INDUSTRY 4.0
ADVANCED MANUFACTURING FORUM

Testlabs and Future of Work, Education and Training

Australian Government
Department of Industry, Innovation and Science

SWINBURNE UNIVERSITY OF TECHNOLOGY

AMWU

Transforming Australian Manufacturing

Preparing businesses and workplaces for Industry 4.0

Mr Andrew Dettmer

National President - Australian Manufacturing Workers' Union

Co-Chair - I4AMF Testlabs, Future of Work and Skills Work Stream

pwc

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SIEMENS
Ingenuity for life

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Aim of this Report

- Industry 4.0 is poised to deliver growth and change, with digitalisation and smart automation expected to add 14 per cent (US$15 trillion) to global GDP by 2030
- Some Australian businesses have begun to transform and starting to reap the benefits but many have not and a 'call to action' is needed to ensure manufacturers can flourish and can engage in global supply chains
- The key objectives of this report were to:
  - Better understand the impact of Industry 4.0
  - Identify business and workforce tranformation issues
  - Identify best practice examples of business and workforce transformation
  - Identify guiding principals and recommendations for transformation
- This report aims to provide practical information and advice to stakeholders to advance the transition of Australian manufacturing businesses and workers towards Industry 4.0

Key Findings from this Initiative

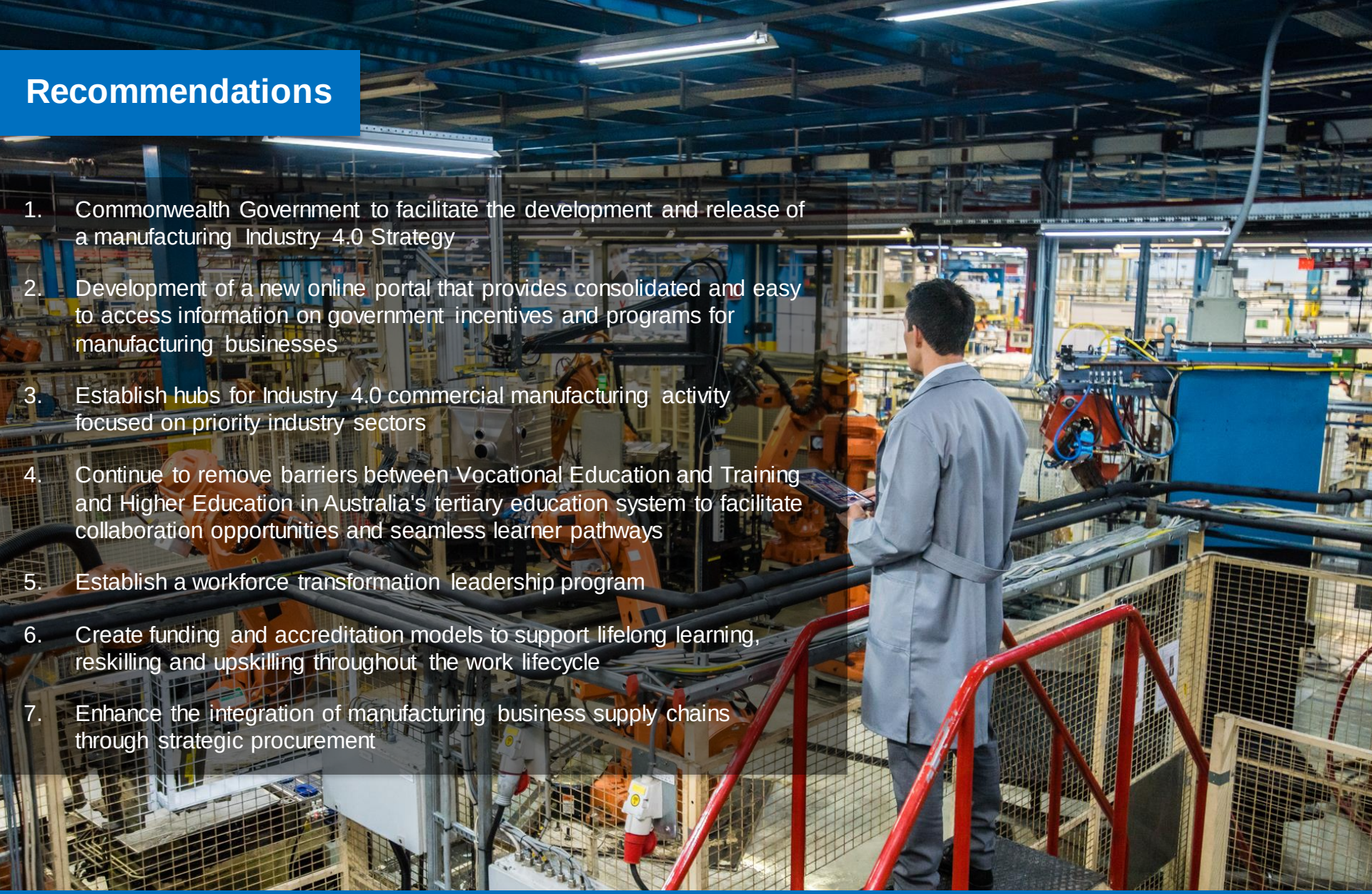
Through surveys undertaken with the Manufacturing sector, interviews with Industry 4.0 and manufacturing experts, and desktop research, the following key findings emerged:

- Businesses must become skilled collaborators in the Industry 4.0 environment – business to business and with education & training orgs, government, unions & peak bodies:
  - Allows businesses to learn from one another and share resources
  - Ensures education and training content is relevant and timely
  - Government programs are aligned; and
  - Government, unions and peak bodies can facilitate appropriate and timely collaborations

