Airports of the Future Project
Annual Report 2011
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Letter from Project Director

Following a busy 2010 in which the Airports of the Future project truly got underway, establishing a suitable mode of operation, and spending considerable time engaging with a wide range of the supporting aviation industry partners, 2011 has seen a consolidation of the progress of the first twelve months. Significant focus has been placed this year on how the various research areas can come together to enhance the impact of the research outcomes for both the scientific community and the aviation industry here in Australia.

The success of the Airports of the Future Pilot Project was further acknowledged this year when the project team was awarded the 2011 Engineers Australia QLD Division Engineering Excellence Awards for Research & Development. It was an honour to accept this award on behalf of the nominated team – Professor Vesna Popovic, Associate Professor Renata Meuter, Professor Michael Rosemann, Associate Professor Clinton Fookes, Professor Ashantha Goonetilleke and Mr Stephen Goodwin – at the awards dinner in October in front of many of our engineering peers. It was a reflection that even though our approach does not follow traditional engineering approaches, the project’s multi-disciplinary nature is widely regarded, and will hopefully set a benchmark for the way engineering projects are carried out in Australia in the years to come.

The Airports of the Future project was also nominated for the 2011 Business-Higher Education Round Table Award for Research & Development Collaboration, which was announced in Melbourne in November. Whilst the project was not successful on this occasion, I was impressed to see so many outstanding research collaborations like ours currently underway in Australia. I would like to take this opportunity to thank all of our valued industry partners for their assistance in preparing this nomination, and no doubt we will try again in the future when the outcomes from the project have had a chance to make more of an impact on the industry.
Last year I was able to report the success of the team in securing more funding from the Australian Research Council to establish a command and control research facility which will be used to enhance the outcomes of our research. I am pleased to announce that Stage 1 of the delivery of equipment (which includes a surveillance camera network, a biometric walkthrough portal, boarding pass scanner and the main command and control infrastructure) is due to take place in mid 2012. I look forward to the grand opening of this facility with you all at an event later in 2013 at our new $230M Science and Engineering Centre.

Within the pages of this second Annual Report for the Airports of the Future project, we provide information about the project and its seven research areas, briefly documenting the research activities that have been undertaken and the associated progress made to date. In particular, we aim to highlight the key milestones and how these relate to both academic and industry deliverables. We also provide full details of our industry engagement activities undertaken throughout 2011, and trust this shows our continued desire to involve our partners closely to ensure project outcomes remain relevant to the air transport industry.

A new era in the Airports of the Future project will be ushered in in 2012, as a series of changes within QUT come to fruition, and we see ourselves operating within a merged faculty which brings a number of our research areas together, but also sees some migrate to other faculties. Consequently, there will be changes within the core project team, and I’d like to say a big thank-you to all of those who have been part of the journey thus far but will be moving on in 2012, and I wish you all well in your new endeavours. In the meantime, we are working to ensure these changes have minimal impact on the project’s progress.

I would like to take this opportunity to thank you all again for your generous support of the Airports of the Future initiative, and I look forward to working with you all again in 2012.

Professor Prasad KDV Yarlagadda
Letter from the Industry Advisory Committee

It is with great pleasure that I write to you again in the Annual Report for 2011, as Chair of the Industry Advisory Committee (IAC) for the 'Airports of the Future' project.

I must say it was a pleasure to see such a large proportion of our industry partners present at the 2011 AOTF Research Grand Showcase in February. The presentations that were given from the research team and industry representatives alike gave us plenty of food for thought. In particular, it was great to have Mr Paul Behan from IATA present on some of the current initiatives that are being tackled from the passenger experience and security perspectives. I am very much looking forward to a follow on event like this in the early part of 2012.

Reflecting over the past three years, I see the IAC as having had a particularly valuable role within this international collaborative project. This year, the IAC has been particularly influential in guiding how the project communicates outcomes to the partners, and in the coming years, the IAC will play a very important role in making decisions related to the commercialisation of some of the outcomes, particularly technology-related outputs such as those developed by the Intelligent Surveillance research.

One of the key outcomes from this particular research area will no doubt emerge in the coming months as the research team prepare for a trial period monitoring the Entry Control Point queues for the Australian Customs & Border Protection Service at Brisbane Airport (initially). This demonstration will hopefully show to all the stakeholders the value in the research being undertaken, and will provide Customs with a new way of reliably measuring their performance in this key area of the international arrivals process.

One of the key roles of the IAC is to ensure the research is exposed to the wider aviation community in Australia. This year, it was great to see the research team involved so heavily in the Office of Transport Security Front of House Security
Forum in Canberra in September. This event gave the team an opportunity to provide some fresh views on some of the key issues in front of house security related to human-centred design, surveillance technology, and business continuity and incident response planning. I must credit Paul Retter and his team for ensuring this exposure to a wider audience of industry professionals of this exciting research was possible.

Another role of the IAC is to arrange and approve the addition of new partners to the project that bring real value to our already large base of knowledge and source of research challenges. Whilst 2011 didn’t add any new partners to the existing team, I look forward to hopefully welcoming a couple of major new additions in early 2012.

As the IAC chair, it was pleasing again to see the success of the Airports of the Future Pilot Project rewarded for the work done at the security screening point in this year’s Engineers Australia Engineering Excellence Awards. The process of preparing this submission gave Brisbane Airport an opportunity to reflect on the direct impacts this work had on our operations and planning cycles, and we were very impressed by the quantitative outcomes. I would encourage all of our partners who have made changes to their operations or planning as a result of the research recommendations to have a careful look at what impact this has had on your business – I’m sure you’ll be pleasantly surprised by the numbers!

Like the current changes going on within QUT, so too are there changes afoot amongst our industry partners, and in particular the members of the IAC. I would like to take this opportunity to thank Jan Dorrington (Customs) and Steve Grant (AFP) for their ongoing support over the past two years, and wish you well in your new roles in 2012. I look forward to working with those senior staff within these two organisations who will step into these roles.

May I take this opportunity to thank all industry participants and QUT again for the fantastic collaboration we have in place, and for the incredible outcomes being produced now and in the coming years for all of us to utilise, learn from and truly prepare us for the ‘Airport of the Future’.

