2011) researchers have completed a report and demonstration for the NSW RTA using NICTA's algorithm for the **detection of people from thermal images for critical infrastructure protection**. NICTA has evaluated their algorithm on thermal video data captured by the RTA for this project. They have given very positive feedback in terms of the significant improvement of NICTA's algorithm over existing technologies. Negotiations for a commercial engagement in this area are underway.

- The Human Performance Improvement project (1/6/2007 – 31/12/2011) has developed a technique for **predicting future relay quality-of-service**, and

providing a "quality-of-service" flag for the IEEE 802.15.6 body-area-networks standard. The combination of accurate prediction, and reliable quality-of-service will allow for reliable relay selection in body-area-networks which will reduce packet loss (particularly for sleeping patients).

- AutoMap (1/12/2008 – 31/12/2011) has carried out a number of larger scale tests in Singapore and Hawaii with a new device that performs "**Telemetry over Audio**". This device samples GPS and accelerometer data and encodes it into an audio channel which is recorded by a common handycam. This enables the **capture of geolocated video data at a very low cost**, two orders of magnitude cheaper than rival methods. AutoMap will be performing a comparative study on the commercial basis of this device with Sensis in Q4.

- The DSIM project (1/8/2008 – 31/8/2011) has finalised the **data collection design of a user study for RTA traffic operators**. The design has been presented to the RTA.
- The Service Delivery and Testbed Framework (TEMPO) project (1/10/2008 – 30/9/2011) **released a new version of the NITCA OMF and OML software**.
- William Han from the Automated Data Analysis (ADA) (1/10/2007 – 30/9/2012) team developed a Named Entity Recognition (NER) module for ADA's document processing software. NER is a subtask of information extraction that locates and classifies elements in text into pre-defined categories such as persons, organisations locations, etc. **The new method has a more than 30% better recall** (proportion of the ground truth recovered) than popular third party systems LingPipe and OpenNLP.
- Edwin Bonilla finalised the engagement of the Automated Data Analysis (ADA) (1/10/2007 – 30/9/2012) CODE group with the Human Performance Improvement (HPI) project, providing two **machine-learning based algorithms for the characterization of swimming activities**. On a set of 30 professional and recreational swimmers, 96.62% of the laps are matched and 93.01% of the swimming styles are identified correctly. Even better performance is expected when more data becomes available. This result has been received with great enthusiasm by our commercial partner.

Theme Activity Updates

- SAT (satisfiability) solving is at the core of constraint programming, hardware and software verification and other more complex reasoning tasks. CRL researcher Jinbo Huang has developed **a new SAT algorithm that is proved to strictly exceed**, in theoretical power, the algorithm of **choice for the past decade**. Empirical investigations show that this additional power can translate into substantial practical gains.
- NRL graduate researchers Etienne Le Sueur, Aaron Carroll and Bernard Blackham completed a **remote power monitoring and metering system for use in homes and offices**. This project, called the e4 Power Meter, won the Asia

Pacific section of the Lantronix Design Competition and has been entered in the global competition with winners to be announced in October.

3.4 Connecting with others

- QRL's COSE PICTE team ran a half-day **workshop at the HISA Health Informatics Conference** on the Procurement process in healthcare. It was attended by around 50 people and provided an opportunity to canvass an issue that is at the core of the PICTE project.
- A series of **meetings have been held with Thales, Boeing, and CSIRO** and the COSE ECHOMOD team (QRL) to scope out new research initiatives. The objective is to develop a consortium of R&D providers, systems developers, service providers and regulators to work on the development of the future airspace system.

- **Advanced Computational Proteomics** (ACP) is now officially a QRL activity in close collaboration with Griffith University Institute for Glycomics (one of the world class centre in rational drug design). The full RMCC proposal on using search to enhance the pre-discovery phase of rational drug design is being revised.