- Industry 4.0 will require new skills, knowledge and a collaborative and integrated approach between Higher Education, Vocational Education and Industry and also with Unions and Peak Bodies particularly in the case of worker transition:
  - Emerging skill requirements in intelligent data analytics, digital and advanced cognitive skills will require upskilling current workers and creating and encouraging new entrants
  - Industry needs to lead this upskilling, working closely with education organisations

- Business culture, ways of working and practices need to be strengthened to ensure successful transformation:
  - A positive change culture will ensure successful implementation of new practices
  - Increased demand for digital skills requires creating a digital culture shift
  - International mindset is needed

Recommendations



1. Commonwealth Government to facilitate the development and release of a manufacturing Industry 4.0 Strategy
2. Development of a new online portal that provides consolidated and easy to access information on government incentives and programs for manufacturing businesses
3. Establish hubs for Industry 4.0 commercial manufacturing activity focused on priority industry sectors
4. Continue to remove barriers between Vocational Education and Training and Higher Education in Australia's tertiary education system to facilitate collaboration opportunities and seamless learner pathways
5. Establish a workforce transformation leadership program
6. Create funding and accreditation models to support lifelong learning, reskilling and upskilling throughout the work lifecycle
7. Enhance the integration of manufacturing business supply chains through strategic procurement

Panel Session

Chair: Andrew Dettmer – National President - Australian Manufacturing Workers' Union

Jeff Connolly – Chairman and CEO - Australia Pacific Region - Siemens

Aleksandar Subic – Deputy Vice-Chancellor – Research and Development - Swinburne University of Technology

Sara Caplan – Partner and CEO – Skills for Australia - PwC Australia

Athena Andriotis – Director – Advanced Manufacturing – Dept Jobs, Precincts and Regions - Victoria Government

National Industry 4.0 Testlab Network

Professor Aleksandar Subic

DVC Research and Development - Swinburne University of Technology

Co-Chair - I4AMF Testlabs, Future of Work and Skills Work Stream

Australian Government
Department of Industry, Innovation and Science

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UNIVERSITY of TASMANIA

UTS

THE UNIVERSITY OF WESTERN AUSTRALIA

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

University of South Australia

Session Overview

Session Chair: Professor Aleksandar Subic – DVC Research and Development - Swinburne University of Technology

- Background and Overview of the National Industry 4.0 Testlab Network
- Short Overview from each Testlab
- Q&A Panel Session.

Presenter/Panel Members are:

Associate Professor Nico Adams – Director, Factory of the Future, Swinburne University of Technology – *Reconfigurable Manufacturing Facility as an Open Demonstrator, Teaching and Industry Outreach Testlab*

Professor Bronwyn Fox – Director, Manufacturing Futures Research Institute, Swinburne University of Technology – *Composite Product Automation*

Associate Professor Nikki Stanford – Testlab Director, University of South Australia – *Defence Manufacturing*

Professor Andrew Chan – Head, School of Engineering, University of Tasmania – *Food Quality and Integrity Testlab*

Professor Michael Brünig – Dean and Head, School of Business, University of Queensland – *Green and Smart Energy Testlab*

Professor Jochen Deuse – Professor, School of Mechanical and Mechatronic Engineering, University of Technology Sydney – *Intelligent Biomanufacturing Accelerator Testlab*

Doctor Darren Rowland – Research Fellow/Testlab Project Lead, Faculty of Engineering and Mathematical Sciences, University of Western Australia – *Energy and Resources Digital Interoperability Testlab*

Background of National Industry 4.0 Testlab Network

- 2016 - Prime Ministers Industry 4.0 Taskforce established - Initially to connect Australian and German Industry leaders for collaboration and sharing of Industry 4.0 knowledge and advances
- Understanding gained of importance of establishing innovative learning platforms and facilities to support SMEs, students and workforce transformation.
- German Labs Network Industrie 4.0 driving development of Testbeds in Germany
- 2018 - Australian Government provides $6m support for National Industry 4.0 Testlab Network ($1m to 6 Universities) and Siemens provides significant support through software grants
- Swinburne's DVC R&D, Prof Aleksandar Subic leading the development of the Testlab Network through his role as Co-Chair of the Testlabs, Future of Work and Skills work stream of the Australian Industry 4.0 Advanced Manufacturing Forum (I4AMF). The I4AMF is auspice by AiGroup and continues the work of the Taskforce.

Industry 4.0 Testlabs and how they will benefit industry

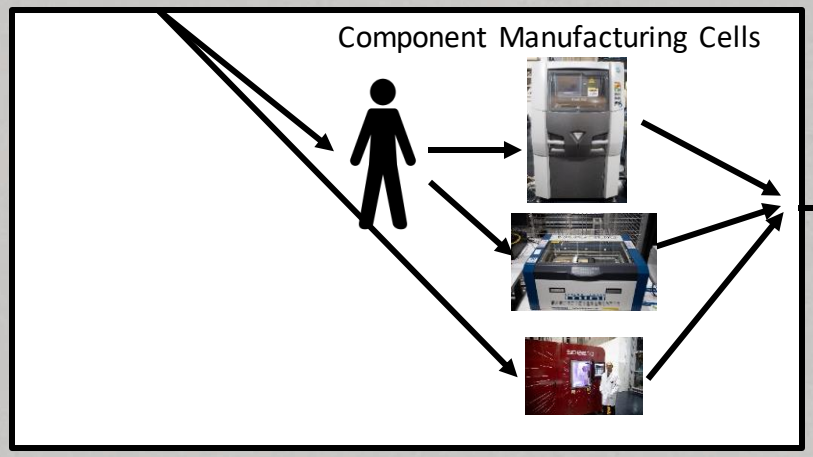
- TestLabs are innovative learning platforms and facilities across the entire continuum of education and training
- Enable the research and education sector to work closely with the industry sector in order to progress Industry 4.0 transformation
- Supportive, non-competitive, cooperative environments that act as co-creation spaces
- Industry can immerse in Industry 4.0 concepts and experiment with new technologies and processes, digitally integrated systems and new Industry 4.0 embedded business models
- Industry engaging with Testlabs will develop capabilities that will enable adoption and workforce transformation.
- Testlabs are being developed in 6 states, based on a pilot-plant concept, focusing on a particular industrial application, and are to be completed by end 2019.

