Prospective FEnEx CRC R&D Projects for Program 3: Digital Technologies & Interoperability

R&D Project	Category	Description
Process Control Technology: Reducing the total cost of ownership	Interoperable Digital Technologies	Interoperability Standards for Industry 4.0 Technologies will be developed for use within process plant environments. Working in collaboration with the international Open Process Automation Forum (OPAF), these new industry standards will ensure the interoperability of digital technologies, and also provide work-flows to allow the demonstration of such interoperability. These will then be adapted for use in the context of LNG and hydrogen export.
Self-tuning Advanced Process Control Systems	Operational Excellence: Increased throughput & reduced costs	Digital technologies that can automatically tune the process control systems to automatically deal with, for example, changing feed gas composition can significantly improve overall efficiency and minimise operations risk. Furthermore, the time taken to shut-down and re-start cryogenic heat exchangers in LNG and hydrogen plants can be minimised, thereby increasing productivity. This project will seek to demonstrate and/or improve the performance of current and emerging self-tuning advanced process control systems to facilitate their wider adoption.
Data Driven Modelling: Development and validation	Operational Excellence: Increased throughput & reduced costs	Big data sets for process plants or unit operations within the plant are analysed using the latest data science techniques. These allow for a model of the system to be extracted directly, alleviating or removing the need for physical and mathematical theories that are often over-simplified. Instead, specialised tree and graph mining algorithms will be used to highlight common patterns and anomalies that occur in the large plant data sets, and used to train automated predictive models. Industrial-scale plant infrastructure will be used to test and validate these algorithms.
Digital Technologies for Reliable Remote Operations	Operational Excellence: Increased throughput & reduced costs	Isolated locations and high labour costs are two of the primary challenges faced by Australia's natural gas and LNG production industries. Digital technologies that allow effective remote operations of these facilities offer the potential to substantially mitigate these cost challenges; however there are outstanding concerns relating to the consequential impacts on both reliability and safety. This project will focus on demonstrating, improving and qualifying digital technologies central to the delivery of safe, reliable and efficient remote operations (plant & production).

R&D Project	Category	Description
Digital Twin-Based Asset Management and Robotic Infrastructure Monitoring	Predictive Maintenance	This project will seek to qualify non-intrusive technologies and demonstrate digital technologies targeting incremental productivity improvements for LNG plants. These include the identification of activities and appropriate maintenance schedules such that both liquefaction facility shut-down frequency and duration are reduced. This would include research focused on closed loop start-up practices that reduce the regeneration time of various gas processing operations, as well as reduced gas flaring from predominately cryogenic units.
Reduced Spares Inventory	Predictive Maintenance	Significant costs are associated with the need to purchase and store a large inventory of spare parts to ensure continuous operations in the event of equipment problems or failures. This capitally-intensive burden for operating companies can be alleviated through the use of smart sensors for improved condition monitoring, which feed data in real-time into digital twins of the facility or equipment. These models will then predict when replacement parts will actually be required, enabling a reduction of the spares inventory held, especially if combined with onsite 3D printing in appropriate cases. This project will seek to implement and test the digital technology components (sensors, digital twins, supply chain management software) central to this outcome.