Stephen Goodwin
Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFP</td>
<td>Australian Federal Police</td>
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<td>AIM</td>
<td>Airport Information Modelling/Model</td>
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<td>AOTF</td>
<td>Airports of the Future</td>
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<td>AQIS</td>
<td>Australian Quarantine and Inspection Service</td>
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<td>BAC</td>
<td>Brisbane Airport Corporation</td>
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<td>BARA</td>
<td>Board of Airline Representatives Australia</td>
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<td>BCM/IRM</td>
<td>Business Continuity Management/Incident Response Management</td>
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<td>BNE</td>
<td>Brisbane Airport</td>
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<td>BPM</td>
<td>Business Process Management</td>
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<td>CBR</td>
<td>Canberra Airport</td>
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<td>CCTV</td>
<td>Closed Circuit Television</td>
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<td>CS</td>
<td>Complex Systems</td>
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<td>Customs</td>
<td>Australian Customs &amp; Border Protection Service</td>
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<td>DIAC</td>
<td>Department of Immigration and Citizenship</td>
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<td>EBP</td>
<td>Evidence-Based Practice</td>
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<td>ECP</td>
<td>Entry Control Point</td>
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<td>HS</td>
<td>Human Systems</td>
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<td>I&amp;AM</td>
<td>Identity and Access Management</td>
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<td>IAC</td>
<td>Industry Advisory Committee</td>
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<td>IATA</td>
<td>International Air Transport Association</td>
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<td>IDM</td>
<td>Identity Management</td>
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<td>IS</td>
<td>Intelligent Surveillance</td>
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<td>KPI</td>
<td>Key Performance Indicator</td>
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<td>MCY</td>
<td>Sunshine Coast Airport</td>
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<td>MEL</td>
<td>Melbourne Airport</td>
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<td>OOB</td>
<td>Object-oriented Bayesian Network</td>
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<td>OOL</td>
<td>Gold Coast Airport</td>
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<td>OTS</td>
<td>Office of Transport Security</td>
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<td>PACS</td>
<td>Physical Access Control System</td>
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<td>PER</td>
<td>Perth Airport</td>
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<td>QUT</td>
<td>Queensland University of Technology</td>
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<td>RFID</td>
<td>Radio Frequency Identification</td>
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<td>Transport Security Program</td>
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<td>The University of Melbourne</td>
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<td>UTS</td>
<td>University of Technology Sydney</td>
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About Airports of the Future

‘To provide a highly-respected multi-disciplinary platform for holistic knowledge discovery and problem solving for the continuous improvement of airport operations’

The Airports of the Future project (ARC Linkage LP0990135) aims to improve the safety, security, operational and resource efficiency, and passenger experience within Australian airports by developing a ‘whole-of-airport’ approach to design, management and operation of the airport system. The project has been built on a strong history and track record of research collaboration between QUT and several of the current partners. This is particularly true for the substantial alliance between QUT and the Brisbane Airport Corporation (BAC) which was recognised by the Business Higher Education Round Table (BHERT) in 2006 as Australia’s most successful research and development collaboration. This strong relationship was exemplified through the Airports of the Future Pilot Project which ran during 2009 which won the 2011 Engineers Australia QLD Division Engineering Excellence Award for Research & Development. The current collaboration includes six research institutions led by QUT, domestic and international airports, international airlines, government stakeholders, service providers and other aviation industry bodies.

Taking a whole-of-industry approach ensures that all aspects of airport operations and design are being considered simultaneously, enabling individual components of the airport system to be modelled, but more importantly for the interactions between each of these systems to be better understood. This integrated approach will enable industry participants to balance and effectively manage the often conflicting objectives of security, efficiency and the passenger experience.

Outcomes of the project will enable flexible and adaptable design in recognition that the airport environment is continually changing in response to government policy and regulations, environmental considerations, as well as technology and the expectations of the travelling public. Project outcomes will be scalable, enabling findings, developed technology applications and design guidelines to be adopted by partners regardless of their operating characteristics. These outcomes will ultimately provide aviation industry participants with the capabilities to identify and manage interdependencies between airport systems, with the goal of improving airport design practices, operational efficiency and effectiveness, and the passenger experience, as well as reducing the cost of mandated security and cultivating flexibility to ensure the sustainable growth of airport operations.
Industry Advisory Committee

The Airports of the Future IAC is chaired by lead Partner Investigator, Mr Stephen Goodwin (BAC) who represents the airport sector. Other committee members comprise executives and senior managers from established research partners within the project. This includes members from the research sector, security and policing agencies, regulators, border protection agencies, domestic and international airports, and airlines.

The IAC is strategic in focus and has the following responsibilities:

- to offer the Program Committee (project Chief Investigators and Partner Investigators) informed advice on the strategic and timely development of the project;
- to ensure partnership management and communication of results to all stakeholders as appropriate;
- to ensure protection of all intellectual property and identify potential commercialisation opportunities;
- to review and approve research outcomes for release to the general public;
- to ensure partner organisation, stakeholder and community ownership and accountability of the project; and
- to offer stakeholder perspectives and reviews on the functions and operations of the research.

The committee meets three times per year when possible.
2011 Committee Members

Jan Dorrington (Australian Customs and Border Protection Service)
Paul Retter (Office of Transport Security, Department of Infrastructure and Transport)
Steve Grant (Australian Federal Police)
Simon Gandy (Melbourne Airport)
David Blackwell (Rockhampton Airport)
Agnieszka Holland (Department of Immigration and Citizenship)
Prasad Yarlagadda (QUT)

2011 Meetings

10 February, 2011 – Brisbane Airport Corporation
30 June, 2011 – Melbourne Airport
Project Management Team
The role of the project management team is to ensure the smooth delivery of project research to the academic and aviation communities. In particular, this involves the creation of protocols surrounding the handling of sensitive industry-specific data, the submission of academic papers (to ensure no confidential information has been disclosed), and communication through media channels. The project management team operates under the guidance of and in close cooperation with the IAC.

Project Management Team
Professor Prasad Yarlagadda (Project Director)  
Professor Michael Rosemann (Industry Liaison)  
Associate Professor Clinton Fookes (Technical Director)  
Vikas Reddy (Research Fellow/Project Officer)  
Ruth White (Project Coordinator)

Research Team
Chief Investigators
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Ed Dawson  
Robin Drogemuller  
Clinton Fookes  
Priyan Mendis  
Kerrie Mengersen  
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Vesna Popovic  
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Nara Srinivasan  
Prasad Yarlagadda

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Simon Denman  
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Tristan Kleinschmidt  
Ben Kraal  
Ruan Lakemond  
Samia Mazhar  
Jason Reid  
Paul Wu

Partner Investigators
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John Hansman Jr (MIT)

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Sam Amirebrahimi  
Alina Bialkowski  
Marisa Camastral  
Andrew Cave  
Xin Cheng  
Michael Devine  
Charisse Farr

Partner Investigators
Anna Harrison  
Phil Kirk  
Alison Livingstone  
Wenbo Ma  
Jegar Pitchforth  
Shahrzad Roohy Gohar  
David Ryan  
Sivalapan Sabesan  
Sarah Shuchi  
Nimal Skandhakumar  
Levi Swann  
Ehsan Zare Borzeshi  
Jingxin Xu
Collaborative Research Partners

University Partners

[Images of university logos]

Airport Partners

[Images of airport logos]

Airline Partners

[Image of airline logos]

Australian Government Partners

[Images of government logos]

Service Providers and Representatives Bodies

[Images of service provider logos]
Summary

Airports, as part of international transportation networks, epitomise the notion of a complex socio-technical system characterised by interdependence. Contemporary airport operations have to deal with the tensions between the timely flow of passengers, the success of commercial business and the effective detection of potential terrorism and criminal activities. As an example, the increased focus on airport security in recent times has often come at the expense of passenger facilitation. Processing people and goods through inspections causes bottlenecks, impedes flow and heightens stress for passengers and staff, thereby adversely effecting passenger experiences and commercial operations. This has resulted in airports which are seen as obtrusive, inefficient and has led to an increasing trend of discontented passengers.

