Swinburne - AM Capabilities

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ADDITIVE MANUFACTURING AUSTRALIA MAKES CRC

Acknowledgement of Country

We respectfully acknowledge the Wurundjeri People of the Kulin Nation, who are the Traditional Owners of the land on which Swinburne's Australian campuses are located in Melbourne's east and outer-east, and pay our respect to their Elders past, present and emerging.

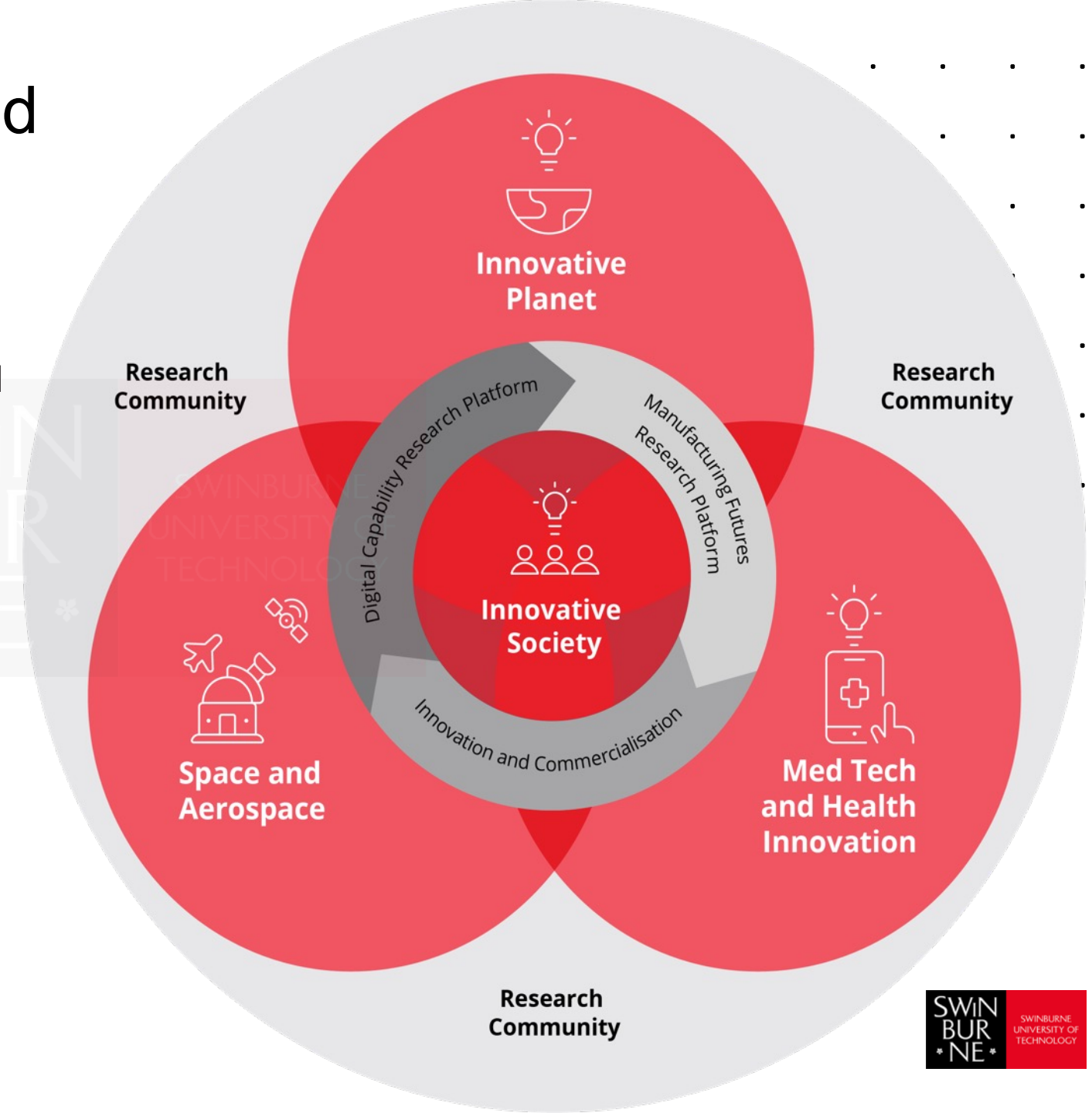
We are honoured to recognise our connection to Wurundjeri Country, history, culture, and spirituality through these locations, and strive to ensure that we operate in a manner that respects and honours the Elders and Ancestors of these lands.