Advanced Manufacturing – Open Demonstrator, Industry Outreach, Teaching and Research Platform

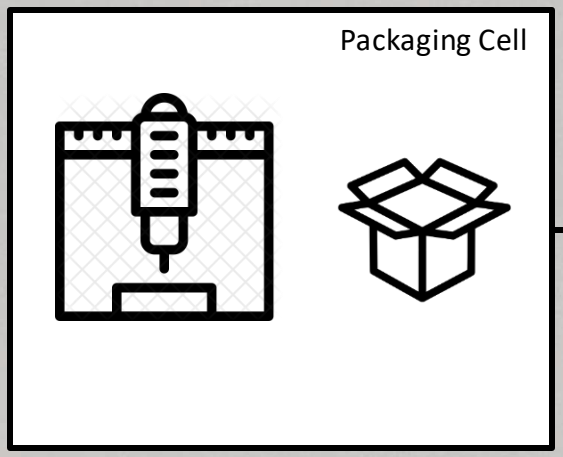
Swinburne University of Technology

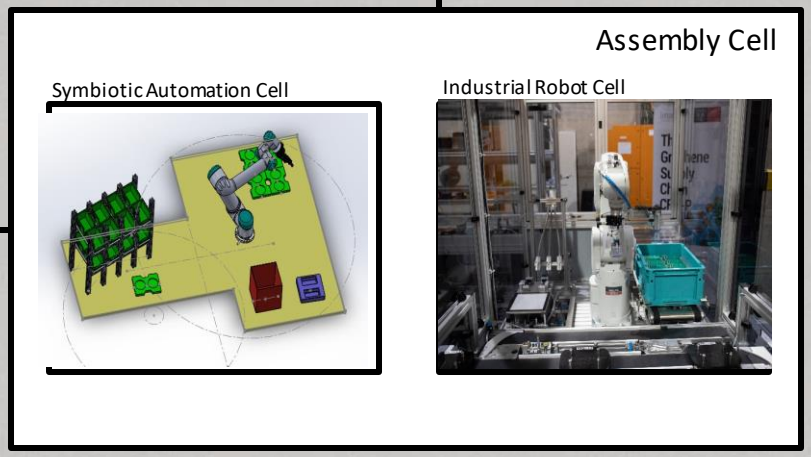
Associate Professor Nico Adams
Director, Factory of the Future
nico.adams@swin.edu.au

Description of Testlab



Smart Storage (3rd Party Parts)





Key Features

- Open, Extensible, Reconfigurable, Hackable
- Engagement/Training/Teaching/Research Platform

Business Best Suited to Utilise and How

Innovation Journeys Through Playing, Thinking and Doing

Playing

Development of technology demonstrators showing business outcomes

- e.g. increased productivity through better resource usage
- e.g. increased productivity through better predictive maintenance
- e.g. competing on differentiated value through products of one for markets of one - reconfigurability

Thinking

Co-creation of Industry 4.0 Strategy with businesses – consulting services (Vic Government I 4.0 Hub grant)

- Delivery of Innovation Audit
- Delivery of Industry 4.0 readiness assessment
- Development of Industry 4.0 enabled product strategy
- Development of product and technology roadmaps

Doing

Training and scalable university engagement models

- Short technical courses
- Industry 4.0 for Leaders

"Tier 2 Manufacturers"