The Airports of the Future (AOTF) project (ARC Linkage LP0990135) aims to improve the safety, security, operational and resource efficiency, and passenger experience within Australian airports by developing a ‘whole-of-airport’ approach to design, management and operation of the airport system. To support this, the research team—comprising six research institutions led by Queensland University of Technology (QUT)—has been collaborating with a range of aviation industry participants including airport operators, airlines, government agencies, service providers and industry representation bodies. Taking a whole-of-industry approach ensures that all aspects of airport operations are considered and catered for, enabling individual components of the airport system to be modelled, but more importantly for the interactions between each of these systems to be better understood and modelled. This integrated approach will enable industry participants to balance and effectively manage the often conflicting objectives of security, efficiency and passenger experience.

The project also brings an integrated complex systems approach with a broad cross-disciplinary team examining aspects across people, technology,
process, spatial and information domains. There are currently seven broad areas of research focus: Airport Information Modelling (AIM), Business Continuity and Incident Response Management (BCM/IRM), Business Process Management (BPM), Complex Systems (CS), Human Systems (HS), Identity Management (IDM), and Intelligent Surveillance (IS).

Outcomes will provide capabilities to identify and manage airport interdependencies, with the goal of improving airport effectiveness and cultivating the flexibility for the sustained growth of airport operations. The deliverables of this project will be transferable to other complex socio-technical systems providing the potential to transform a range of Australian critical infrastructure and transportation hubs.

During the life of the four year project, outcomes will be progressively generated in five general areas of interest to the air transportation industry: Operations Management, Border and Aviation Security, Passenger Experience, Terminal Design and Incident Response. Progress has been made in each of these areas, although some areas have seen more progress to date due to the nature of the problems and the research methodologies required to address these. Outcomes involving input from multiple research areas are beginning to emerge, and these will gather momentum in the next two years of the project.
Research Update

After a successful launch in 2010 in which the Airports of the Future ARC Linkage Project officially commenced, the project website was made public, initial research data collection activities took place, and the first partner workshops were held in Brisbane, 2011 was much more a year of consolidation. Throughout the year, the research team has been very busy analysing data collected during 2010–11, spending more time visiting partner airports and other organisations, and starting to produce recommendations and outcomes which will be of value to partners in the years to come.

Following on from the December 7, 2010 research workshops and showcase, 2011 kicked off with a full-day ‘Research Grand Showcase’ at QUT in February, despite the January floods closing down a number of our key facilities! This event was very well attended by the industry partners, as well as airport delegates from as far away as Belgium, Sweden and The Netherlands. Following the welcome by Professor Martin Betts, and Ms Julieanne Alroe (CEO, Brisbane Airport Corporation), the core activity for the day was to demonstrate the progress made by the team throughout 2010, with particular emphasis on research activities which are taking place across the seven disciplines in order to develop holistic solutions for airport design, operations and management, which is what makes this project so unique. Attendees were also treated to a number of keynote speeches:

- Mr Paul Behan – Head of Fast Travel Program, International Air Transport Association (IATA) – spoke about current trends in airline service innovations;
- Mr Stephen Goodwin – General Manager, Operations, Brisbane Airport Corporation (BAC) – questioned the airport of the future, and provided an industry response to the ever changing aviation environment;
- Ms Jan Dorrington – National Director, Passengers Division, Australian Customs and Border Protection Service – provided government perspectives on passenger facilitation; and
- Ms Karly Pidgeon – Acting GM, Supply Chain & Screening, Department of Infrastructure and Transport – discussed the need for working together to achieve aviation security.
For the remainder of 2011, the project team has continued to engage closely with project partners, and the impact of this interaction has led to a number of glowing testimonials for partner representatives (some of which can be found throughout the pages of this report). Some particularly important engagements have come with the Australian Customs and Border Protection Service, Melbourne Airport, and Brisbane Airport, just to name a few. A full list of engagement activities can be found later in this report.

A key sub-project that is currently in the preparation stage is to do live performance monitoring for Australian Customs and Border Protection Service of the queues at the Entry Control Point. This will be achieved through a combination of previously-demonstrated CCTV analytics, namely the ‘virtual gate’ and soft-biometrics, and will enable Customs to monitor individual passenger times in the ECP, and will ultimately play a role in the whole-of-airport performance framework being pursued by the National Passenger Facilitation Committee. This prototype trial will run at Brisbane International Terminal for approximately six months in early 2012, and if successful will be extended to Melbourne Airport and others later in 2012.

One of the other ongoing activities within the project has been the placement of PhD students in the airports. There have been a number of students undertaking this type of engagement at Brisbane Airport, Gold Coast Airport, and soon to be Melbourne Airport. Whilst these activities are primarily data collection in nature, there is plenty of opportunity for mutual gain. In particular, the placement of PhD students from the Business Continuity and Incident Response Management program have been able to provide advice on the design of risk and compliance report protocols, design and specification of handbooks for risk and compliance reporting, design and implementation advice on corporate risk registers, and analysis and specification of needs for operational knowledge management. These types of outcomes can only be achieved through mutual engagement, and we thank our industry partners for opening these opportunities to our students.

It was a pleasure again to see the success of the Airports of the Future Pilot Project given glowing public appraisal when the project team was announced as winners of the 2011 Engineers Australia Qld Division Engineering Excellence Award for Research & Development ahead of some very impressive entries. This award was based on the outstanding impact this project had on the security screening point at Brisbane.
Airport. This exercise highlighted to personnel at BAC some of the numbers that this equated to, including an 80% reduction in average waiting times at security (from 20 minutes to 3.9 minutes), increase in passenger throughput from 260 pax/hr to 340 pax/hr, and a reduction in security operation costs by 20% (to name a few). We are looking to see if similar impacts can be made across our other partner airports in the years to come.

In 2010, we announced the successful bid to establish an ‘Integrated Command and Control Facility for Large-Scale Critical Infrastructure Management’, with initial focus on airport passenger processing. During 2011, we have spent considerable time finalising equipment lists, placing purchase orders, identifying locations for the equipment, and also undertaking basic training for use of the software. The initial installation will take place in mid 2012, with full installation later this year and early 2013. Research Grand Showcase. More details on this facility can be found within the pages of this annual report.

This year we also initiated a monthly seminar series in order to increase the level of mutual understanding of technical disciplines within the project. The primary goal of this activity is to enhance the cross-program collaboration which will result in holistic outcomes for both the Australian aviation industry and the academic community.

The following pages provide an update of the milestones and achievements for each of the individual research areas for 2011. In addition to these activities, the research team has undertaken a number of research-oriented workshops involving all team members. These were culminated in a two-day aviation research retreat at Mt Tamborine which focussed on getting the maximum output from the existing project, whilst also discussing the strategic future of aviation research at QUT beyond the Airports of the Future project.