We also respectfully acknowledge Swinburne's Aboriginal and Torres Strait Islander staff, students, alumni, partners and visitors.

We also acknowledge and respect the Traditional Owners of lands across Australia, their Elders, Ancestors, cultures, and heritage, and recognise the continuing sovereignties of all Aboriginal and Torres Strait Islander Nations.

Swinburne's future-focused Research Strategy 2025

Swinburne's future-focused research and innovation combines science, technology and innovation with humanity to deliver genuine, collaborative and sustainable social, environmental and economic impact.



Advanced Manufacturing & Surface Engineering

Capabilities:

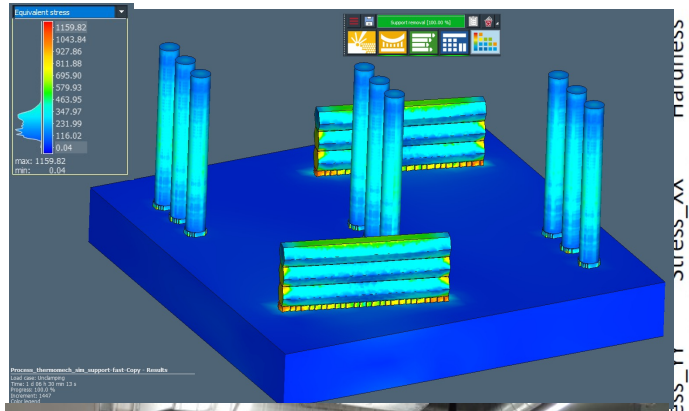
- Repair of Defence components using AM techniques
- Design and simulation of thermomechanical properties of Metal AM parts
- Topology-optimisation of metal 3D-printed structures
- Development of advanced cutting tools for machining of additively-manufactured structures
- Laserline blue high-power (2 kW) diode laser*
- LaserBond robotic safety cell*
- Welding optics and cladding optics (incl. CMOS and IR cameras, CLAMIR monitoring) and dual powder feeders

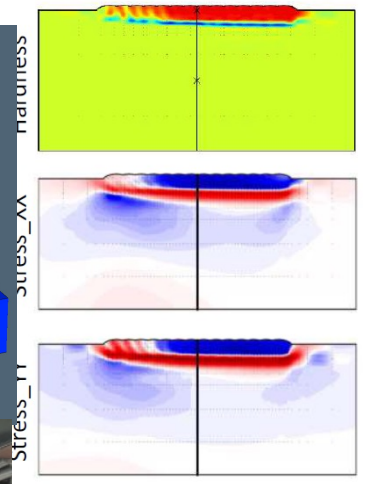
Industry Partners:

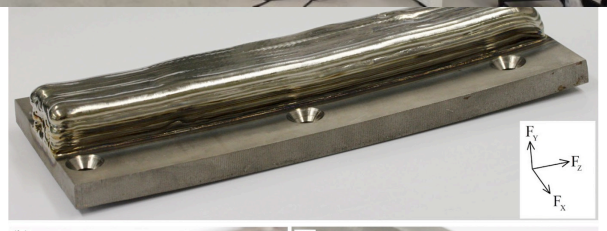
DMTC, Rosebank Engg., BAE Systems, DSTg,, Sutton Tools, Amiga Engg., Amaero Engg. Romar

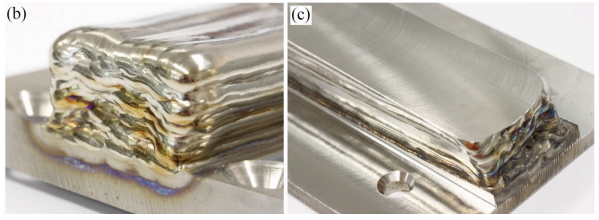
Other research partners:

UQ, RMIT, UoW, ANSTO, CSIRO, IIT-M









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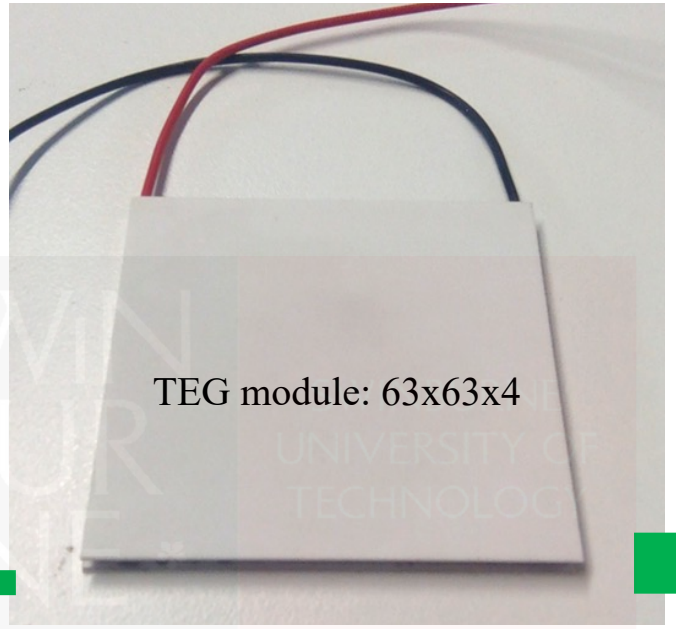
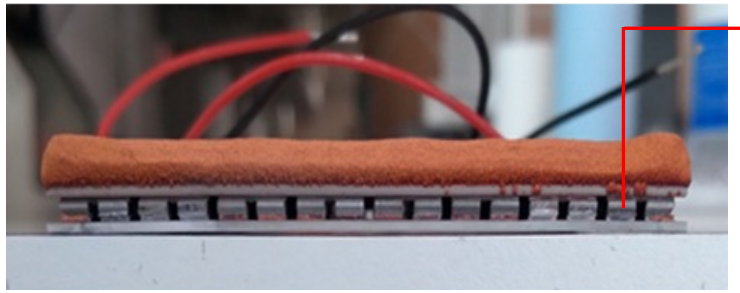
Cold Spray Additive Manufacturing

- Builds parts up to 4kg;
- diameter up to Ø350mm by 300mm high.
- DSTG



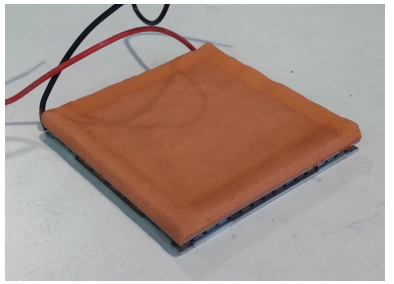
Thermoelectric materials development



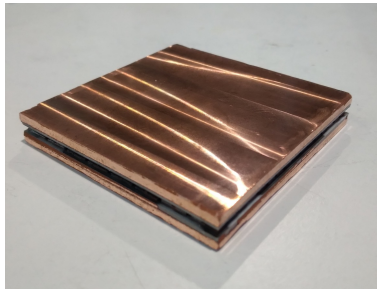
Thermoelectric Generator (TEG):

- Converts waste heat to electricity (electricity co-generator)
- Potentially reduces heat signature of naval platforms

Cu coating on Al_2O_3 ceramic (enhancing heat-transfer)



After deposition



Machined

Bi-Te alloy material, containing rare-earth (Bi) and toxic (Te) elements.