Primes/OEMs and their supply chain

Digital Transformation Service Providers

Composite Product Automation 3D Printing of Composites

Swinburne University of Technology

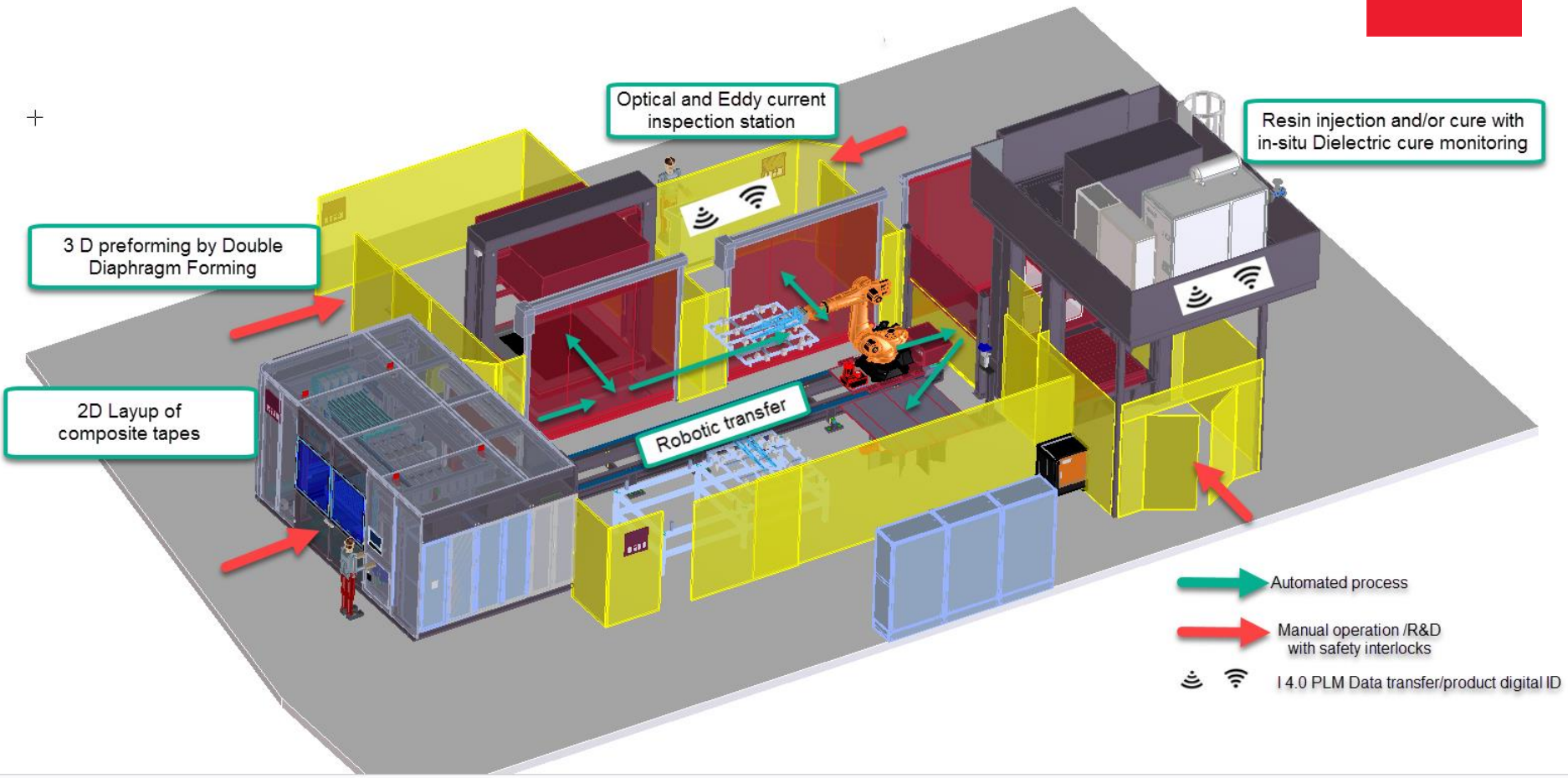
Professor Bronwyn Fox

Director, Manufacturing Futures Research Institute

Swinburne University of Technology

Description of Testlab

SWINBURNE UNIVERSITY OF TECHNOLOGY



Business Best Suited to Utilise

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How will you engage with industry and which industry sector/s

- Aerospace
- Defence
- Automotive
- Future mobility
- Sports

Key industry partners

- Ford
- Boeing
- Quickstep/Fill/Plataine
- Daimler
- Magna
- DSM

Benefits for Business

SWINBURNE UNIVERSITY OF TECHNOLOGY

Research Projects

- 3D printing of composites – fast production rates, low cost, low waste
- Digitalization of design optimization of parts generating machine code
- Research on new fibre architectures (eg helical fibre orientations)
- Next generation polymers and fibres
- Manufacture, simulation and digitalization of preforming
- Digital twin of product, process and performance of product and process

Education

- PhD student training and exchange
- Undergraduate projects with industry sponsored prizes
- Demonstration in an immersive environment of digitalization of a manufacturing process

Training

- In-house training of PAVE apprentices
- Training for SME's in the use of digital tools in a real manufacturing environment
- Training and upskilling for automation and robotics specialists

UniSA Industry 4.0 Test-lab
Defence Manufacturing

University of South Australia

Professor Nikki Stanford

Business Best Suited to Utilise

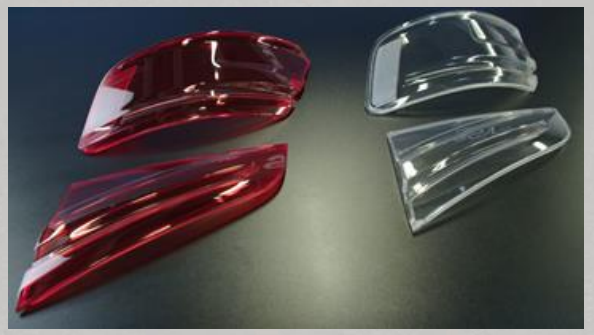
Defence Testlab focussed on businesses who design, develop and manufacture bespoke, low volume, high value-add components for the defence supply chain.

Businesses wishing to explore Industry 4.0 technologies and experiment with rapid prototyping or active coatings. The coatings may impart new functionality such as optical effects, abrasion resistance, corrosion resistance, optical and infrared camouflage, low friction properties, liquid repellence and wear resistance.

