



DIAL Quarterly July 2014: DIAL's collaborator Omron UK, Airport Operations 2025 workshop, ISMM's projects 2014, DIAL's Phil Woodall presenting at the House of Commons and much more.

Meet DIAL's visitors:

Vijay Dodwani



Vijay is a 4th year undergraduate student from the Department of Chemical Engineering at the Indian Institute of Technology Bombay (IIT Bombay) in India. After completing his undergraduate studies, Vijay would like to pursue a PhD in Computer Science and Technology. During his 2 months stay, Vijay is working on the ALADDIN project, which is funded by the Boeing company, with Torben Jess and Duncan McFarlane. Part of the project is to build an information recommending system for different users searching databases. The project will monitor the data searched by users and will recommend further data that could be interesting to the users.

**Introduction from
Professor Duncan
McFarlane:**

**Welcome to the
summer issue of
the DIAL
Newsletter**



We have had a number of conversations latterly with sponsors and other companies about the need for resilience in their manufacturing supply chains. The issue is how to prepare and / or insulate manufacturing operations (and their outputs) from unplanned and uncontrollable events occurring within production, the supplier base or due to customer variations. Apart of the immediate effect of such an event – a supply failure, product quality problem, cancelled order – on production, the knock-on effects can be particularly damaging. Delays to multiple orders, widespread schedule changes and productivity losses can often dwarf the impact of the initial disruption.

In DIAL we are tackling the issue of manufacturing resilience in a number of ways. We have a simple auditing tool which we use to capture a snapshot of companies' resilience challenges and capabilities. We are developing models and algorithms for representing and improving resilience. In our automation lab we are building a "disruptable" production line for evaluating new automated control and tracking strategies in terms of their impact on resilience. We will report on the latest developments in our lab in the next issue. Please get in touch if you would like to know more.

Shiven Rastogi



Shiven is a second year undergraduate student pursuing a Bachelors in Mechanical Engineering from the Indian Institute of Technology Delhi (IIT Delhi) in India.

Shiven is interested in Mathematics, Economics and Management and would like to pursue his PhD in either of these fields. After successful completion of his PhD, Shiven hopes to have a career as an entrepreneur or in politics. During his two months stay, he is working with Ajith Parlikad and Raj Srinivasan on a project with the London Underground. As a part of this project, a model has been prepared to tackle the problem of getting to know the frequency with which replacement of machines have to be carried out in a cost effective way.

Martyna Sikora



Martyna Sikora joined DIAL in July 2014. She is currently a third year undergraduate student at the Queen Mary University in London where she is studying mathematics. Due to her excellent results, Martyna was granted the Cambridge Long Vacation Scholarship.

DIAL's Philip Woodall visits the House of Commons

Dr Philip Woodall was invited to the House of Commons on 10th June 2014 to celebrate the work that Boeing does with UK university and charity partners, and to meet with Constituency MPs for Boeing's partnerships.

At this high-profile event, Philip discussed with Sir Gerald Howarth, the reception's host, and Sir Roger Bone, Boeing's UK President, the challenges associated with managing data in industrial organisations, and the great promise of new Big Data approaches that could allow engineering organisations to gain strategic advantage from their data.

This follows Philip's work on various Boeing projects within DIAL, led by Prof. Duncan McFarlane. It also follows Philip's recent joint talk with Boeing's Vice President, Gary Fitzmire, on the University of Cambridge's strategic research collaboration with Boeing at the Department of Engineering's conference on "Research through Industrial Collaboration: Engagement in Practice – Lessons from the Coalface".



Dr Philip Woodall presenting to various industrialists at the Department of Engineering's conference on Research through Industrial Collaboration

In this talk Philip explained the lessons learnt from conducting research for Boeing and how, he and his colleagues have learned to go way beyond the 'research outputs' to concentrate on the 'business outcomes' by focusing on value within the world into which their research will fit. At the end of a project, it is absolutely not about "handing over a research report, waving goodbye, and requesting funding for the next project". DIAL is just as keen as Boeing for their research to be used to benefit actual operations and therefore extends full support to ensure the research is given the best possible chance of adoption into the business. For the last project, this involved developing software applications, which can be used by Boeing staff to support them in data administration tasks, including correcting data quality errors and understanding the meaning of shared datasets. In the planning of DIAL's latest project with Boeing, the whole of the final year has been allocated for supporting the handover of research outputs and their integration into the business – including assessing to what extent these have benefited the business.

During her 4 week visit she will be working with Torben Jess on valuing information using prediction markets. Martyna works as a Mathematics Tutor at the Bishop Challoner Collegiate School in London where she is helping A-level teachers. At the same time, she works part-time as a Student Ambassador at the Queen Mary and as an assessor of Polish language in Tower Hamlets. Recently, she also became a Vice President of the Mathematics Society at the Queen Mary University. Last summer she undertook an internship at the Noble Securities Brokerage House, and since then she has become interested in using markets as a tool for aggregating information.