- NRL has delivered the final **Research Services Agreement between NICTA and Open Kernel Labs.**

- The VRL Networked Systems team has been working with the Institute for a Broadband Enabled Society (IBES) at the University of Melbourne on collaborative research activities focusing around **cost and network modelling for the National Broadband Network** (NBN). The research activity is to develop design methods for and provide a cost estimate of the NBN. One of the key focuses of the project is to address the issue of how and where the 90% (or more) fibre-to-the-premises (FTTP) coverage will be attained.
- VRL Managing Complexity researchers have been looking at gait and movement analysis for hospital and rehabilitation patients. In conjunction with the Royal Talbot Rehabilitation Centre (Austin Hospital), Royal Melbourne Hospital and Southern Health, a **submission for Market Validation funding has been made** to the Department of Innovation, Industry and Regional Development (DIIRD) under the *Smart SMEs Program*.

- The Trusted Networking project's collaborative work with I2R in Singapore was **showcased at the 2R Techfest in Singapore.**
- A participant meeting for the **Future Logistics Living Laboratory** was held at ATP in August.

- The Business Adaptation and Interoperation project commenced a **R&D Services engagement on Cloud Computing evaluation with AMP**.
- CRL PhD student Elena Kelareva, working with Melbourne company OMC International, has developed and installed DUCK Optimiser, a **ship scheduling application for Port Hedland, Australia's biggest iron ore port**. The application is built using MiniZinc, the open source part of NICTA's G12 programming platform.
- Professor Bruce Thomas, Director of the University of South Australia Wearable Computing Laboratory visited and discussed potential **collaboration.** A subsequent visit by Dr Ross Smith is guiding the VIBE project to develop a fully wearable unit for the human trials of bionic eye assisted navigation.
- The wireless relay demonstration for Human Performance Improvement generated substantial interest from a number of delegates at EU ICT2010. Leif Hanlen presented outcomes and potential of the wireless aspects of HPI to IMEC in Leuven. Initial **collaborations between HPI@NICTA and the WATS@IMEC group have commenced**.
- Leif Hanlen, Dino Miniutti and Daniel Lewis met Peter Bradely from **Zarlink** in CRL, **to initiate contract research** as part of the HPI-wireless new approach to contract R&D.
- **AutoMap** presented to an ensemble of Telstra Executives in Sydney at the "**Telstra Innovation Challenge Day**". Although not selected for support under this program, the Telstra CTO contacted us, investigating other means to get involved with AutoMap.
- In July, CRL participated **in the Shanghai World Exposition,** where Nick Barnes and Chunhua Shen presented the Vision Processing for the Bionic Eye Project. The audience included representatives of C-Sight, the Chinese bionic eye project. This was followed in August by the **visit of the ACT chief Minister to CRL and a briefing of the Deputy Chief Minister,** focusing on NICTA's activities in smart infrastructure and health, respectively.
- The **CRL Technet** on September 15, opened by Deputy Chief Minister Katy Gallagher attracted **over 150 participants** from Industry, government and academia. Media coverage that followed included articles on Vision Processing for the Bionic Eye and Human Performance Improvement.

3.5 Research Grants

- Jian Zhang's request for **funding from Microsoft Research Asia** has been approved for 2010-2011 and the first instalment of $A53k paid. This grant has the option to be extended for a three year term. This is for research into video-based action indexing for use by online video search engines.

- NICTA has signed an **MOU with Microsoft Research** who will provide access to $1.5M in-kind of Azure Cloud Computing resource. Dr Anna Liu will coordinate

this initiative. The Business Adaptation and Interoperation (BAI) and possible Smart Mobile Content Distribution project will benefit from these resources.

- **Two further research grants were awarded** to the Decision Support for Incident Management (DSIM) project team by the U.S. Air Force Office of Scientific Research (AFOSR).

- NICTA was a partner of a **successful Marie Curie IRSES proposal** with ITI-CERTH in Greece, University of Pierre Marie Curie in France, New York Polytechnic, the Nile University of Egypt and the Abdelmalek Essaadi University of Morocco.