Description of Testlab

The UniSA Testlab augments our three core capability areas in Industry 4.0:

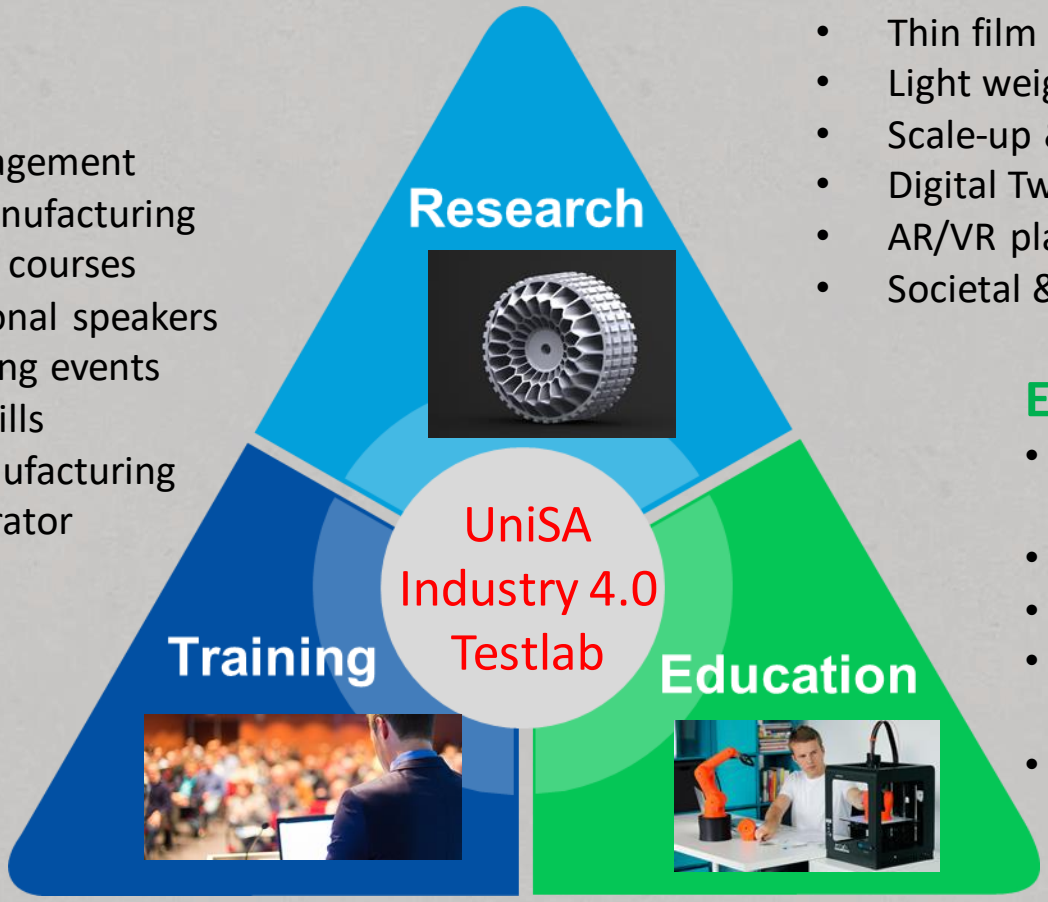
1. Human centred design using AR/VR capability and immersive engineering for product visualisation
2. Advanced manufacturing and product proto-typing using multi-material, full colour, pantone certified 3D printer. In-house CAD expertise to assist industry with product design challenges
3. Pilot scale, in-line sputter coating facility to demonstrate the IoT, real-time decision making/AI and digital twin concepts



Benefits for Business

Training

- SME Engagement
- Rapid manufacturing
- Specialist courses
- International speakers
- Networking events
- Career skills
- Pilot manufacturing demonstrator



Research

- Pilot manufacturing facility
- Thin film coatings
- Light weight structures
- Scale-up & IIoT
- Digital Twins
- AR/VR platforms
- Societal & workforce impacts

Education

- Under graduate and post graduate students
- Engagement with TAFE
- International Internships
- Primary and high school students
- Public outreach and demonstration (open days)

UNIVERSITY of TASMANIA

Taslab - Food Quality and Integrity Testlab

University of Tasmania

Professor Andrew Chan
Head of School Engineering

utas.edu.au

Description of Testlab

Testbeds	Activities	UTAS and partners
Innovative production methods for feed manufacture	Aquaculture and animal feed	Institute for Marine and Antarctic Studies
Innovative methods for feed and food analysis	Agrifood, agritech	Tasmanian Institute of Agriculture
Innovative methods for food analysis for food safety	Food safety, security, authenticity	Centre for Food Innovation
Sensory-consumer lab facility for innovative food production methods	Cybersecurity and blockchain, product tracking	School of Engineering School of ICT Cromarty
Internet of Things (IoT) showcase lab	Sensing and telemetry (eg LoRaWan)	Sense-T Definium Technologies
Portable field facility	SME producer on-farm IoT kit, provenance and supply chain monitoring kit	Sense-T School of Engineering Cromarty

Business Best Suited to Utilise and How

Key Industry to Utilise

- Agriculture
- Agritech
- Aquaculture
- Farming supply chain
- Food processors and packagers
- Transport and logistics operators
- Exporters
- Retail and restaurants
- Defence

How to Utilise

- Access the TasLab or request on-farm trials
- Explore food safety, security and authenticity methods and technologies
- Discuss scalable solutions and integrated solutions
- Build Industry 4.0 knowledge and capability
- Extend industry knowledge to all aspects of the food value chain to increase value adding activities

Benefits for Business

- **Engagement**

  Front door for industry access, innovation and knowledge partnering

  Collaborative space for industry, academics and public

  Demystify Industry 4.0 and IoT

  Developing pathways to Industry 4.0

  Solutions for pre-farm, farm and post-farm, and product tracking

  SMEs engaging in best practice – in the TasLab and on farm trials

  Public fora

- **Education**

  Opportunity for schools engagement and post-secondary

  Non-credit short course

  TasTafe/UTAS University College Industry 4.0 content in programs

- **Research**

  Leveraging for funded regional development and outreach projects

  On farm trials

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA
CREATE CHANGE

Industry 4.0 Energy Testlab @UQ

Green and Smart Energy Testlab

Professor Michael Brünig | Dean & Head of School
School of Business
The University of Queensland, Brisbane, Australia

