

# Additive Manufacturing R&D

Prof Richard Yang

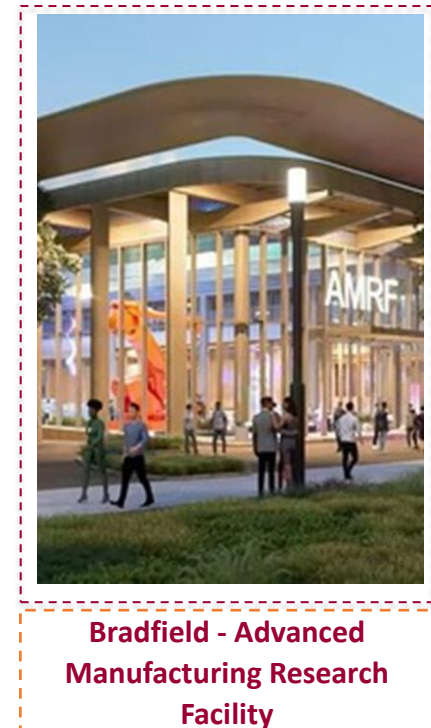
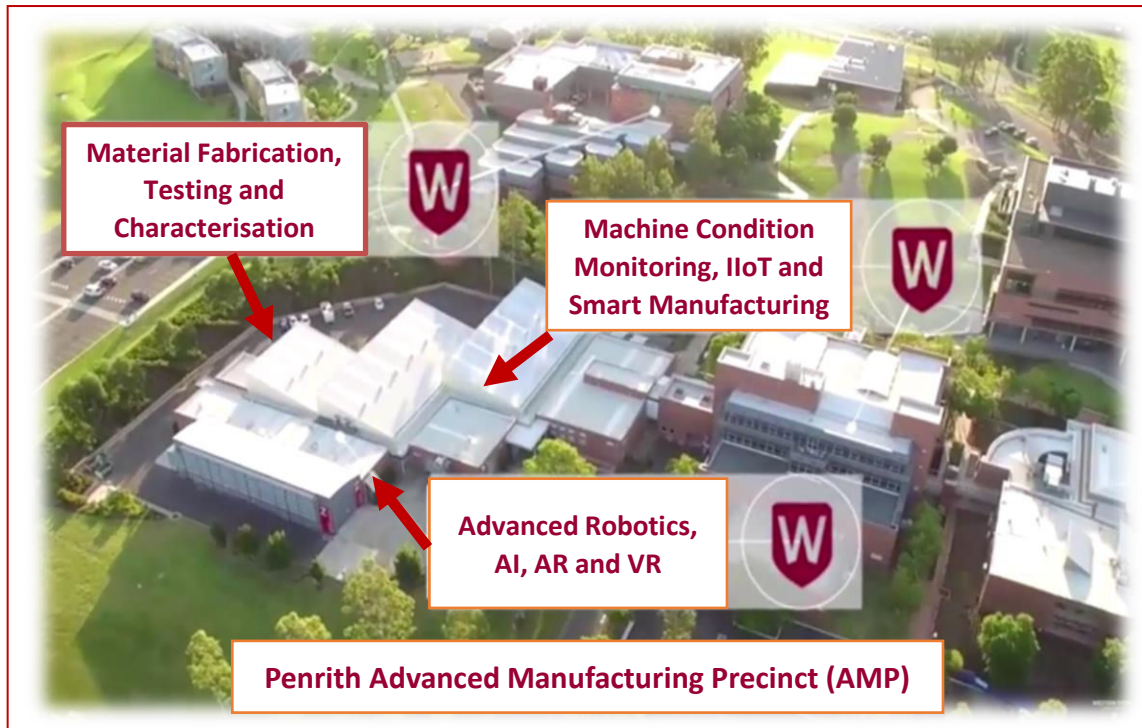
Director, Centre for Advanced Manufacturing Technologies (CfAMT)