4 Tracking

α) **Roadmap Q3 2010 with AAP milestones highlighted in yellow**

Type of Activity	Activity	Milestone	Status
Execute on existing projects to deliver world-class outcomes	Annual review of projects	Projects to identify scientific and technological challenges and make substantial progress.	**Milestone met.** The annual review of projects by the executive team was completed in Q2. With the exception of one sub-project - which will now be closed - projects have all progressed as expected. Each project leader has participated in a follow up meeting with the Scientific Director to identify clear project milestones for the future.
	Ensure all projects have clearly and explicitly articulated targeted impacts and credible paths to achieve them	Identify and articulate in the project term sheets each project's desired impact and paths to impact	**Milestone met:** All projects have revised term sheets, with more concrete research milestones. New commercial milestones and external engagements have also been added in many cases to the term sheet.
	Build and leverage resources and collaborations to address the challenge and impact effectively	Identify and articulate the key relationships we have and what they contribute to the scientific and technological challenges and end user impact	**Milestone partially met.** Impact areas have been identified. Engagement milestones added to projects' termsheets to identify key relationships and develop new ones where appropriate over the next 12 months.

Develop Theme research and future projects to world-class standards	Develop, publish and execute the NICTA Research Theme visions	Publish NICTA's long term scientific and technological research vision (AAP)[1]	**Milestone met.** Theme Visions outline the areas in which NICTA will focus its efforts in the future to make a global impact. The theme visions are published on the external website. http://www.nicta.com.au/research/research_themes
		Disciplines (which make up the Themes) explicitly represented on external web page. [2]	**Milestone met.** Each of our five labs has a unique combination of expertise and critical mass in a number of disciplines. The disciplines are published on the external website. http://www.nicta.com.au/research
	Articulate and strengthen NICTA's targeted research competencies	Publish NICTA's targeted research competencies [3]	**Milestone met.** Each Lab has identified a small number of research disciplines describing their main research competencies.
Improve research planning and execution processes	Improve the quality of research project proposals, reviews and term sheets.	Falsifiable evidence for all aspects (scientific challenges, end user impact, and linkages captured within each term sheet after project reviews [4]	**Milestone met.** In close consultation with the Scientific Director and Commercialisation unit, projects have prepared new termsheets outlining scientific, commercial and linkage milestones.

1 Carried over from Q2 2010 – Milestone not met
2 Carried over from Q1 2010 – Milestone partially met
3 Carried over from Q2 2010 – Milestone not met
4 Carried over from Q2 2010 – Milestone partially met

		Enforcement of actions coming out of project reviews.	**Milestone met.** The actions to come out of the project review process are tracked by the Project Management Office (PMO). Actions were resolved at the follow up meeting and any future issues have been captured as milestones in the updated termsheets.
		Adapt project review process to more explicitly assess quality of project management (give a score).	**Milestone met.** As a part of the review process projects are given a Project Value Rating score for scientific excellence. One of the factors considered in this dimension is quality of the research team and the ability to deliver.
Drive new initiatives for research collaboration and strengthening areas of lab competency and impact	Identify and build internationally competitive areas of NICTA lab competency and impact	Set targets for projects and $ within identified lab foci [5]	**Milestone partially met.** As a first step, each lab has identified its main areas of research competency. The next step will be to develop some initiatives to promote international collaboration in these areas.

[5] Carried over from Q2 2010 – Milestone partially met

a) Quarterly Board reporting research metrics

	Q1	Q2	Q3	Q4
Number of active projects in this quarter	20	22	22	
Average size of project budgets	$0.98M	$0.90M	$0.87	
Number of projects >$1M/year	6	6	6	
Number of project proposals submitted in this quarter	4 *(counting G13 as 3 projects)*	2 *(Mobile Content, STaR)*	1 *(Green Car)*	
Number of new projects initiated	3 *(AI for the Smart Grid, Mesh Protocols, SCENT)*	3 *(Scalable Vision Machines, Bionic Eye, Smart Mobile Content Distribution)*	0	
Number of projects closed during this quarter	0	1 *(CPP/G12)*	0	