Description of Testlab

The University Of Queensland
AUSTRALIA

Business Best Suited to Utilise

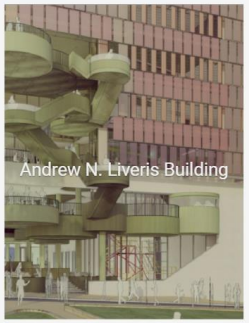
THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

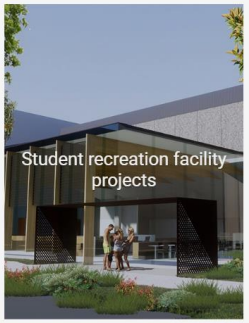
Industry sectors

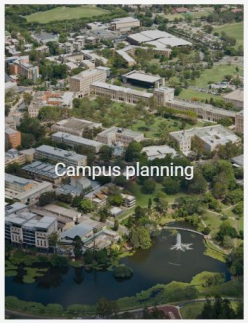
- Generator
- Transmission & Distribution company
- Building management service Providers
- Cyber security agency
- Energy service provider
- Data Enabled Services Business

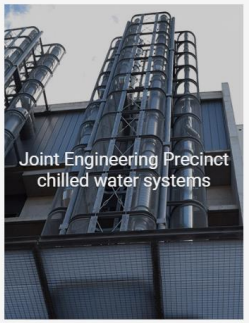
Our Key Industry Partners

SIEMENS
NOJA POWER
ERGON ENERGY
energex
REDBACK TECHNOLOGIES
Powerlink QUEENSLAND
ABB
Ausgrid
TransGrid
TasNetworks
essential energy
SA Power Networks
united energy









Benefits for Business

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Research

- Building-campus-city energy management
- Peer-to-peer trading
- Power system stability
- Cyber security
- IoT and Big data
- Condition monitoring and predictive maintenance

Training

- Engagement and knowledge transfer with SMEs
- Collaboration with Properties & Facilities
- International collaboration
- Summer school and workshop
- Industry showcasing
- Specialized training for SMEs

Education

- Engaging and deeply realistic teaching and learning for students
- Hands-on teaching and research environment to facilitate in depth energy system & cyber security research
- Collaboration between different schools and faculties of UQ
- Public outreach and demonstration on UQ open days

UTS Intelligent Bio-manufacturing Accelerator

Professor Jochen Deuse
Professor, School of Mechanical and Mechatronic Engineering
Faculty of Engineering and Information Technology
University of Technology Sydney

Description of Testlab

Integration of algae production and intelligent manufacturing enabling technologies for tech transfer to SMEs and knowledge discovery.

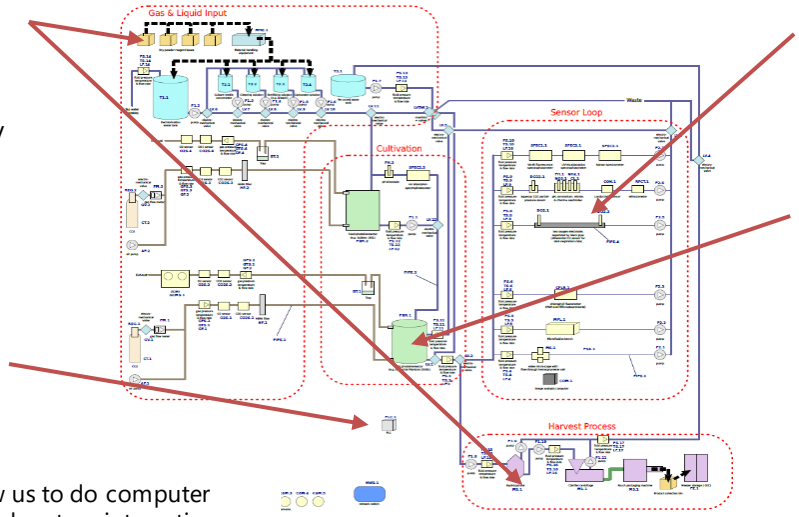
Why Algae? Algae, an organic product created from saltwater and sunlight, offers a huge diversity of products in medicine, energy and agriculture.

Current industrial algae production is disjointed and highly inefficient which may be greatly enhanced with finer control and monitoring techniques provided by I4.0. Complete process monitoring with machine learning can provide early warning and mitigate adverse process conditions. Process history will provide a rich dataset to accelerate product development for SMEs.

1. Automated systems for raw material delivery, cleaning, packaging and storing

2. Motion tracking and CCTV for remote lab management (collaborative robotics)

3. Monitoring and Control managed by suite of Siemens hardware/software including Simatic and Tecnomatix

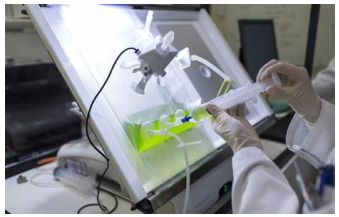


4. Digital Twinning will allow us to do computer simulation of the process and system interaction remotely.

5. Chemical and optical analysis is automatically stored for statistical learning

6. Algae production closely observed (in real time) and fully instrumented

7. Physical Twinning – Secondary microscale site to connect frontline research to production. The microscale lab and the industrial scale lab will allow for robust recipe development for industrial production



UTS

Business Best Suited to Utilise and How

Testlab provides a physical space for businesses and researchers to come together to trial, explore and showcase Industry 4.0 technologies and processes as well as to develop an innovation platform through:

HOW TO ENGAGE

- Showcase Site
- Manufacturing Sandbox
- Industry-focused professional education
- Collaborative Research and Consultancy
- Development Support of SME Capabilities into Biomanufacturing