9 November 2023

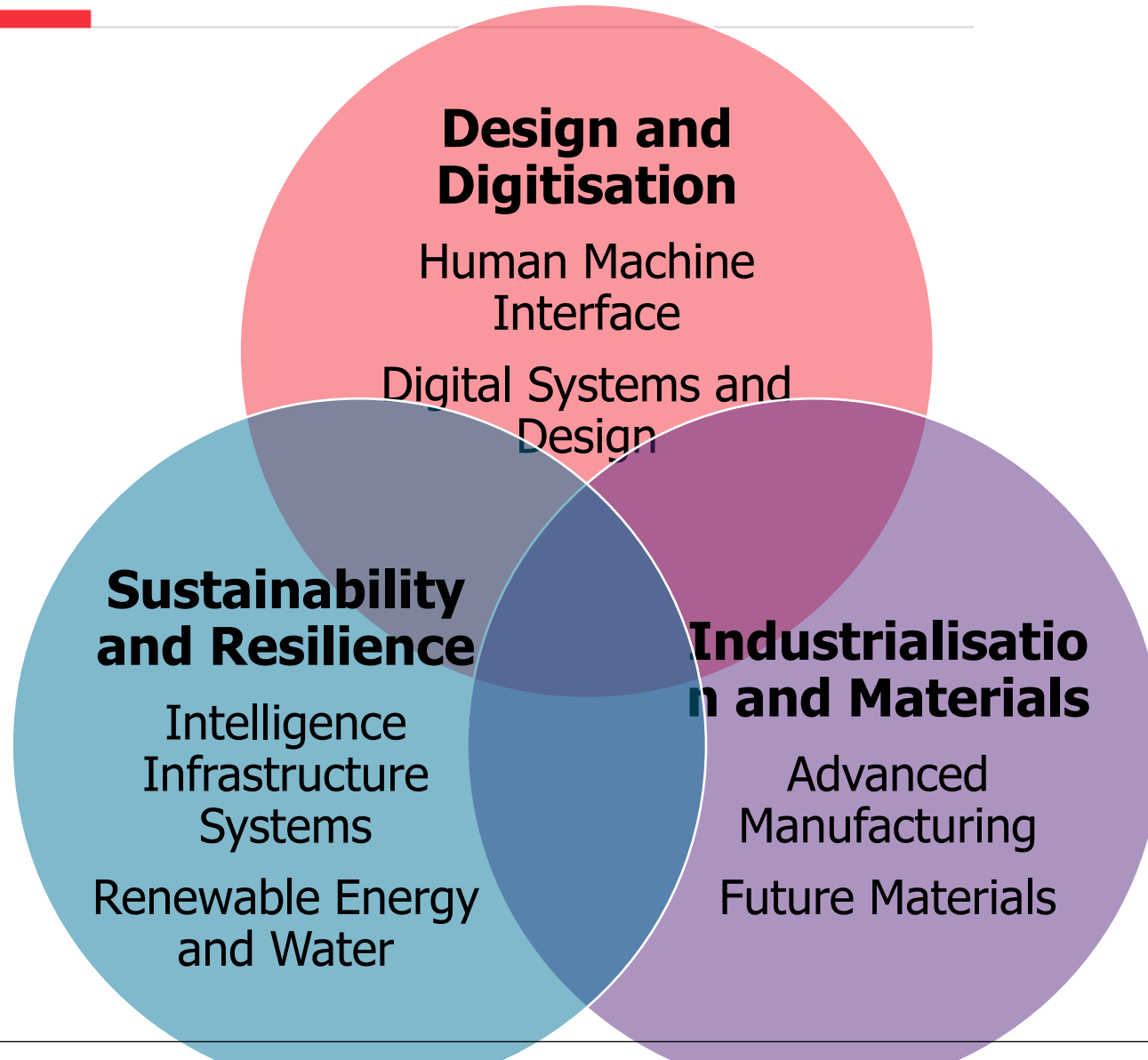


# Geographical Advantages and Partnerships Mission

## Network of Advanced Manufacturing Precincts in Greater Western Sydney Region



# Cross-Disciplinary Research Themes



**School of Engineering, Design and Built**

## 3 Research Centres:

- Centre for Infrastructure Engineering
- Centre for Smart Modern Construction
- Centre for Advanced

## Centre for Advanced Manufacturing Technology

**12 Core Members**

3 Profs

2 A/Profs

4 Senior Lecturers

3 Lecturers

**10 Associate members**



# Research, Technology and Commercialisation

Capabilities supporting leading edge R&D, innovation and commercialisation in partnership with industry

## Centre for Advanced Manufacturing Technology (CfAMT)

- AM Technologies, CAE/Digital Twin
- Advanced Engineering Materials and Defence Technology
- Automation and Robotics
- AM Education and Training

## Advanced Manufacturing Precinct Technical Facilities

- Materials Testing Lab
- CNC Machining Lab
- Nanotechnology and Advanced Materials Lab
- Robotics Lab
- 3D Printing Hub/Makerspace

## Launch Pad Technology Business Incubator – Factory of the Future

- Business mentoring and capability development supporting technology adoption
- Intelligent Production
- Value Innovation
- Simulation and Visualisation

# Nanotechnology Innovation for Durable Bonded Joints with High Performance under Operational Conditions

Sarah Zhang, Richard Yang, Chun Wang, et al. Next Generation Technologies Fund, Department of Defense, \$334k 2020-2022