During 2011, the project team also focussed on how our reporting mechanisms can be improved. As part of this, and in response to suggestions from members of the Industry Advisory Committee, we implemented a traffic light report against each of the deliverables in order to provide a better indication of the project’s cumulative progress in each of these areas of interest. We have also looked at the concept of impact statements as a more marketable form of communication, and these should become more prevalent in the coming years. Finally, instead of providing lengthy milestone reports all the time, as part of the Intelligent Surveillance research, a discussion paper was released in order to get partners more involved in the research, and to ensure that the fundamental concepts that are being developed have relevant end-uses. Thank-you to all who took the time to respond to that particular discussion paper.
Integrated Command-and-Control

In December 2010, Chief Investigators of the Airports of the Future project were successful in a bid to the Australian Research Council Infrastructure, Equipment and Facilities scheme. This funding, commencing in 2011, was to establish an ‘Integrated Command and Control Facility for Large-Scale Critical Infrastructure Management’ (LE110100023). This grant aims to create a state-of-the-art test-bed for sustainable critical infrastructure operations research in a wide range of applications with a major focus on airport operations.

The benefit of this facility for the Airports of the Future project and its partners is that it allows the research team to integrate research outcomes with existing commercial systems and hardware. This opens up a range of new testing and development opportunities which can be performed in a live but non-critical environment.

This test-bed will also be the first publicly available facility of its kind in Australia.

This facility will be housed within the new Science and Engineering Centre at QUT’s Gardens Point campus which is due for completion by late 2012. Two remote sites connected to the facility will also be located at partner locations: The University of Technology Sydney, and The University of Melbourne.

Airports command-and-control centre concept – ‘Airport without a Runway’.
Facility Benefits to the Airports of the Future Project:

- the aggregation of data across independent airport systems through a common command and control platform.
- practical integration and implementation of research outcomes into future operational systems.
- to provide a solution for demonstration and communication of some research outcomes to end-users.
- the migration and integration of data from external airport sites into QUT.
- to provide a platform for future development and an avenue for potential commercialisation and knowledge transfer.

This facility will be operating a leading commercial solution for command and control and incident response management called Siemens Vantage. As part of this Project, Siemens Australia and Siemens Global have made a commitment to the Airports of the Future Group of software licensing for Vantage (core license). This offer extends to all industry and government partners.

Project Contacts: Professor Prasad Yarlagadda, Associate Professor Clinton Fookes.
Summary

The Airport Information Model (AIM) is targeted to help improve operations management in an airport setting. AIM is designed to minimise operational risk, improve regulatory compliance and allow safe execution of routine business activities by staff. The model will integrate information systems and data stores concerning all aspects of the airport within 3D models of the airport structure. We are also investigating how AIM could enable better visualisation and interaction with a range of airport systems.

AIM will provide decision support for airport operations including alerting and assisting in emergency response scenarios, supporting airport performance monitoring, and synthesising surveillance data feeds and related analytic capabilities. These capabilities will also be extended to support airport design. The model will also integrate damage assessment tools for bomb responders and security planners to determine probable effects of explosive devices inside airport passenger buildings. Where relevant, performance metrics may be included in the 3D visual environment. This system will be combined with a federated identity and access management (I&AM) system to ensure that the data and tools are accessible only by authorised users.

Research Progress

- Completion of a paper that introduces the concept of using a building information model as a graphical tool to support spatial access control configuration and management; this documents a survey of existing spatiotemporal models and proposes an appropriate authorisation architecture.
- Review of interoperability standards for Physical Access Control (PACS) systems to support visualisation and graphical configuration of PACS rules using the AIM.
- Preparation of two advisory reports: (i) Selected Approaches to Resilience: With Reference to Airport Functioning; and (ii) Creating Reliability in Airports (The Application of Issues from Theory into Practice).
Implications for Industry

- A concept of operations and authorisation architecture has been developed which utilised a 3D model of an airport to enhance the management and configuration of physical access control systems and software applications (including facilities management, asset management, CCTV etc.). This concept has been developed with input from personnel from Brisbane (BNE) and Melbourne (MEL) Airports who have provided positive feedback on the benefits of the proposed design.

Looking Ahead

The model will work in conjunction with all parts of the Airports of the Future project and will facilitate:

- Network modelling, the ‘whole-of-airport’ network model which will inform decisions around planning, design and operations.
- Simulation and assessment of changes to processes within the airport and the impact this would have on passenger facilitation, as well as other aspects such as spatial configuration and screening technology.
- Process models developed by the business process management team, built in to inform a comparison of processes and create a reference tool that can inform best-practice process pathways incorporating considerations such as full service vs low cost, international vs domestic.
- Development of intelligent surveillance candidate crowd-based measures derived from CCTV feeds specifically for measuring and managing queues.

Your study and subsequent process mapping of our outbound international passenger process has assisted us in better understanding the issues that surround this activity.

... would use this to develop our International Airline Standard Operations Procedures (SOP).

David Blackwell – Strategic Manager
Rockhampton Airport
Summary
Optimising passenger experience and human interactions with operational and security systems in airports is a key research goal of the Human Systems and Business Processing research teams.

An understanding of current passenger behaviour is a necessary first step towards innovation. To this end, our observational research has focused on developing a comprehensive taxonomy of passenger activities in the airport. Recommendations for improving passenger preparation at key checkpoints will emerge through observation of passenger interactions with existing airport environments. In addition to the observational approach, we are also investigating passenger activities from a business process perspective. On the basis of interviews and process modelling workshops with representatives from airports, airlines, government agencies, facilities management and passengers, we have developed a configurable set of process models. These models look at the human interaction aspect of airports, and are based on global process management standards. The aim is to consolidate these models into an integrated tool- and web-based airport reference model: the ‘Airportpedia’.

Research Progress
- Taxonomy for passenger interaction and experiences, built on group activities, concurrent activities, individual activities and activities related to ownership of personal items carried after check-in.
- Passenger facilitation process modelling of international departures at five airports (BNE, MEL, OOL, PER, and ROK), as well as development of international arrivals models for Melbourne Airport.
- Conceptual model for the integration of passenger experience in terminal design.
- Process models which capture current stakeholder practices for international departures and arrivals at Melbourne Airport.
- Models for IATA’s Toolbox for Simplifying the Business have been validated.
- Report on data collection activities at Melbourne International Airport, including initial findings and recommendations for process improvement.
- Report on how a wide range of performance metrics (including those identified within the
National Passenger Facilitation Committee’s Performance Framework project) link to the IATA Toolbox. These provide airports with a starting point to assess airport process performance.

- Compilation of identified process-based issues at Melbourne Airport has been provided in the form of an Issues Register and a Stakeholder Collaboration Report.
- Demonstration of how a reference process model can be constructed and configured, using the selection of the security process across four modelled airports as a case study.