Substitute with

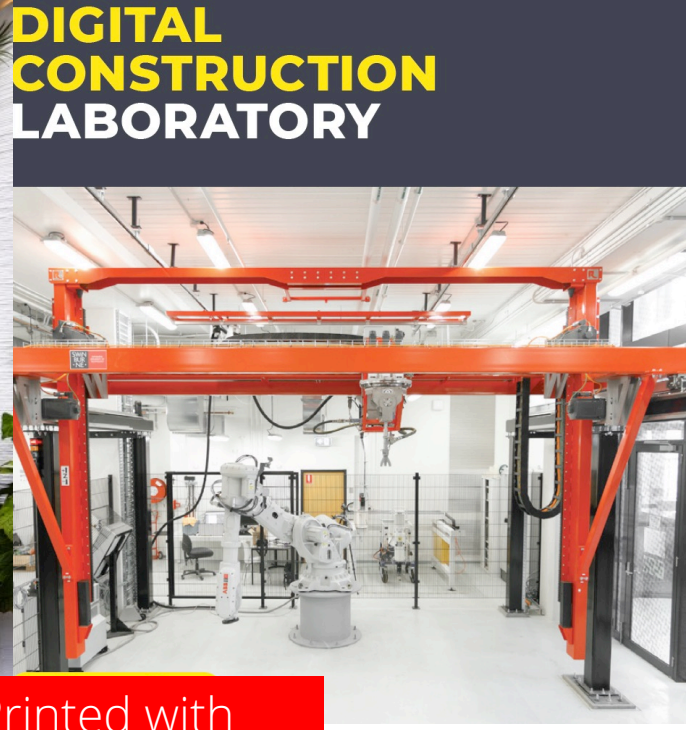
Earth-abundant, environment[illegible]iendly material: Cu-based metal mat[illegible] composite

3D Concrete Printing & Composite

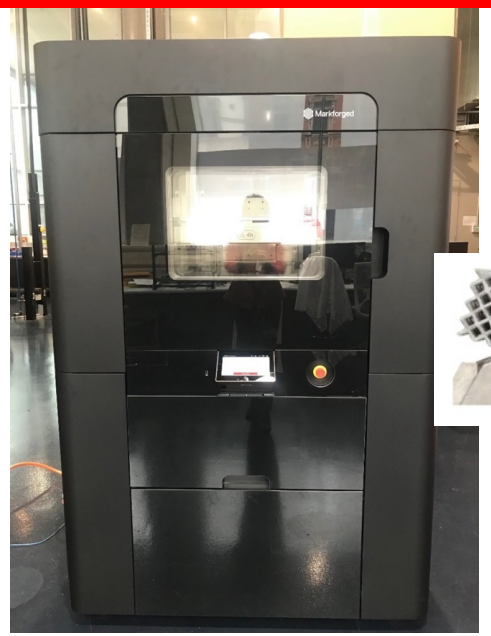
Capabilities:

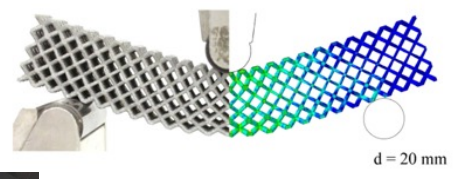
- Large scale 3D concrete printing
- Low carbon concrete with no Portland cement
- Geopolymer concrete
- Digital design and fabrication

- Print continuous fibre-reinforced composites using carbon, glass and Kevlar fibres
- Design and print components for industry applications



Garden Furniture 3D Printed with Concrete in DC Lab





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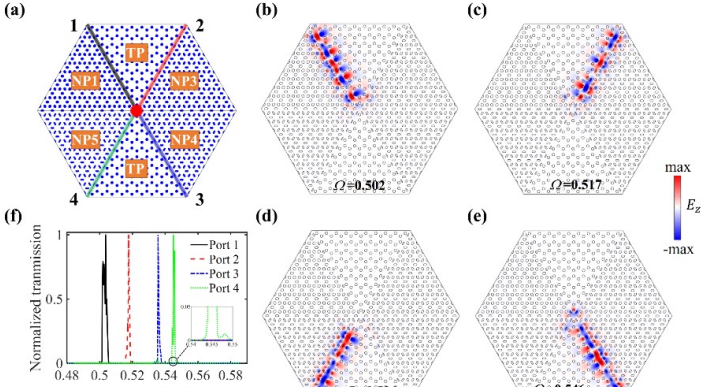
Polymer Composite Processing & Topology Optimization design

Capabilities:

- Additive Manufacturing of Polymers and their Composites, including continuous CFRP, GFRP and alloys with metals/inorganic particulates
- Fused Filament Fabrication, Direct Ink Writing and Photopolymerisation 3D Printing
- Extrusion, Compression and Injection Moulding
- Recycling & Functional Upcycling of Polymers/composites
- Topology optimization of single and multi-material mechanical and civil structures
- Topology optimization of cellular and composite materials and metamaterials with exceptional mechanical and acoustic properties

A Micro-Meso-Macro Approach to AM of Composites, th[illegible]ility



Research Partners:

- CSIRO Data61, University of Melbourne and Luxemburg Institute of Science and Technology, etc

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NANOLAB/ 3D nano-micro printing @ OSC-Optical Sciences Centre

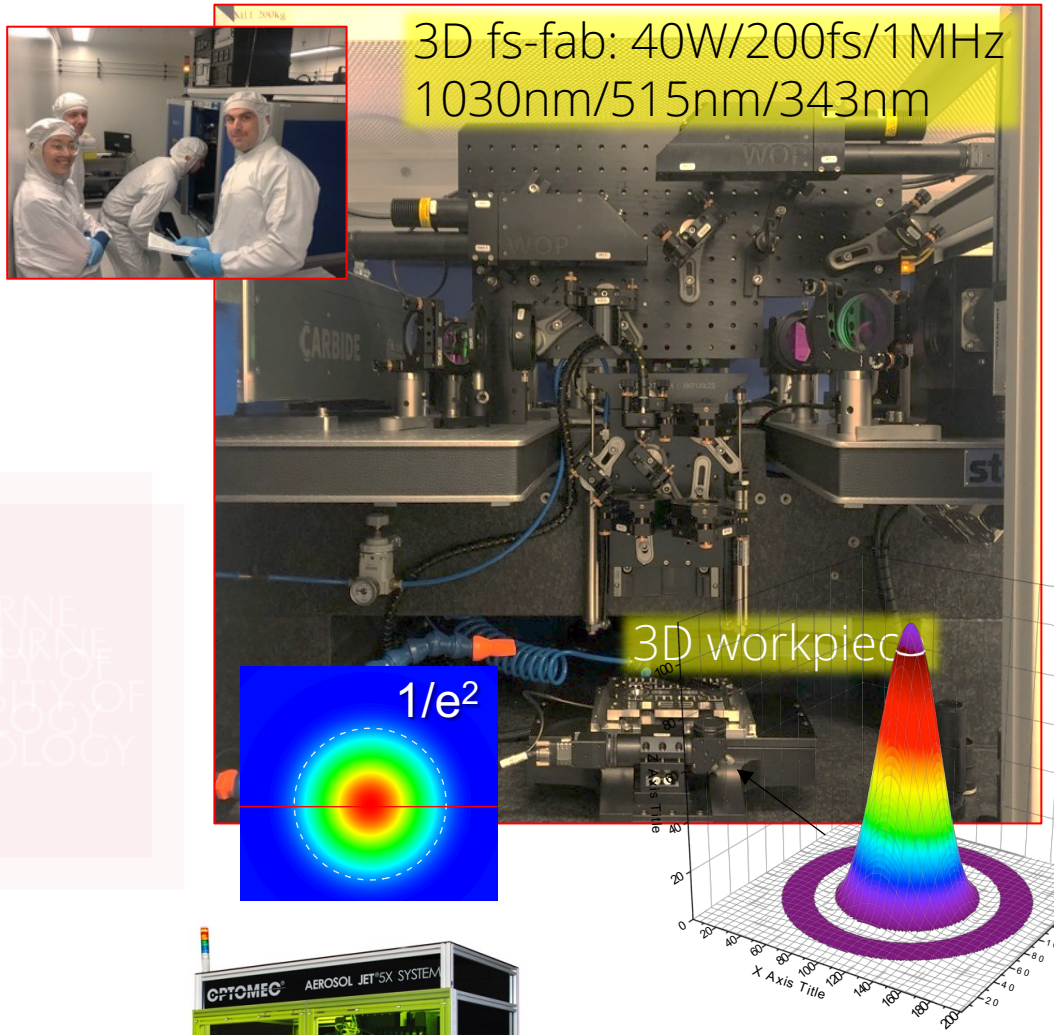
Capabilities: 3D printing @ energy deposition TW- : <1ps :