WHO CAN ENGAGE

- Technical suppliers
- Professional service providers
- Any SMEs including the following domains:
  - Biomedical
  - Pharmaceutical
  - Wastewater
  - Energy
  - Food and Agriculture

Benefits for business

BUSINESS

- Industry 4.0 technologies advancing integration of algae production and intelligent manufacturing enabling technologies for sustainable product development for domestic SMEs as well as knowledge discovery
- Enormous potential of algae (food, nutraceuticals, aquaculture, agriculture, biopolymers, pharmaceuticals, industrial enzymes, and fuel)
- TestLab provides transferable training opportunities with I4.0 techniques and algae production

EDUCATION & TRAINING

- i4.0 technologies available to SMEs, students and researchers for upskilling and training
- VET/SMEs/Tertiary collaboration, including curricula
- Data Science training on industrial processes
- Training with industrial (Siemens) hardware/software

RESEARCH

- Innovations that address the unique needs of algae biotechnology sector
- Process and instrumentation research for both education and industry to enhance finer control and monitoring techniques of i4.0 and algae production
- Digital twinning to provide pathway for rapidly scale production methods
- Autonomous and Human Interactive of robots with active perception for material handling and product packaging

The UWA Industry 4.0 Energy and Resources Digital Operability Testlab

Enabling integrated, continually optimising operations

erditestlab.com

Dr Darren Rowland
Testlab Project Lead
University of Western Australia

Australian Government
Department of Industry, Innovation and Science

THE UNIVERSITY OF WESTERN AUSTRALIA

ETP Enterprise Transformation Partners

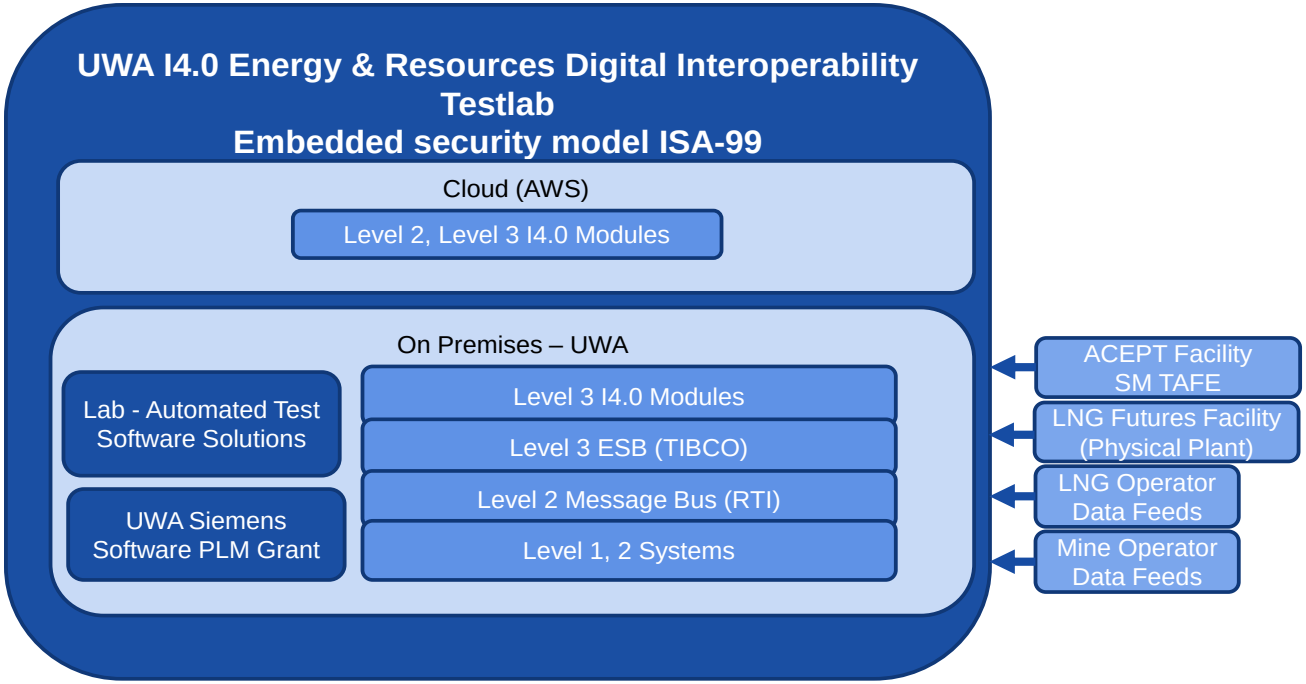
GOVERNMENT OF WESTERN AUSTRALIA

TAFE South Metropolitan

Description of Testlab

The **UWA I4.0 ERDi Testlab** is a collaboration between the University of Western Australia, the Department of Industry, Innovation and Science, AMIRA International, Enterprise Transformation Partners, and South Metropolitan TAFE.

Focussed on accelerating the adoption of Industry 4.0 technologies in Australia's energy and resource sectors through the development and demonstration of Standards-based, secure, interoperable process control and automation.



