

PROJECT INSIGHTS SA Water

Diagnostic Prognostic Management System

Background

Resonate Systems, in collaboration with **SAGE Automation**, has successfully implemented an integrated condition monitoring solution for **SA Water**, the largest water utility in South Australia. This comprehensive solution facilitates data-driven decision-making by enabling continuous online monitoring of critical infrastructure through SA Water's data analytics platforms.

The newly deployed Diagnostic and Prognostic Management (**DPM**) system aligns with SA Water's objective to maintain an accurate and up-to-date understanding of the condition of its water infrastructure.

This system empowers the prediction and detection of asset conditions, leading to improved maintenance scheduling and lower maintenance costs. Ultimately, the aim is to minimise disruptions to customers and the community.

Project requirements

To deliver improved customer outcomes through operational efficiencies, more informed operation and cost savings, **SA Water** wanted to establish a Condition Based Monitoring (CBM) system. This approach would enable **SA Water** to move from a 'manual corrective' strategy to an 'automated condition-based monitoring' capability for its pump station assets.

This CBM solution was required to integrate into the larger **SA Water** systems and processes, including SCADA, data analysis platform and client computerised maintenance management system (Maximo).

Key Figures

Number of pump stations	30
Number of pumps monitored	131
Number of sensors	883 (total)
Proximity Probes	200
Accelerometers	552
Tachometers	131
	Time waveforms
	Frequency spectra
	Trends
Vibration analysis techniques	Orbit analysis
	Bode/Polar plots
	Autocorrelation
	Imbalance
Faults assessed	Mechanical Inoseness
	Rearing fault
	Misalignment
	Coupling deterioration
	Impeller deterioration
	Motor rotor/winding faults
	Bearing over-temperature
	White/Journal bearing damage
	Oil whip/instability
	Structural resonance





The Solution



Typical edge device configuration

- A combination of sensor inputs, including accelerometers, proximity probes, tachometers, and temperature probes are mounted directly at each motor and pump bearing.
- Accelerometers are mounted on the bearing casing
- Two proximity probes are mounted per bearing, spaced 90 degrees apart, and used to measure and characterise the movement of the pump shaft.
- A tachometer sensor was used to detect the speed of the shaft which is useful for pumps with variable speed.
- Each sensor is connected back to a multi-channel data acquisition hardware (NI CompactRIO / cRIO).
- The cRIO acquires from each sensor simultaneously at a rate of up to 5,000 samples per second, and performs a preliminary analysis and assessment, including time waveform and spectral analysis.
- The cRIO also captures data event-based pump operating states which include raw time waveforms.
- All of this data is transferred to a central InsightCM™ server for further trending and complex analysis.
- Users can access the data for all sites and pumps stored in the InsightCM™ Server via a web browser application.
- This interface allows users to view all monitored assets, compare trends and vibration parameters, and update the configuration of the remote systems.





Images credit: NI



A fully Integrated and open Condition Based Monitoring (CBM) System



Based on an open architecture which included SDKs and APIs, Resonate Systems were able to customise the InsightCM[™] solution to meet the requirements of SA Water's asset reliability and data analytics teams.

At the on-site level, each CompactRIO controller utilised Modbus TCP/IP communication to report live vibration and sensor parameters to assist on-site technicians with machine status and diagnostic information.

At the server end, additional raw data streams were added to feed into SA Water data lake and machine learning platforms.



Cutsforth InsightCM™

The Cutsforth InsightCM™ software platform gives access to data trending, configurations and alarms.

The secured browser-based interface provides an interface to configure measurement channels, set analysis parameters and alarm levels/thresholds.

The analysis toolset includes parameters such as time waveforms, frequency spectra, Bode and orbit plots and many more.

InsightCM™'s database retains historical data and enables direct access to trend data across all channels and analysis parameters.





ABOUT Resonate Systems

Resonate Systems collaborates closely with clients to design and build measurement and control systems tailored to their specific project and application needs.