Research Contacts
Professor Vesna Popovic, QUT
Professor Michael Rosemann, QUT

Implications for Industry
- Recommendations will have impact on passenger flow and design of the airport terminal, particularly in regards to communication with passengers.
- Understanding of the influence wavers have will provide opportunities to include the provision of a retail environment that focuses on the needs of both wavers and passengers, leading to retail spaces which promote prolonged social activities and addressing the disincentives associated with the cost of short-term parking. This will have potential experiential benefits for passengers and financial benefits for the airports.
- Understanding of the security screening point activities will streamline security screening, eliminate passengers’ congestion and explore future design potentials. This should provide a means by which IATA’s Checkpoint of the Future can be realised in a passenger-friendly manner.
- Repository of potential process improvement and innovation ideas developed which captures novel practices and characteristics of airports/airlines around the world. This has been populated with some initial practices acquired from secondary data, through scanning primarily internet-based resources.

Looking Ahead
- Following analysis and consolidation of issues identified across five studied airports, underlying themes and factors to be considered during terminal redesign and around passenger facilitation have been extracted. These will form the basis of process improvement recommendations for partners in the upcoming phases of the project.
- Further development and research around security screening points; aiming toward the proposal of the Security Checkpoint of the Future in 2012.
- Development of a configurable reference passenger facilitation process model.
- Development of a conceptual framework for passenger terminal design.
Summary

Border and aviation security plays a critical role for airports. The challenge of how to manage security systems and processes alongside the other business aspects of airports is explored. The Intelligent Surveillance program aims to enhance the human component of visual surveillance for airport security purposes, and assist in airport performance management. Surveillance activities are improved through the automatic merging of intelligence acquired from large multi-camera networks. This allows the detection of ‘suspicious activities’ and tracking of persons of interest.

Airport management will be enhanced through the use of technology-driven systems for producing time-based efficiencies and intelligence for measuring and monitoring queues in real time. The research will produce prototypes of a range of surveillance technologies, designed to complement those already in use or planned by industry partners.

Surveillance tasks (object tracking, crowd counting and density estimation, queue monitoring, and soft biometrics) and supporting technologies such as motion segmentation and camera calibration, are being investigated. Algorithms are in development that will be capable of functioning in a multi-camera space and able to operate in any weather or lighting conditions.

Research Progress

- Development of crowd-based monitoring and data acquisition, including improvements to previous crowd counting algorithms, and abnormality detection in crowded environments.
- Demonstration of the use of ‘virtual gate’ technology for counting and time-stamping passengers as they disembark an aircraft.
- Distribution of a discussion paper which aims to identify the key crowd-based and human activity events for recognising in surveillance footage, and to ascertain the availability of data to model these events.
- Crowd counting (in particular the ‘virtual gate’) and soft biometrics techniques are being incorporated into a prototype queue monitoring system to be trialled at the Entry Control Point at Brisbane International. This prototype will be developed over the next six months, and Customs will then trial the system in a live, operational environment.
• Continued development of a human action recognition system based on graph embedding and special interest points at UTS. Such a system promises robustness against variable lighting conditions and flexibility across a range of different types of human action.

Research Contacts
Professor Massimo Piccardi, UTS
Associate Professor Clinton Fookes, QUT
Professor Sridha Sridharan, QUT
Professor Nara Srinivasan, Edith Cowen University

Implications for Industry
• Single camera, person/object tracking demonstration system has been improved to allow capability to track objects in off-peak conditions, and in the presence of multiple variables in the scene. Also extended to work in a multi-camera system with better motion segmentation for difficult lighting conditions, and better hand-off between cameras (both overlapping and disjoint camera views).
• Feedback from partners will be used to configure the surveillance prototypes, ensuring the demonstrations are relevant to the aviation industry in Australia.
• Demonstration of a ‘virtual gate’: looking at aircraft disembarkation, providing an initial mechanism for quantifying a performance framework. This is a key project within the National Passenger Facilitation Committee, led by the Australian Customs & Border Protection Service.
• The virtual gate concept has led to an upcoming performance measurement trial at the Entry Control Point which will measure queues at this key processing point in the international arrivals path.
• Algorithms developed by this research will enable more robust automatic surveillance in the presence of changing lighting conditions throughout the day, as well as occlusions from static airport structures and other passengers when performing person/object tracking.
• The capabilities of this research have been demonstrated by various surveillance prototype systems. We envisage extensive applications and extensions of surveillance systems beyond traditional security applications, to the measurement of KPIs.
Looking Ahead

- Outbound border security processes will be explicitly modelled at chosen airports to inform a reference model.
- Initial recommendations will be made to improve screening processes at selected airports (informed by business process modelling). Knowledge gained from these can then inform generation of a new reference model and new process models based on emerging technologies will be evaluated.
- New technologies and screening processes will be assessed for the impact they have on passenger experience. Methods to support integration of new technology and processes will be developed.
- Information provided by the AIM will enable easy integration of new technologies into 3D airport models to analyse impacts on the physical environment.
- Development and demonstration of a system that can track objects or person(s) based on CCTV and biometrics. This will support development of effective human action recognition (HAR) system.
- A federated access management system will be investigated and assessed and integrated with the AIM to enable support to detect suspicious behaviours.
Summary

Terminal design in modern airports involve multiple stakeholder, multiple objectives and complex interdependencies that need to be captured in a ‘whole-of-airport’ model.

A Bayesian Network model provides the ability to analyse the airport system in its current state and to perform what-if analysis on potential configurations and operational scenarios. It allows the inclusion of a wide range of data including surveys, real-time system feeds and expert opinion, and actual quantification of crucial parameters that affect the system including processing time and facilitation measurements.

It allows the inclusion of a wide range of data including surveys, real-time video analytics and other real-time data feeds, and expert opinion. This data populates the parameters of the model related to system performance including processing time, arrival rate and other facilitation metrics.

Using the Bayesian Network as a basis, a generic and flexible complex systems modelling framework is being developed. This framework provides feedback on passenger flow, time-based efficiencies, security and passenger experience to assist airport planning, design and operations.

Research Progress

- Development of a quantified Bayesian Network (BN) prototype of the international arrivals passenger facilitation process.
- A BN model of wayfinding has been developed and quantified. This model will be further developed for Brisbane Airport Corporation (domestic and international terminals) in 2012.
- Development of a hybrid modelling concept demonstrator of the Entry Control Point (ECP).
- Completion of Concept of Operations (CONOPS) paper detailing operational concepts, usage scenarios and requirements for complex systems models of an airport passenger terminal.
- Extension of agent-based or individual passenger simulation model of the arrivals process at the Brisbane International Terminal to incorporate inbound duty-free shopping.
- Airports Talking to Airports – progressed from initial conceptual model towards a knowledge repository, commenced in conjunction with Sunshine Coast Airport.

Research Contacts

Professor Kerrie Mengersen, QUT
Implications for Industry

- Confirmation of key concepts on wayfinding that incorporates all factors of wayfinding in an airport. This highlighted the complexity of the wayfinding problem.
- Development of a hybrid concept demonstrator.
- Development of a knowledge repository on expansion or refurbishment decision making for airports.
- Development of an Object-Oriented (as compared to agent or individual) BN model incorporating issues involved with the refurbishment or expansion of airports to help guide these processes.