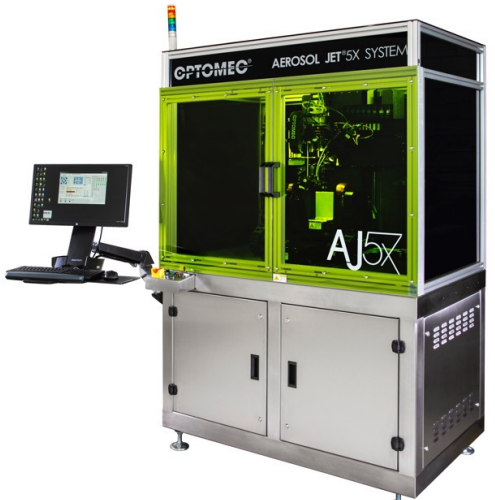
- Photo-polymers/composites, nanoparticle production
- Alloying of nano-films, hard X-ray , THz generation
- Nano-micro CNC machining on surface & inside materials
- Solar cell patterning
- Plasma polymerisation reactors for surface modification plus wide range of surface characterization instruments
- Optomec aerosol jet printer for 2D surface patterning
- Large area femtosecond laser micromachining and surface micro/nano texturing and patterning
- Mass customization of personal products (Autodesign)

Industry Partners:

- ANCA (Linkage ARC); DefendTEX (Linkage ARC)

Other Research Partners: AuSy - synchrotron (ANSTO), MCN – ANFF, HB11 Pty, Quobasystems Pty, Miftar Ganija (Uni Adelaide), Robby Pebst (ISFH – Inst. Solar Energy Research, Germany), Sajeev John (Uni Toronto)





90% of max
- nanoscale patterning
- direct write

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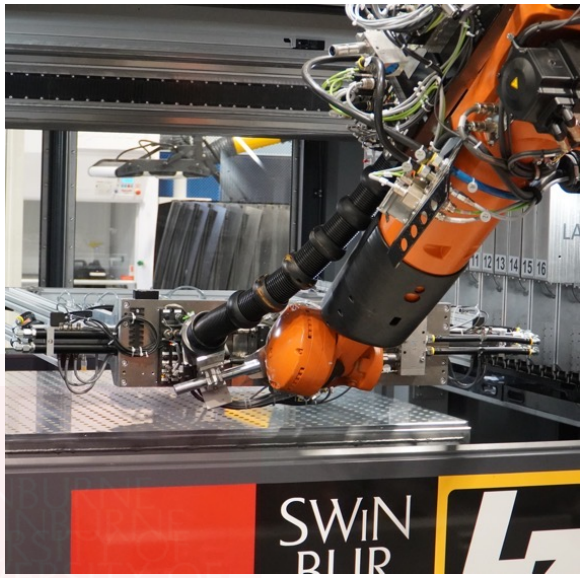
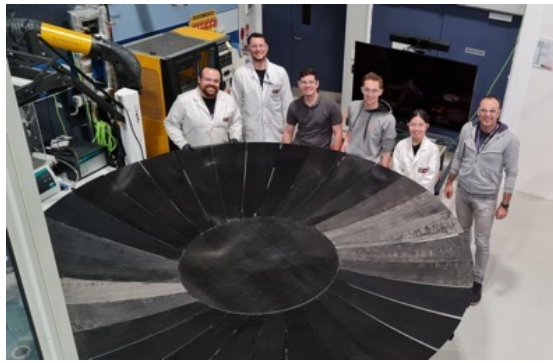
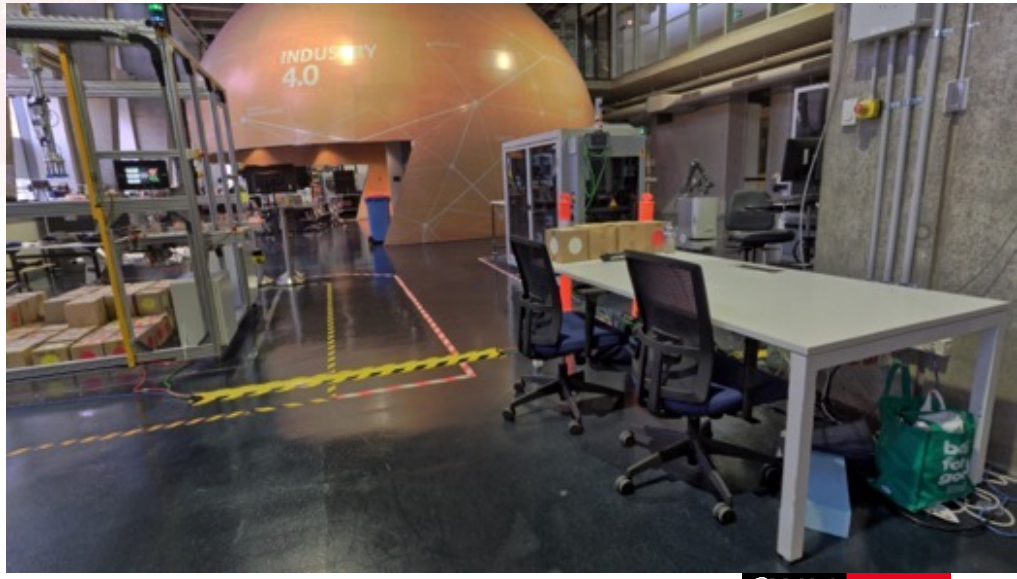
Factory of Future & Swinburne/CSIRO Industry 4.0 Testlab





