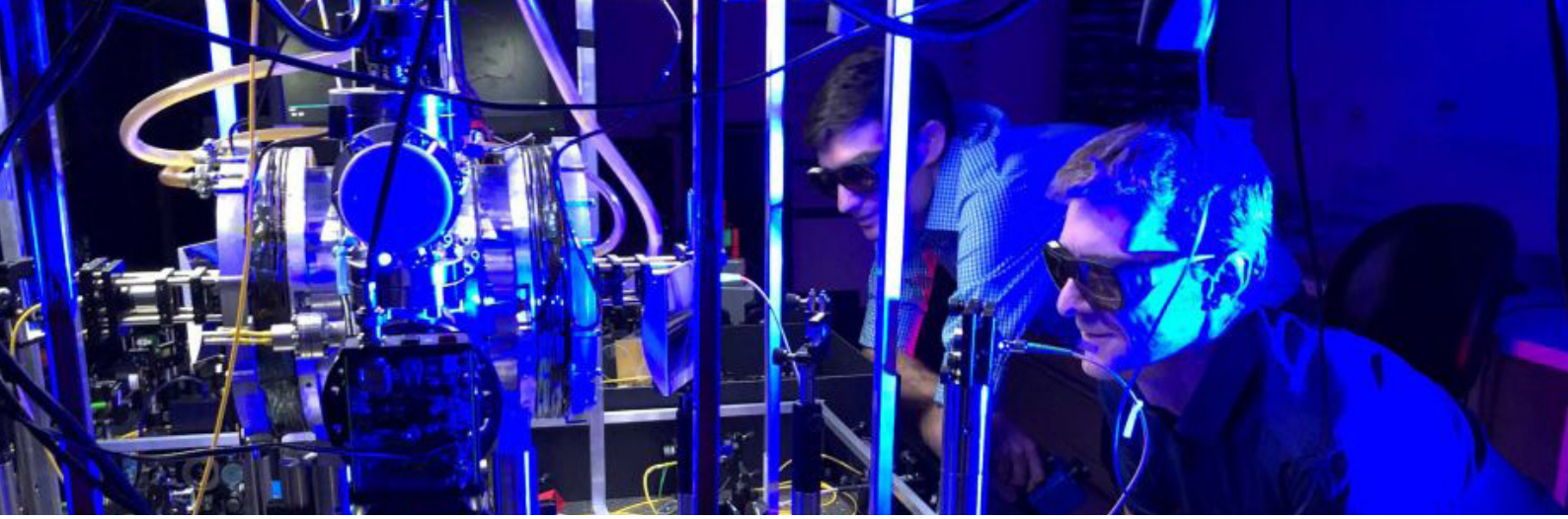

Sapphire clock case study

CSIRO ON was established in 2015 through NISA support. The Sapphire clock case study conducted under aegis of this program, substantiates the impact of this work, relative to invested funds.

This case study describes the economic, environmental and social benefits arising from the Sapphire Clock project. The information is for accountability, communication and continual improvement purposes.

The challenge

The industry doesn't have options to measure precision time and frequency, which is critical in many sensing, communication and computational tasks. This is particularly important in radar technology, very long baseline radio astronomy and quantum computing.

The response

The cryogenic Sapphire Clock is (10-1000X) stable and an ultra-low phase-noise frequency oscillator; better than any other competing technology currently available. Stable oscillators can be used for extremely stable generation of radio frequency and microwave signals required for next generation MIMO (multiple input, multiple output) and distributed radar systems for defence, autonomous vehicles, improve spectral efficiency for higher bandwidth utilisation for 5G wireless and beyond, as well as quantum computing fabrication.

A second important element to the project was the design and construction of a cryogenic fridge to cool the sapphire crystal. This development enabled the technology to become much more portable and opened the door to its commercialising. Previously the crystal was cooled with liquid helium.

The impact

The work is central to Australia's sovereign industrial capabilities. Australian Defence Industry Policy Statement describes it as a capability that must be developed or supported by Australian industry because overseas sources do not provide the required security or assurances. Initial tests of the innovation by the DSTG has shown substantial end-to-end system benefits as Australia's key surveillance asset.

Accelerate through CSIRO's ON program

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