Looking Ahead

The whole-of-airport model developed by the Airports of the Future project will be integrated within a 3D environment, incorporating airport specific objects and requirements, and with an emphasis on compatibility with existing simulation and information systems. Ease of updating by internal and external consultants will be a priority, and information will be retrievable via query formats in an easy-to-understand output.

...we clearly see significant benefits from this work, specifically in the area of future Terminal Development where ... structured, step by step, initiatives such as this would guide and assist those with functional design, way finding and passenger needs.

Maurice Geary – Manager, Terminals and Stakeholder Relations
Gold Coast Airport
Summary
The transition between normal and emergency states, and then back again is a key aspect of incident response in an airport environment. We are formulating an ideal incident response system for airport environments, complete with integration of spatial information of the airport to assist in the determination of the appropriate scale of the response, and assign responsibilities.

From a business continuity perspective, we are examining scaling consequences from incidents. The potential for a rapid flow of impacts throughout the public and private spaces of an airport can mean that management are more likely to face a series of incidents within and across functional areas. The potential for this type of cascading effect may lead to decisions to evacuate parts or all of an airport.

From a modeling perspective, we are working synergistically with the AIM team to develop an integrated identity and access management (I&AM) approach. The AIM will be a 3D integrated information model which acts as a gateway to applications and services that drive airport business, including passenger facilitation, physical security, screening and surveillance. This research will deliver new tools in the area of spatial management and access control which will help to support new practices in airport incidence response.

Research Progress
- Procurement of as-built or as-operated building models for Rockhampton Airport (ROK) and BNE.
- Collation of key parameters to consider in airport design, refurbishment and extension with a particular view to how this enables flexible use of space in short and long term scales.
- Comparative benchmarking exercise examining specific KPIs currently used by airport partners. This included visits to Perth (PER), Rockhampton (ROK) and Darwin (DRW) airports. This study incorporates input from both operational security and corporate governance/risk areas.
- Identification of theoretical and practical relationships between high reliability and BCM, and a proposal for how to examine how such BCM practices could create high reliability traits in airports.
- Develop a concept of operations for emergency event management based on the AIM.
- Develop a concept of operations for physical access control and facilities management using the AIM as a unifying graphical command and control interface.
- Guidance notes on developing generic Business Continuity Plans in Airports.
Research Contacts
Dr Paul Barnes, QUT

Implications for Industry
• Clear identification of performance measures related to continuity management and Transport Security Program (TSP) compliance currently in use at airports around Australia, as well as those currently under consideration. This study will also reveal potential efficiencies by providing a means to gauge KPI function against purpose and commonalities between operational security and corporate governance/risk practice.
• Documentation of the roles and challenges of aviation industry participants in collaborating on efforts to align performance measures and demonstrate compliance for TSP outcomes, operational reliability and incident response capability in general.

Looking Ahead
As the work of this program continues, it is obvious that scope exists for deeper investment of time and resources to explore levels of integration of Command, Control, Coordination, Communication and Information (C4i) capability within modern airports. It follows that further investigation of how such systems, both human and automated, can assist in effective escalation and de-escalation of a response and enhance the transition back to normal management.
Operations Management:
- The airport-independent Bayesian Network ‘whole-of-airport’ performance framework prototype has been further refined and quantified. The focus of the current model is for measuring time-based efficiencies in the arrivals path, and across all associated stakeholders.
- A comprehensive range of usage scenarios for ‘whole-of-airport’ models have been devised and released in the form of a Concept of Operations.
- Initial preparation and development for a six month trial measuring key performance indicators (KPIs) based on closed circuit television (CCTV) footage at the Entry Control Point at the Brisbane International Terminal. This will ultimately provide input to the ‘whole-of-airport’ performance framework Bayesian Network.
- Advancement of the initial inbound prototype to demonstrate simulation and inferencing for quantitative analysis of international arrivals process.
- Publication of key concepts and findings on model usage scenarios (including existing scenarios) for a whole-of-airport complex systems model.

Border and Aviation Security:
- Development of a concept of operations for physical access control and facilities management using the Airport Information Model as a unifying graphical command-and-control interface. This system has the potential to be used to track airport personnel access to physical and informational resources.
- Distribution of the ‘Activity and Event Detection Discussion Paper’ which focused on how CCTV-based technology could be used to detect suspicious behaviours and undesirable crowd-based events. The responses received will be used to guide the development of prototype systems focusing on the activities of interest.
- Demonstration of initial prototype systems for: (i) human activity recognition; (ii) person/object tracking during off-peak periods; (iii) anomaly detection in crowds; and (iv) blast modelling.

Passenger Experience:
- Completion of modelling the international departure processes at five international airports around Australia – Brisbane, Gold Coast, Melbourne, Perth and Rockhampton; process models have been validated and delivered to each of these airports. The modelling process has enabled root causes of differences in processes between airports to be identified, and these are currently being integrated into a ‘best-practice’ configurable reference model.
- Identification of common issues related to passenger communication and preparation based on findings from both process modelling and observation of passenger activities. These findings were presented to industry partners at a workshop held in November, 2011.
Terminal Design:

- Relationships between terminal space and airport processes have been identified, and these are playing an integral role in the development of the configurable reference process model.
- Development of initial Bayesian Network models for expansion or refurbishment of airport terminals, as well as for effective passenger wayfinding. In conjunction with this, an initial structure for a knowledge repository which captures information and key contacts relating to airport design has been formulated.
- Recommendations based on the previously developed passenger taxonomy, as well as retail experience findings and security screening point activities have been made and delivered in milestone reports.
- Development of a 3-dimensional Building Information Model which can be used to support spatial awareness in all other areas of the project, as well as suitable for use in identifying flexible design strategies for airport re-design projects.

Incident Response:

Performance measures related to continuity management and Transport Security Program (TSP) compliance currently in use and under consideration at airports around Australia have been identified and documented. This process also highlighted the roles and challenges for aviation industry participants in collaborating on efforts to align performance measures.
The following list of publications provide a sample of all publications which were generated by the project in 2011. These publications are highlighted briefly over the following pages.

Wide baseline correspondence extraction beyond local features
Lakemond, Ruan, Sridharan, Sridha, & Fookes, Clinton B.

Check-in processing: simulation of passengers with advanced traits
Ma, Wenbo, Kleinschmidt, Tristan, Fookes, Clinton, & Yarlagadda, Prasad K.D.V.

Including airport duty-free shopping in arriving passenger simulation and the opportunities this presents
Kleinschmidt, Tristan, Guo, Xufeng, Ma, Wenbo, & Yarlagadda, Prasad K.

Risk-informed thinking in airports: the application of business continuity management in airport infrastructure
Camastral, Marisa & Barnes, Paul H.