When off-the-shelf solutions fall short, clients often face compromising on outcomes. Resonate Systems bridges this gap by delivering integrated turn-key systems that meet exact requirements.

Backed by a team of mechanical, electrical, and computer systems engineers, Resonate Systems guides clients through every stage, from initial requirements gathering and concept design to prototyping, deployment, and testing. With a history of successful system deployments, Resonate Systems leverages its team's expertise in proven hardware and software designs to quickly deliver reliable solutions.

Committed to flexibility and innovation, Resonate Systems consistently provides tailored, cost-effective systems that meet and exceed client expectations.



Key Personnel

Dr. Mike Kidner

Director



Dr. Mike Kidner has over twenty years of experience in research, development, and consulting, providing technical leadership on a wide range of projects and mentoring engineers in the UK, USA, and Australia.

Mike has worked on several technically challenging assignments within local, national, and international teams for clients including NASA, Boeing, USAF, CoA, Rio Tinto, and SNC Lavalin.

Additionally, Mike has published 42 technical papers. His expertise lies in signal processing, structural dynamics, and data analytics.

Past projects (short list)

Department for Infrastructure and Transport (DIT)	Ansaldo-STS Autohaul JV	Wivenhoe Power Station, Queensland	SNC Lavaling
Design and development of online vibration monitoring system for ventilation fans at Adelaide Heysen Tunnels	Design and supply of collision detection systems	Testing and commissioning of hydro-turbine vibration monitoring system	V-Line life extension program.
University of Adelaide	ARTC	QUANTX Labs	APAL
Development of an high fidelity ground truthing of smart sensor signals	On Board Vibration Logger System. Analysis for feature extraction from vibration data sets as a function of speed, location etc.	FPGA development for the Cryogenic Sapphire Oscillator the "Cryoclock"	Application of machine learning to advance soil sample testing
SA Water	Hensoldt GmbH	Dept. Of Defence - LEA/CASG	Braemac
UV Reactor fatigue investigation	Qualification of Antenna Dynamics	Expert consultant on commissioning program for the heavy vibration test facility	Legacy system obsolescence test program support

Michael Foo

Director



Michael Foo is a Director at Resonate Systems with over fifteen years of experience in vibration, acoustics, and system design and integration. His expertise lies in the design and development of custom data acquisition and analysis systems, which have been utilised across various industries, including power generation, mining, automotive, rail, and transport.

Past projects (short list)

Department for Infrastructure and Transport (DIT)	Transport for New South Wales	Wivenhoe Power Station, Queensland	Pacific National (SA and NSW)
Design and development of online vibration and notor electrical monitoring system for O-Bahn City cccess and Heysen Tunnels.	Design, development and integration of wayside noise monitoring system for capture of noise and images for Transport for New South Wales.	Testing and commissioning of hydro-turbine vibration monitoring system.	Development of a wagon mounted vibration and GPS logging device for the assessment of rail vehicle and track condition.
lepartment for Infrastructure and Transport (DIT)	Singapore LTA	Komatsu Shovel, Leigh Creek Coal Mine, SA	Viterra Australia
oftware development of bus ride condition nonitoring system.	Development of remote vibration monitoring system for fault diagnosis of rail infrastructure.	Development of permanent vibration monitoring system	Routine condition monitoring of elevators, conveyors and auxiliary plant at Viterra plants
lepartment of Defence	Synergen	Wivenhoe Power Station	Micro-X
commissioning and sustainment of a large vibration est system	Mintaro Power Station Gas Turbine In-situ Balancing. Vibration assessment and in-situ balancing of Mintaro Gas Turbine during return to service phase	Online vibration monitoring system. Development and installation of hydro-turbine online condition monitoring system.	Development and deployment of production control and automated test systems



Resonate Systems

Adelaide SA 5000 t : +618 7200 5700 Australia

178 Wright Street e: info@resonatesystems.com.au w:www.resonatesystems.com.au

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PARTNERING WITH CLIENTS TO DELIVER INSIGHTS INTO THE PHYSICAL WORLD