

# Australian Research Council Industrial Transformation Training Centre for Integrated Operations for Complex Resources

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## Post-Doctoral Research Opportunity

The purpose of this Training Centre is to deliver the vital enabling tools – advanced sensors, data analytics and artificial intelligence – for automated, integrated and optimised mining. Automating a mine requires the integration of all stages of the mining and processing system so that intelligence across the value chain can be automatically generated, delivered and exploited. The Training Centre is training the next generation of engineers and scientists in the development and application of these enabling tools, a current knowledge priority for the mining industry.

The Training Centre comprises three university partners (University of Adelaide, University of South Australia and Curtin University), two mining companies (BHP and OZ Minerals) and 19 mining equipment, technology and services companies and other organisations.

We are seeking applications for a post-doctoral research position (PDR3). Applicants should have a strong background in one or more of the following areas: mining engineering, mineral processing, chemical engineering, chemical physics/physical chemistry, applied geology, physics, computer science, geostatistics, mathematics, and related areas.

The successful applicant will work in an inter-disciplinary environment alongside academic researchers, 16 PhD scholars and industry partners. The successful applicant will be based at the University of Adelaide and will work with two other post-doctoral researchers (PDR1 and PDR2) and participate in the supervision of some of the PhD scholars. The successful applicant will also work closely with the Chief Investigators on selected research themes. In particular, the successful applicant will contribute to the following research projects:

- Rapid updating of resource knowledge with sensor information including structures (linked to HDR project 14).
- Draw-point and LHD productivity based on optimised fragmentation through blast control (linked to HDR project 2).
- Optimising resource value through ore selection to downstream processing.

## *Higher Degree by Research (PhD) Projects*

1. Cross-borehole seismic interferometry to interpolate rock mass and geometallurgical variables (University of Adelaide).
2. Draw-point and cave operations and fragmentation sensing (University of Adelaide).
3. Wireless sensor network radio frequency identification for continuously deployable tagging (University of Adelaide).
4. Gold sensing (University of Adelaide).
5. Vibration and accelerometer sensing for early stage roping detection in hydro cyclones (University of Adelaide).
6. Pulp chemistry monitoring for leach applications (University of South Australia).
7. Integration and analytics of drill sensor information to derive geometallurgical attributes (University of Adelaide).
8. Fingerprinting ore types and blends by fusing hyper-spectral and other sensor data using assisted machine learning (University of South Australia).
9. Ore tracking model from uncertain resource model to belt sensors and run-of-mine stockpiles (University of Adelaide).

10. Integration of sensors to maximise crushing plant throughput (University of Adelaide).
11. Integration of grinding circuit sensors including ultrasonics for particle size distribution to maximise mill throughput (University of Adelaide).
12. Integration and analytics of pulp chemistry sensor information with in-stream analysis for flotation plant optimisation (University of South Australia).
13. Integration of in-stream and particle size measurements using ultrasonics in flotation (University of South Australia).
14. Rapid updating of resource knowledge with sensor information including structures (University of Adelaide).
15. Measuring and monitoring particle size distributions so as to divert low value waste (University of Adelaide).
16. Linking the resource to down-stream products (University of Adelaide).

Descriptions of these projects are given in the accompanying HDR Project Details brochure.

### *Postdoctoral Research Projects*

Postdoctoral position PDR1 (University of Adelaide) is contributing to the following research projects:

- Wireless sensor network radio frequency identification for continuously deployable tagging (linked to HDR project 3).
- Decreasing acquisition time on high tonnage run-of-mine belts using Prompt Gamma Neutron Activation Analysis, possibly in combination with other sensors such as X Ray Transmission and hyper-spectral imaging.
- Vibration and accelerometer sensing for early stage roping detection in hydrocyclones (linked to HDR project 5).
- An ore tracking model from uncertain resource model to belt sensors and run-of-mine stockpiles (linked to HDR project 9).
- Sensing variable mineralogy on high tonnage run-of-mine belts by fusing multi-sensor data.
- Integration of sensors to maximise crushing plant throughput (linked to HDR project 10).

Postdoctoral position PDR2 (University of South Australia) is contributing to the following research projects:

- Integration and analytics of pulp chemistry sensor information with in-stream analysis for flotation plant optimisation (linked to HDR project 12).
- Integration of leaching sensor information for hydrometallurgical processing.

All three positions (PDR1, PDR2 and PDR3) will contribute to an integrated simulator to link resource knowledge to models across the value chain for optimisation.

### *Industry and government partners*

BHP	Magotteaux
OZ Minerals	Maptek
AMIRA	METS Ignited
Boart Longyear	MZ Minerals
Bureau Veritas	Orica
CRC ORE	Petra Data Science
Datanet Asia Pacific	Rockwell Automation
Dassault Systèmes	Resources & Engineering Skills Alliance (RESA)
Manta Controls	RoqSense
South Australia Department for Energy and Mining	Scantech
EKA Software Solutions	

## *The research environment*

The Centre provides a unique research opportunity including:

- World class facilities and experts across the participating universities, industry partners and other organisations.
- An integrated Training Centre research agenda with inter-disciplinary projects.
- The opportunity to work with leading mining industry and research translation partners.
- Research skills and career development workshops.
- Competitive support for national and international conference travel.
- Generous project support.

## *Selection criteria*

The Training Centre provides a unique inter-disciplinary approach to complex inter-disciplinary problems. Successful applicants will work within this inter-disciplinary environment and be expected to integrate their work with disciplines other than their own.

**The essential minimum criteria are:**

- (1) A PhD in a discipline relevant to the Training Centre. Relevant disciplines include mining engineering, mineral processing, chemical engineering, chemical physics/physical chemistry, mechanical engineering, computer science, geostatistics, mathematics, and related areas. In assessing applications, preference will be given to applicants who can demonstrate an ability to work across disciplines. For example, an applicant may have a PhD in mining engineering in which the research was in geostatistics, data analytics or stochastic optimisation; or have a PhD in computer science in which machine learning was applied to a geological, mining or mineral processing problem. When applying for a particular project, please state briefly and clearly the relevance of your research to the project description.
- (2) An ability to apply, adapt and develop methods relevant to the PDR1 position or the demonstrated ability to acquire this expertise in the short-term.
- (3) A demonstrated ability to conduct research in the specific area of the PDR1 position.
- (4) Good programming skills.
- (5) Strong inter-personal communication skills and fluency in written and spoken English.
- (6) An ability to work individually and as a member of an inter-disciplinary team.

**Desired criteria are:**

- (1) Prior experience in one or more of the areas listed for the PDR3 position.
- (2) A good publication record, particularly in areas relevant to the Training Centre, would be a distinct advantage.
- (3) Good organisational skills and demonstrated ability to set priorities and to meet deadlines.

## *Enquiries*

- Further general information is available from the Training Centre Business Manager, Dr Ruth Shaw, Ph: +61 (0)8 8313 1189., E-mail: [iocr@adelaide.edu.au](mailto:iocr@adelaide.edu.au) .
- Queries specifically regarding PDR3 should be directed to the Training Centre Director Professor Peter Dowd, Ph: +61 (0)8 8313 4543, Email: [peter.dowd@adelaide.edu.au](mailto:peter.dowd@adelaide.edu.au) .
- General queries regarding the Training Centre should be directed to the Training Centre Business Manager.

The Training Centre website can be accessed at <https://iocr.com.au>