Dynamic texture reconstruction from sparse codes for unusual event detection in crowded scenes
Xu, Jingxin, Denman, Simon, Sridharan, Sridha, Fookes, Clinton B., & Rana, Rajib

Determining operational measures from multi-camera surveillance systems using soft biometrics
Denman, Simon, Bialkowski, Alina, Fookes, Clinton B., & Sridharan, Sridha

Scenarios for a Complex Systems Airport Modelling Framework
Wu, Paul P., Mengersen, Kerrie, & Kleinschmidt, Tristan
**Title**
Wide baseline correspondence extraction beyond local features

**Authors**

**Abstract**
Robust, affine covariant, feature extractors provide a means to extract correspondences between images captured by widely separated cameras. Advances in wide baseline correspondence extraction require looking beyond the robust feature extraction and matching approach. This study examines new techniques of extracting correspondences that take advantage of information contained in affine feature matches. Methods of improving the accuracy of a set of putative matches, eliminating incorrect matches and extracting large numbers of additional correspondences are explored. It is assumed that knowledge of the camera geometry is not available and not immediately recoverable. The new techniques are evaluated by means of an epipolar geometry estimation task. It is shown that these methods enable the computation of camera geometry in many cases where existing feature extractors cannot produce sufficient numbers of accurate correspondences.
Check-in processing: simulation of passengers with advanced traits


Abstract

In order to tackle the growth of air travellers in airports worldwide, it is important to simulate and understand passenger flows to predict future capacity constraints and levels of service. We discuss the ability of agent-based models to understand complicated pedestrian movement in built environments. In this paper we propose advanced passenger traits to enable more detailed modelling of behaviours in terminal buildings, particularly in the departure hall around the check-in facilities. To demonstrate the concepts, we perform a series of passenger agent simulations in a virtual airport terminal. In doing so, we generate a spatial distribution of passengers within the departure hall to ancillary facilities such as cafes, information kiosks and phone booths as well as common check-in facilities, and observe the effects this has on passenger check-in and departure hall dwell times, and facility utilization.
Including airport duty-free shopping in arriving passenger simulation and the opportunities this presents

Kleinschmidt, Tristan, Guo, Xufeng, Ma, Wenbo, & Yarlagadda, Prasad K. (2011)

Abstract
Simulating passenger flows within airports is very important as it can provide an indication of queue lengths, bottlenecks, system capacity and overall level of service. To date, visual simulation tools such as agent based models have focused on processing formalities such as check-in, and not incorporate discretionary activities such as duty-free shopping. As airport retail contributes greatly to airport revenue generation, but also has potentially detrimental effects on facilitation efficiency benchmarks, this study developed a simplistic simulation model which captures common duty-free purchasing opportunities, as well as high-level behaviours of passengers. It is argued that such a model enables more realistic simulation of passenger facilitation, and provides a platform for simulating real-time revenue generation as well as more complex passenger behaviours within the airport. Simulations are conducted to verify the suitability of the model for inclusion in the international arrivals process for assessing passenger flow and infrastructure utilization.
Title  
Risk-informed thinking in airports: the application of business continuity management in airport infrastructure

Authors  

Abstract  
Airports worldwide represent key forms of critical infrastructure in addition to serving as nodes in the international aviation network. While the continued operation of airports is critical to the functioning of reliable air passenger and freight transportation, these infrastructure systems face a number of sources of disturbance that threaten their operational viability. Recent examples of high magnitude events include the eruption of Iceland’s Eyjafjallajokull volcano eruption (Folattau and Schofield 2010), the failure of multiple systems at the opening of Heathrow’s Terminal 5 (Brady and Davies 2010) and the Glasgow airport 2007 terrorist attack (Crichton 2008). While these newsworthy events do occur, a multitude of lower-level more common disturbances also have the potential to cause significant discontinuity to airport operations. Regional airports face a unique set of challenges, particularly in a nation like Australia where they serve to link otherwise remote and isolated communities to metropolitan hubs (Wheeler 2005), often without the resources and political attention received by larger capital city airports.

This paper discusses conceptual relationships between Business Continuity Management (BCM) and High Reliability Theory, and proposes BCM as an appropriate risk-based management process to ensure continued airport operation in the face of uncertainty. In addition, it argues that that correctly implemented BCM can lead to highly reliable organisations. This is framed within the broader context of critical infrastructures and the need for adequate crisis management approaches suited to their unique requirements (Boin and McConnell 2007).
<table>
<thead>
<tr>
<th>Title</th>
<th>Dynamic texture reconstruction from sparse codes for unusual event detection in crowded scenes</th>
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<tbody>
<tr>
<td>Authors</td>
<td>Xu, Jingxin, Denman, Simon, Sridharan, Sridha, Fookes, Clinton B., &amp; Rana, Rajib (2011)</td>
</tr>
<tr>
<td>Abstract</td>
<td>Unusual event detection in crowded scenes remains challenging because of the diversity of events and noise. In this paper, we present a novel approach for unusual event detection via sparse reconstruction of dynamic textures over an overcomplete basis set, with the dynamic texture described by local binary patterns from three orthogonal planes (LBPTOP). The overcomplete basis set is learnt from the training data where only the normal items observed. In the detection process, given a new observation, we compute the sparse coefficients using the Dantzig Selector algorithm which was proposed in the literature of compressed sensing. Then the reconstruction errors are computed, based on which we detect the abnormal items. Our application can be used to detect both local and global abnormal events. We evaluate our algorithm on UCSD Abnormality Datasets for local anomaly detection, which is shown to outperform current state-of-the-art approaches, and we also get promising results for rapid escape detection using the PETS2009 dataset.</td>
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<tr>
<td>Title</td>
<td>Determining operational measures from multi-camera surveillance systems using soft biometrics</td>
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<tr>
<td>Abstract</td>
<td>CCTV and surveillance networks are increasingly being used for operational as well as security tasks. One emerging area of technology that lends itself to operational analytics is soft biometrics. Soft biometrics can be used to describe a person and detect them throughout a sparse multi-camera network. This enables them to be used to perform tasks such as determining the time taken to get from point to point, and the paths taken through an environment by detecting and matching people across disjoint views. However, in busy environment where there are 100’s if not 1000’s of people such as an airport, attempting to monitor everyone is highly unrealistic. In this paper we propose an average soft biometric, that can be used to identity people who look distinct, and are thus suitable for monitoring through a large, sparse camera network. We demonstrate how an average soft biometric can be used to identify unique people to calculate operational measures such as the time taken to travel from point to point.</td>
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Scenarios for a Complex Systems Airport Modelling Framework


Abstract
The airport is a prime example of a complex system. Complex systems are characterised by multiple stakeholders, multiple operational objectives and complex interactions and interdependencies between many actors. Some of this inherent complexity can be mitigated by providing a specific modelling perspective and identifying the boundaries of the modelling problem. A systematic and explicit development of the links between users of the model, the high level modelling objectives and modelling capabilities (i.e. modelling requirements) can help to provide such a perspective and identify boundaries. In addition, explicit model usage scenarios and modelling requirements are crucial for the verification and validation of models. Furthermore, such scenarios are a key enabler in the development of reusable modelling tools.