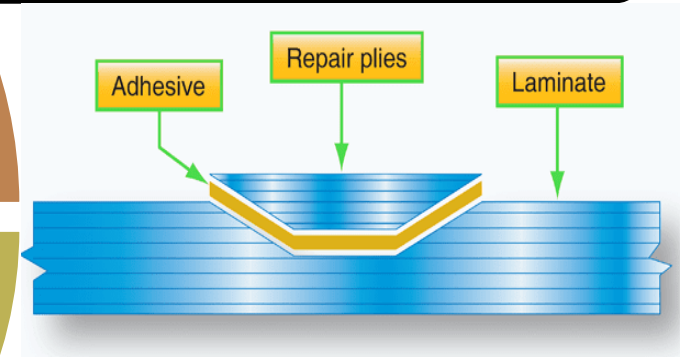
- Enhanced bond strength (137%) and durability (40% at 90 degrees)
- Ability to rapidly repair
- Extensive maintenance cost savings



Impact and Benefit

Adhesive bonding

- Ease of fabrication and design flexibility
- Ability to join similar and dissimilar materials
- Repair applications
- Epoxy adhesives



- Environmental-friendly functionalization methods
- Advanced mixing and toughening methods
- Uniform distribution
- Enhanced interfacial strength

Nanocomposite adhesives

Carbon nanomaterials

- Carbon nanotubes and Carbon nanofibers
- Excellent mechanical, thermal and electrical properties
- Poor dispersion in polymers
- Poor interfacial interactions



# Transforming pastefill delivery system for next-generation mining industry

Chief Investigator: Richard Yang, Sarah Zhang, Kejun Dong, Leo Zhang and Scott Cheevers

Australian Research Council (ARC) Linkage Project

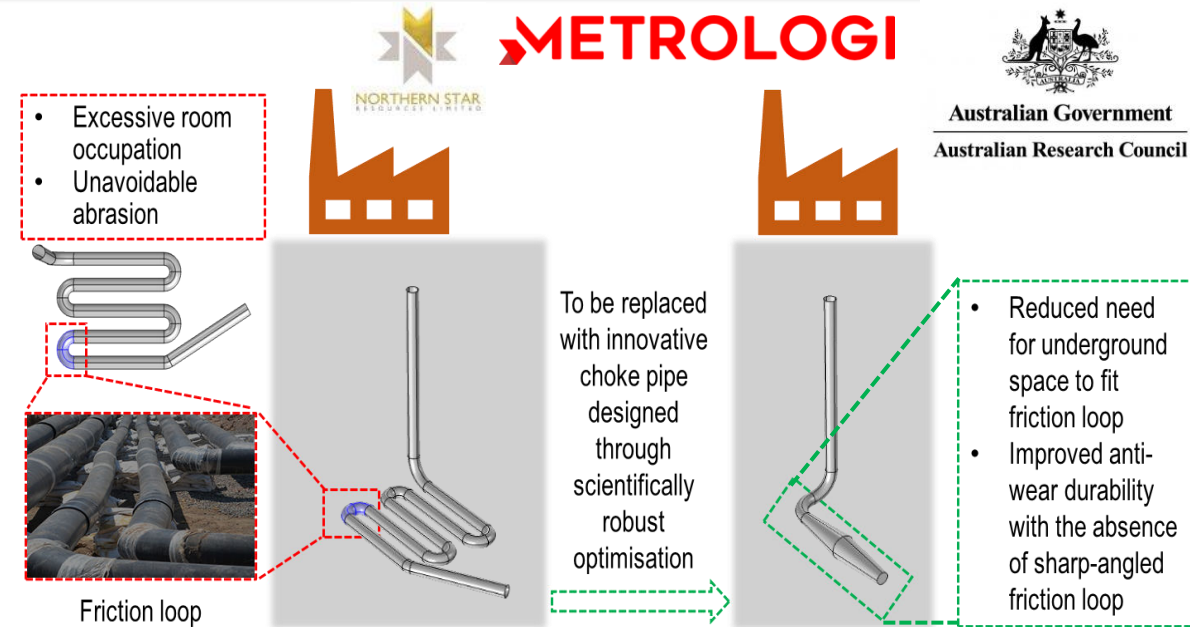
LP220100131, 2023-2025, \$362,000

## Project aims:

To develop a novel and durable pipeline system with a new composite choke pipe (Figure 1) to replace the conventional complex steel friction loops. We will develop advanced numerical modelling and an Artificial Intelligence (AI) framework to model our pastefill system.

## Expected outcomes:

1. A novel AI and numerical modelling-based design and analysis platform for a novel, cost-effective and durable pipeline system.
2. A coupled FEA-CFD-DEM numerical modelling approach for correlating rheological behaviours of pastefill material and pipeline performance.
3. An optimal design of the innovative composite pipeline system.
4. Manufacturing (3D printing) of the novel composite choke pipe with onsite testing for industry application.



Current friction-loop pastefill delivery system and the proposed novel composite choke pipe system