Industrial Systems, Manufacturing and Management (ISMM) Projects 2014

Mac Trzcinski



Mac in his research, is looking at the relationship between dataset size and quality in the context of business decision-making process. The overall aim of his thesis is to analyse how the advent of very large datasets has influenced data quality considerations. The central question of his work is whether increasing data volume can be a better and more cost effective way of refining data analysis results

Some of the other lessons include how working together to achieve the project goals, rather than treating Boeing as the company DIAL must report to, enables the projects to benefit from leveraging the complementary skillsets from both parties. This is exemplified in the frequent secondments arranged between DIAL and Boeing Research and Technology (BR&T). Research projects are also chosen on the basis of mutual interest, with Boeing receiving ideas and solutions that address their current and future business challenges while also being flexible and aligning with DIAL's expertise and interests.

DIAL's collaborator – Omron UK

Omron's relationship with the University's Engineering Department goes back some twenty years, soon after its establishment in the UK in 1991, donating PLC equipment to the Institute for Manufacturing's old Mill Lane site and giving annual lectures to the Manufacturing Engineering Tripos (MET) students.

For those unfamiliar with Omron, we are a global leader in the field of automation. Established in 1933, Omron has more than 36,000 employees in 35 countries working to provide products and services to customers in a variety of fields including industrial automation, electronic components industries, and healthcare.

When the IfM relocated to its current site, Omron provided the latest equipment to equip the Automation Lab, including PLCs, vision inspection systems, safety and networking products. As well as being used for teaching MET and ISMM students, the equipment is widely used within industrial research projects by DIAL.

As the Marketing Manager for Automation products, along with my colleague Justin Baker (Specialist Applications Engineer), we are members of DIAL's Industrial Advisory Board, ensuring that any research is industrially useful and has clearly defined paths to deployment in industry. We have also been sponsors for several MET and MPhil students' projects.

Of course, much of DIAL's research benefits us greatly too, as much of the output can be used to help our own customers make their operations more efficient and resilient and, in many ways, helps us to shape our future products.

As part of Omron's Corporate Social Responsibility plan, we aim to contribute to a better society through business operations and have been actively involved with the education sector for many years.

As you may be aware, according to a 2011 study from the Royal Academy of Engineering, British industry needs 100,000 new graduates in science, technology, engineering and mathematics (STEM) subjects and a further 60,000 technicians and apprentices every year until 2020 just to maintain current employment

than improving dataset quality. The research focuses on two aspects of the problem - the managerial side studied using real-life scenarios and the technical side, analysed with computer experiments.

Anthony Wainman



As part of his MPhil in ISMM, Anthony is looking into how manufacturers can re-purpose ERP data. Repurposing looks into finding a new purpose for data which has already been used for a business operation, for other tasks in different parts of the business. This research is done with a view to potentially finding ways to automate the repurposing of ERP data. Anthony said he is very excited to be working on this project as he has been able to see first-hand the number of time-consuming workarounds that manufacturing managers are often using to repurpose data.

Recent Research Publications:

Liang, Z., Parlikad, A.K.,
[A tiered modelling approach for condition-based maintenance of industrial assets with load sharing interaction and fault propagation](#),
IMA Journal of Management Mathematics, 24th June 2014, pages 1-20

numbers. The issues surrounding education have been a concern since publication of 'The Leitch Review of Skills' in 2006, which stated that the UK was almost becoming a third-world country for manufacturing and engineering due to an engineering skills gap. Unfortunately, since publication of the report there appears to have been little progress. A lack of continuous development of engineering skills over the years has left many engineers out of touch with the latest technologies and trends in the industry, resulting in the need to outsource skilled engineering and research needs to organisations such as Omron and DIAL.

Omron is proud to be an active participant in raising the engineering skills level and ensuring that engineers and engineering students keep abreast of changing automation technologies. Automation is now starting to merge into the IT world – with much tighter integration of automation systems into enterprise systems, playing a pivotal role in the “Internet of Things” and “Big Data”. The PLC is no longer a ‘dumb device’ and courses and research need to reflect these developments to ensure that manufacturing stays in line with current trends.

The relationship between automation technology suppliers and engineers needs to start early - while the engineers of the future are still in education - to support manufacturing sector growth by ensuring a competent workforce for the future, and we very much look forward to a continued, fruitful relationship with the University.

Karl Walker,

Marketing Manager for Automation Products,

Omron UK

Past Event: “Airport Operations 2025” Workshop

Airport operations continue to be stretched with increasing aircraft numbers and a need to provide ever changing tailored services. With lean operational service providers and capacity constrained airports all battling to meet critical on-time performance measures, operational processes have become critically sensitive to unexpected delays and disruptions.