Level Hierarchy:
0 – Field instruments including sensors & actuators
1 – Robust input/output modules & basic controllers including PLC
2 – Supervisory computers and distributed control schemes (DCS) monitored by operators
3 – Operations management for production optimization & performance target monitoring

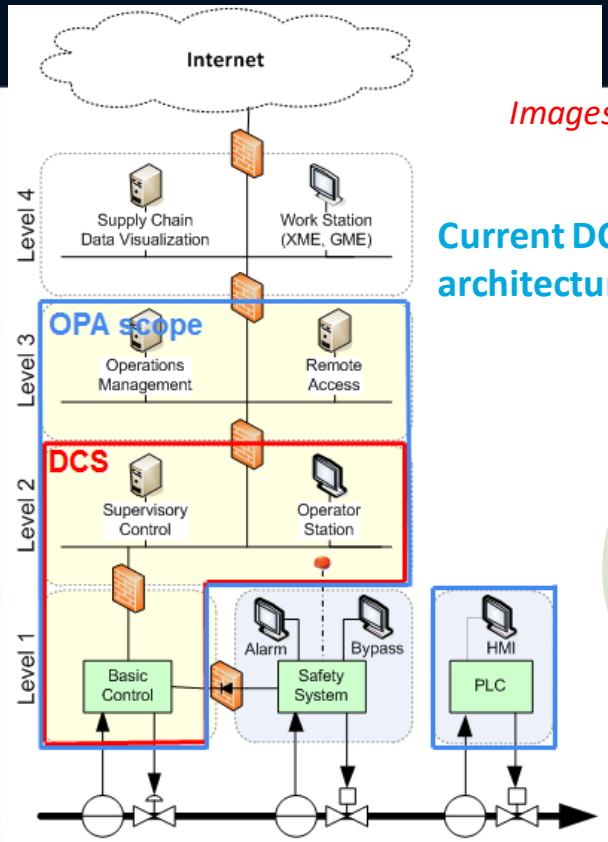
Business Best Suited to Utilise

- Digital interoperability is one of the key enablers for future tech including Smart Factory, Digital Mine, Digital Oilfield etc.
- The Testlab will attract industry partners with interests in creating, adopting, or maintaining interoperable hardware and software
- SMEs receive support to create best-of-breed solutions to industry problems
  - Showcase and demonstrate their innovations at the Testlab
  - Lower the barriers to entry in competitive markets

Benefits for Business

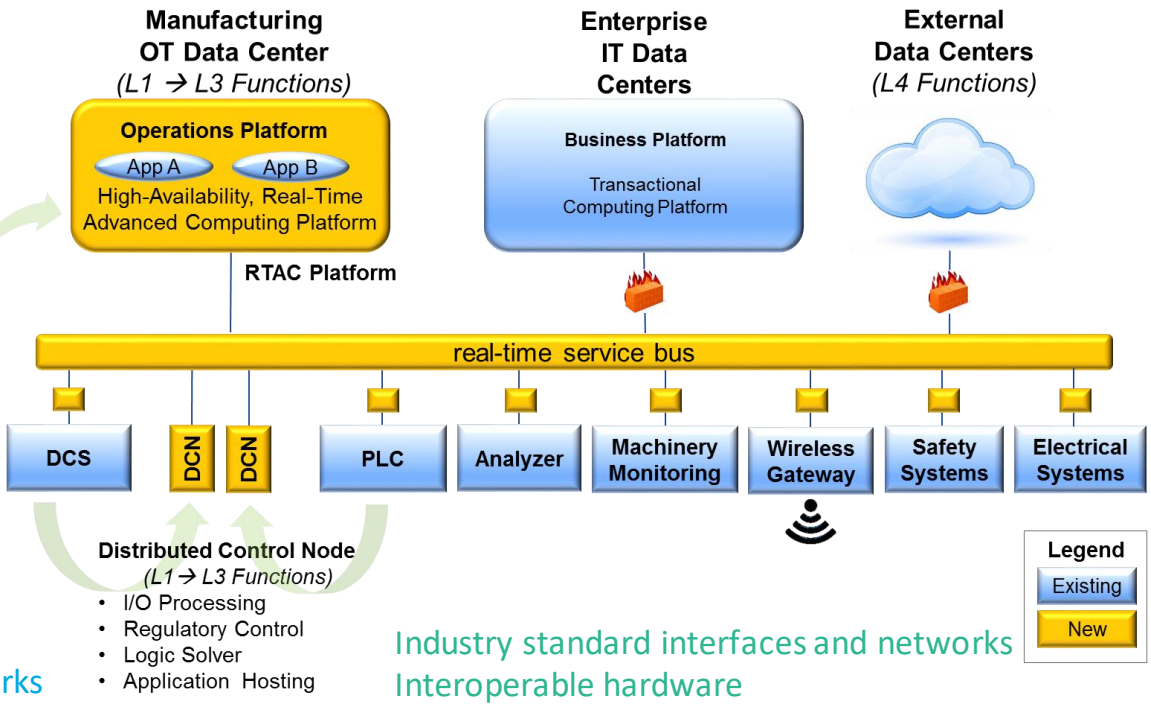
Images courtesy of ExxonMobil

Current DCS architecture



Proprietary hardware, interfaces and networks
Vendor-controlled software access
Security not intrinsic: bolted-on, not built in

OPA reference architecture



Industry standard interfaces and networks
Interoperable hardware
Open software access
Designed-in security

Validation and Certification of I4.0 Standards-compliant technology
Interoperability proof-of-concept projects and Standards enhancement
With SM TAFE, development of I4.0 micro-credential for worker upskilling / re-training
Education of industry personnel for designing and maintaining continually-optimising operations

Panel Session

Chair: Aleksandar Subic – DVC Research and Development – Swinburne University of Technology

Nico Adams – Director - Factory of the Future - Swinburne University of Technology
Bronwyn Fox – Director - Manufacturing Futures Research Institute - Swinburne University of Technology
Nikki Stanford – Testlab Director - University of South Australia
Andrew Chan – Head - School of Engineering - University of Tasmania
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Darren Rowland – Testlab Project Lead - University of Western Australia