It is found that a systematic approach, such as that based on systems engineering or a Concept of Operations (CONOPS), has not yet been applied to develop modelling scenarios and requirements in the existing airport passenger terminal modelling literature. This paper presents a method based on the CONOPS methodology to structure usage scenarios using modelling objectives, users, operational policies and model capabilities. Using existing airport passenger terminal models as a basis, it is found that there are three major operational objectives for airports, namely: passenger satisfaction, facilitation efficiency and facilitation security. It is shown that a model usage scenario comprises metrics, the links between them and airport, passenger, passenger traffic, flight and service characteristics. A number of case study model usage scenarios are constructed based on different combinations of the above metrics and system characteristics as determined by the modelling objectives. It is proposed that airport passenger terminal models can be classified under high level usage categories of review and analysis, planning and design, and real-time operations.
## Journal Articles

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<tr>
<th>TITLE</th>
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<tbody>
<tr>
<td>Hessian-Based Affine Adaptation of Salient Local Image Features</td>
<td>Ruan Lakemond, Sridha Sridharan, Clinton Fookes</td>
<td>Journal of Mathematical Imaging, September 2011, pp. 1-18.</td>
</tr>
<tr>
<td>Wide Baseline Correspondence Extraction Beyond Local Features</td>
<td>Ruan Lakemond, Sridha Sridharan, Clinton Fookes</td>
<td>IET Journal of Computer Vision, vol. 5, no. 4, 2011, pp. 222-231.</td>
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## Refereed Conference Papers

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<tr>
<td>Measuring Security and Corporate Governance Performance in Airports: An Examination of Convergent and Divergent Practice</td>
<td>Paul Barnes, Michael Devine, Marisa Camastral</td>
<td>15th International Research Society for Public Management Conference, 11-13 April, 2011, Dublin, IRE</td>
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<tr>
<td>3D Ellipsoid Fitting for Multi-View Gait Recognition</td>
<td>Sivapalan Sabesan, Daniel Chen, Simon Denman, Sridha Sridharan, Clinton Fookes</td>
<td>8th IEEE International Conference on Advanced Video and Signal-Based Surveillance, 30 August-2 September, 2011, Klagenfurt, AUT</td>
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<td>Gait Energy Volumes and Frontal Gait Recognition using Depth Images</td>
<td>Sivapalan Sabesan, Daniel Chen, Simon Denman, Sridha Sridharan, Clinton Fookes</td>
<td>International Joint Conference on Biometrics, 10-13 October, 2011, Washington DC, USA</td>
</tr>
<tr>
<td>Dynamic Texture Reconstruction from Sparse Codes for Unusual Event Detection in Crowded Scenes</td>
<td>Jingxin Xu, Simon Denman, Clinton Fookes, Rajeev Rana</td>
<td>Joint ACM Workshop on Modeling and Representing Events, 28 November-1 December, 2011, Scottsdale, AZ, USA</td>
</tr>
<tr>
<td>Negative Determinant of Hessian Features</td>
<td>Ruan Lakemond, Clinton Fookes, Sridha Sridharan</td>
<td>Digital Image Computing: Techniques and Applications Conference, 6-8 December, 2011, Noosa, AUS</td>
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### Publications

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<tr>
<td>Including Airport Duty-Free Shopping in Arriving Passenger Simulation and the Opportunities this Presents</td>
<td>Tristan Kleinschmidt, Xufeng Guo, Wenbo Ma, Prasad KDV Yarlagadda</td>
<td>Winter Simulation Conference, 11-14 December, 2011, Phoenix, AZ, USA</td>
</tr>
<tr>
<td>Check-In Processing: Simulation of Passengers with Advanced Traits</td>
<td>Wenbo Ma, Tristan Kleinschmidt, Clinton Fookes, Prasad KDV Yarlagadda</td>
<td>Winter Simulation Conference, 11-14 December, 2011, Phoenix, AZ, USA</td>
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<tr>
<td>Business Continuity Management in Airports: Ensuring Continuity in the Face of Crises</td>
<td>Marisa Camastral</td>
<td>New Researchers Doctoral Panel @ 15th International Research Society for Public Management Conference, 11-13 April, 2011, Dublin, IRE</td>
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### Non-refereed Conference Papers

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<tr>
<td>Modelling an airport terminal as a complex, dynamic, socio-technical system</td>
<td>Jegar Pitchforth</td>
<td>Young Statisticians Conference, 14-15 July, 2011, Brisbane, Australia</td>
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<tr>
<td>Bayesian Networks as a Complex Systems to in the context of a major industry and University project</td>
<td>Charisse Farr, Tristan Kleinschmidt, Paul Wu, Kerrie Mengersen</td>
<td>International Congress on Industrial and Applied Mathematics, 18-22 July, 2011, Vancouver, Canada</td>
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<tr>
<td>The role of Bayesian Networks in Airports of the Future</td>
<td>Charisse Farr, Jegar Pitchforth</td>
<td>Bayes on the Beach 2011 – Australian Bayesian Statistics Conference, 6-7 October, 2011, Gold Coast, Australia</td>
</tr>
<tr>
<td>Wayfinding in Airports: A Bayesian Network Approach</td>
<td>Charisse Farr, Kerrie Mengersen, Tristan Kleinschmidt, Paul Wu</td>
<td>Australasian Bayesian Network Modelling Society Conference, 23-24 November, 2011, Brisbane, Australia</td>
</tr>
<tr>
<td>An Interactive Model for Dynamically Reassigning Resources During an Arriving Passenger Simulation</td>
<td>Ying Chan, Jack Grummitt, Tristan Kleinschmidt, Paul Wu, Duncan Campbell</td>
<td>Winter Simulation Conference, 11-14 December, 2011, Phoenix, AZ, USA</td>
</tr>
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</table>
Media Releases and Articles

- Airports of the Future was featured in the QUT Alumni Links Magazine article ‘Customer experience reinvented for futures airports,’ March 2011, pp. 12-13.

- Project Director, Prof Prasad Yarlagadda, was interviewed for a news item entitled ‘Airport conference puts Memphis in global spotlight’ which was in relation to the 2011 Airport Cities Conference. This item appeared in The Commercial Appeal newspaper in Memphis, TN, on April 10, 2011.

- PhD student, Nimal Skandhakumar, was featured in the Sunday Times on May 29, 2011, featuring his PhD topic on identity and access management and life as an international student at an Australian university. This article was entitled ‘Sky’s the limit for Sri Lankan PhD student.’

- The command and control research facility received a short story entitled ‘Flying high’ in the QUT Alumni Links Magazine in August, 2011.

- Following the success of the project in the 2011 Engineers Australia QLD Division Engineering Excellence Awards, an article titled ‘Queensland ‘Airports of the Future’ pilot project wins engineering award’ focussed on the outcomes for airport security generated by the AOTF Pilot Project.

- An article on the ‘Incident Response Aspects of the AoTF Project’ appeared in the Newsletter for Stakeholders of Queensland’s Critical Infrastructure Protection Program (Attached). The contact for this was Faisal Cummins, A/Senior Project Officer (Critical Infrastructure Protection), Transport Security, Rail Safety & Transport Security Division. Department of Transport and Main Roads