As part of our established collaborations with The Boeing Company and a number of airport operators, airlines and airport service and technology providers, DIAL recently hosted and ran a workshop featuring over 30 attendees from industry. The Workshop, entitled “Airport operations 2025”, was held at the Moeller Centre on 15 May and kindly sponsored by The Boeing Company.

Jess, T., Woodall, P., McFarlane, D.,
Evaluating the Applicability of Multi Agent Software for Implementing Distributed Industrial Data Management Approaches, Sohoma 2014, 5th – 6th November 2014, Nancy, France

Tsamis, N., Giannikas, V., McFarlane, D., Lu, W., Strachan, J.,
Adaptive Storage Location Assignment for Warehouses Using Intelligent Products, Sohoma 2014, 5th – 6th November 2014, Nancy, France

Masood, T, Roy, R, Harrison, A, Xu, Y, Gregson, S, and Reeve, C (2014): **Integrating through-life engineering service knowledge with product design and manufacture**, International Journal of Computer Integrated Manufacturing, DOI: 10.1080/0951192X.2014.900858

Masood, T, McFarlane, D, Schooling, J, Parlikad, A and Catton, C (2014): **The Role of Futureproofing in the Management of Infrastructural Assets**, International Symposium for Next Generation Infrastructure, Vienna, 30 Sep - 1 Oct, 2014 (accepted)

Recent DIAL Seminars:

“Aladdin project current progress”, Phil Woodall & Mark Harrison, 9th May 2014, 14:00 – 15:00, IfM



Workshop attendees during afternoon brainstorming session

The workshop aimed to:

- Identify current major issues that are impacting airports and their everyday operations;
- Capture future requirements from the airport and the wider air transport industry;
- Discuss current developments on-going in EU airports;
- Explore airport operational services and technologies through to year 2025 and beyond;
- Provide a forum to discuss current and future issues.



Boeing's Blair Nadeau in deep discussion with other workshop attendees

The list of delegates included senior advisors, directors, heads and lead engineers from: aircraft manufacturers (The Boeing Company); airports (Manchester, Stansted, Heathrow, Gatwick, Prague); airlines (Easyjet, Flybe, Iberia); airport technology and service providers (Jeppesen, IATA, SITA, ARINC, SwissPort); regulatory bodies (Civil Aviation Authority) as well as fellow colleagues from academia (University of Edinburgh and Nottingham University).

“Joint optimization of preventive maintenance plan, production schedule and quality control policy on discrete manufacturing plant”, Azman Aziz, 15th May 2014, 14:00 – 15:00, IfM

“Inclination analysis can yield early-warning signals of economic recession”, Alena Puchkova, 22nd May 2014, 14:00 – 15:00, IfM

“Market-based industrial data management”, Torben Jess, 19th June 2014, 14:00 – 15:00, IfM

“Use of Recommender System for Industrial data management”, Vijay Dodwani (IIT Bombay), 8th July 2014, 14:00 – 15:00, IfM

“Performance-driven TCO evaluation for decision-making support in physical asset management”, Irene Roda (Politecnico di Milano, Milan), 17th July 2014, 15:00 – 16:00, IfM

“Software Model for Preventive Maintenance”, Shiven Rastogi (IIT Delhi), 18th July, 14:00 – 15:00, IfM

“Re-purposing ERP data”, Anthony Weinman, 31st July 2014, IfM

“Big Data quality in industrial decision making”, Mac Trzcinski, 31st July 2014, IfM

“Valuing Information using Predictive Markets”, Martyna Sikora, 31st July 2014, 14:00 – 15:00, IfM



Workshop attendees at the Social Dinner, Downing College, Cambridge

Findings and insights from the workshop have already been fed back to all participants and discussions are now ongoing with them to set up novel research projects and bids to address the gaps identified on the day. For further details, please contact Alan Thorne (ajt@eng.cam.ac.uk).

White Paper on infrastructure futureproofing

In previous issues of the DIAL Newsletter, we have reported on infrastructure futureproofing workshops held in association with our industrial partners. Currently we are writing a white paper based on the outcomes of the workshops. This paper will explore the following issues related to infrastructure / infrastructure systems:

- What is intended by the futureproofing of infrastructural assets?
- Why and when to futureproof critical infrastructure?
- How can infrastructure assets and systems be prepared for uncertain futures?
- How can futureproofing be incorporated into asset management practice?

The white paper is expected to be published by the end of September 2014.

If you are interested in anything that has been featured in the newsletter or would like further information about DIAL, then please do not hesitate to contact us on dial-enquiries@eng.cam.ac.uk or call Petra Kasmanova on +44 (0) 1223 764306.