Capabilities:

- Industry 4.0 Business Readiness, and Industry 4.0 Training (Nation first)
- Software Engineering, Data and Analytics
- Systems Middleware Architecture and Platforms Research
- Machine Learning and Deep Learning
- Industrial Internet of Things (IIoT), Machine to Machine communication
- Digital Twins and AI, Industrial Metaverse
- Fully automated composite part manufacture
- Small-batch to industrial scale fabrication
- Digital tracking & data analytics for process optimisation



Industry Partners:

Boeing, Quickstep, MAGNA Styr, Titomic, Ford, Plataine, Fill, Langzauner

Other research partners:

CSIRO, ARENA2036, University of Southern Mississippi

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Intelligent Robotics Lab

Capabilities:

- Rapid prototyping of novel robot architectures, sensor fusion, etc.
- Robot cell for large-scale pellet-based 3D printing, teleoperation of ultrasound examinations, autonomous ultrasound examinations
- Industrial robots (IRB2600, IRB 140), collaborative robots (UR5e, CRB 15000-5/0.95 (GoFa), Sawyer, Xarm6 on a linear track, MyCobot 280), parallel robots, mobile platforms, 3D cameras, 3D scanners, lidars, haptic devices, 3d printers, depth cameras, 2D cameras, thermal cameras, lidar, wireless ultrasound probe

Industry Partners:

Through Australian Cobotics Centre (Infrabuild, Weld Australia, Stryker, BR Enclosures, IR4), DSTg, Universal Shower Base, Rectifier Techologies

Other research partners:

- Australian Cobotics Centre (QUT, UTS), Baker Heart Institute

Swinburne Impact Engineering Laboratory & Modelling

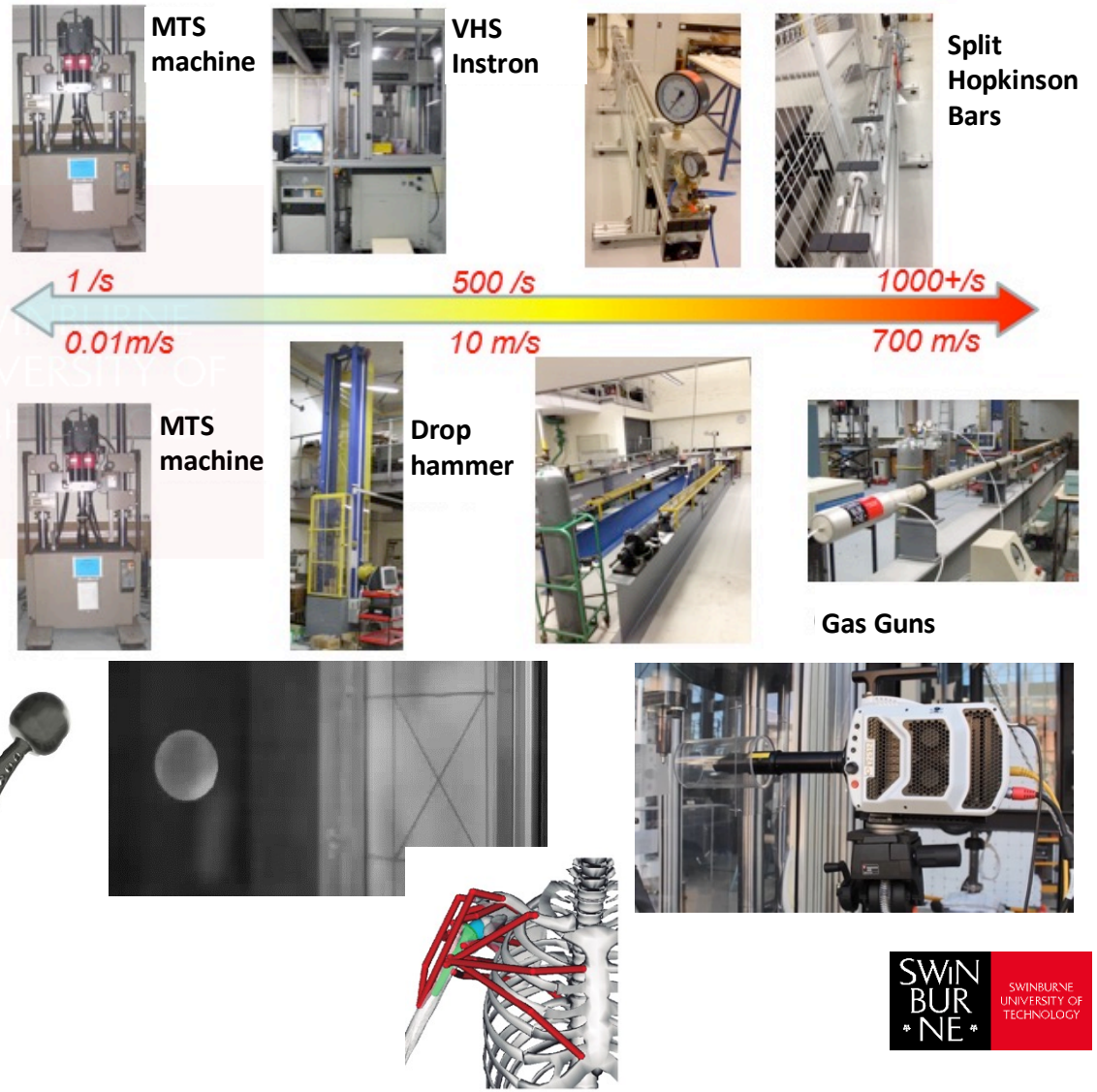
https://www.swinburne.edu.au/research/facilities-equipment/impact-engineering-laboratory-facilities/

Capabilities:

- Characterization of material properties at high strain rates
- Impact and crashworthiness of innovative structures such as automotive, rail, marine and aerospace structures
- Structural response to ballistic impact and blast
- Lightweight/composite materials and structures (honeycombs, foams, 3D printed lattice materials etc.)
- Human head injury due to impact
- Design of Protective Equipment
- Implant/ Prostheses Design

Industry Partners:

- Over 40 partners including DST-G, RoadSafety Australia, CSIRO,



Swinburne Researchers

- **Prof. Suresh Palanisamy (Materials & Manufacturing & NDT)**
- Prof. Jay Sanjayan (Concrete 3D Printing) & team
- Prof. Guoxing Lu (Impact Testing) & team
- Prof. Dong Ruan (Composite 3D printing)
- Prof. Simon Moulton (Bio-medical) & team
- Prof. Gavin Lambert (Medical)
- Prof. Saulius Juodkazis (Nano 3D printing)
- Prof. Prem Prakash Jayaraman (Digital Manufacturing & Digital Twin)
- Emeritus Prof. Syed Masood (Polymer and Metal 3D printing)
- Prof. Xiaodong Huang (Topological optimisation)
- Prof. Paul Stoddart (Bio-medical/ Laser Optics)
- Prof. Boris Eisenbart (Industry 4.0 Testlab)
- A. Prof. Mats Iskasson (Robotics & Automation)
- A. Prof. Yvonne Durandet (Laser Additive Manufacturing)
- Dr. Mostafa Nizkad (polymer recycling & 3D printing)
- Dr. Rizwan Abdul Rahman Rashid (Metal additive Manufacturing)
- Dr. Novana Hutasoit (Metal Additive Manufacturing)
- Dr. Sascha Hoinka (Quantum Gas Microscope) & team
- Dr. Kwong Ming Tse (Modelling)
- Other researchers…

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Thank you

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