

September 2022**Kia ora koutou**

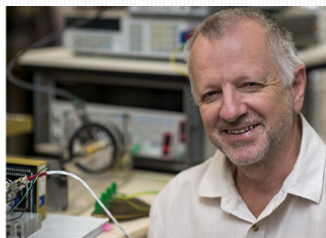
The year may be three quarters done, but there is still plenty to look forward to before 2023. In particular, we are busy preparing for the Conference on Precision Electromagnetic Measurements (CPEM) which is coming to New Zealand for the very first time in December. In this newsletter, Murray Early shares his journey in metrology and what he is looking forward to at CPEM.

We also spotlight the New Zealand clocks and meet Tom Stewart, one of our electrical metrologists.

This quarter we welcomed back Robin Willink, a mathematical statistician who will be working with us part-time, bringing his thoughtful and rigorous approach to uncertainty analysis. And we are recruiting! Check out the link below and share it with your networks.

Aku mihi nui

Annette Koo
Director and Chief Metrologist

**Meet a Metrologist: Dr Murray Early**

Dr Murray Early is a [Principal Research Scientist](#) at the Measurement Standards Laboratory (MSL). For over 30 years, he has played a leading role in MSL's Electrical metrology team, with his areas of expertise including AC voltage and current, DC voltage and resistance, the quantum Hall effect, and cryogenic current comparators (CCCs).

Dr Early is also the Co-Chair for [CPEM 2022](#), the premier conference for all scientists working on precision electromagnetic measurements. This year, for the first time in its long history, CPEM is coming to Aotearoa New Zealand. The event is being held in Wellington, on 12-16 December. We caught up with Dr Early to talk about his background, his career, and his hopes for the conference.

[➤ Read more](#)

For more on CPEM 2022, visit the [conference website](#). Registrations are now open.



It's About Time!

Time has shifted at Gracefield Innovation Quarter by 150 metres

Our Time team has shifted time without changing it. Prior to the demolition of the McKay Building, like the Temperature and Electrical Standards Teams, our Time Team coordinated and moved their scientific equipment housed there to a new fit-for-purpose Time and Frequency Laboratory.

The first step for the move of New Zealand Time (NZT) was completed on Friday 17 December 2021. The team split the New Zealand Time Standard into two 'clocks' – each 'clock' being made up from two Caesium clocks (Cs clocks), a high resolution offset generator and a global positioning systems (GPS) receiver.

One clock was relocated into the new laboratory for monitoring. This move was completed following a five month period of environment testing, tuning and fixing to ensure an exact and reliable environment for NZT.

Each month after this, results were collected from all four Cs clocks, and sent to the International Bureau of Weights and Measures (BIPM) in Paris for comparison. Following analysis of the results from BIPM our team have been able to confirm that the Cs clocks in the new laboratory are correct, and we can have confidence in their ability to take on the role of our National Clock providing NZT.

Our Cs Clocks are robust – they are designed for submarines, and therefore can operate in harsh conditions (temperature, vibration, humidity). However, they are far less accurate when you subject them to a rough environment and we needed nanosecond accuracy.



Over time, National Metrology Institutes across the world have determined that a stable temperature means more accurate frequency, therefore time, and although you turn them on, and they run, it can take months for the frequency to stabilise. For the move, it was critical to transport the Cs clocks carefully and under power, so we did this using MSL's Moon Buggy and a UPS power supply.

NZT itself was officially moved on 10 May 2022. There have only been a few instances globally where time has been moved, so this was a significant undertaking. NZT is now being represented from Clock 1 in the new Time Lab.

What is the time?

NZT is New Zealand's realisation of time – this is the time in New Zealand, and we know what it is in real time.

UTC is Coordinated Universal Time – this is the world time, and is the weighted average of all the world's clocks. It is post-calculated from measurements that each national time lab reports each month. This is done by BIPM (Paris), and published monthly in a document called Circular T. Therefore we only ever know what UTC was, but never what it is now.

Just to be clear, in New Zealand NZT is the time - it's just we don't really know how that relates to the world time today, but we know how it relates to world time last month. Even then we don't know what the actual time was other than at midnight every 5 days. Everything else including the time today is really just a highly informed estimate. Our goal is to keep NZT as close to UTC as we can, preferably within 10s of nanoseconds!

When did time start?

Maybe it's just when we have chosen to say it did, while some might argue 13.8 billion years ago, 4004 BC, or when Maui slowed the angry sun. Maybe 1884 when Greenwich was set as the Prime Meridian – essentially, when a group of countries agreed to use Greenwich Mean Time (GMT), the forerunner to UTC – but national measurement institutes (NMIs) might select dates between 1955 and 2004. Why?

Time travelled

Well, in 1955 the first Caesium clock was produced – this allowed standalone time to be created to the 10s of nanoseconds accuracy. In 1972 UTC was introduced, and in 2004 the GPS network was incorporated into the global time calculations, providing very accurate referencing between countries. Before GPS, we carried our flying clock around Asia to compare with other national clocks.



Can time be recreated?

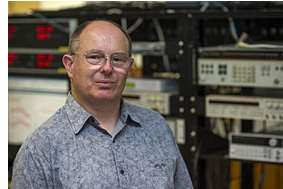
Time is a particularly interesting standard – it cannot be created from nothing, since it is only the average of all the clocks. By this we mean if all the clocks in the world stopped, we couldn't recreate time to be the same. The 'second' is easy because it's just based on the frequency of Caesium, but the actual time, we would need to start it again. We'd be quite accurate, but it wouldn't be the same.

150th anniversary of NZT

In 2018, MSL Celebrated the [150th anniversary](#) of NZT. Maintaining NZT is part of MSL's responsibilities, as well as contributing to 'world time'.

Talking time with Radio NZ

Did you know the earth is spinning faster than it did 50 years ago? This means the days are shorter, and it's creating headaches not just for scientists, but also for airline booking systems and the stock market.



Last month our resident 'Time Lord' – Senior Research Scientist Adam Dunford – explained to Radio New Zealand's Jesse Mulligan why the earth is spinning faster, and just what that means for time.

Listen to the clip [here](#).

Adjustment to MSL Fees

Adjustment have been made to MSL's professional and calibration service fees, in most instances these were increased from 1 July 2022. Find out more to view our calibrations service fees for a wide range of instruments and artefacts.

Thank you in advance for your continued support.



[Find out more](#)



August Training Courses

If your organisation had the opportunity to upskill staff by attending one or more of our training courses – thank you, it was a privilege to be able to support New Zealand laboratory's accreditation along with the professional development of 77 participants across all courses.

Training courses will be offered again in August 2023. If your organisation requires training before then, and you have a group of five or more participants, please get in touch, and we'll try to meet your requirements.



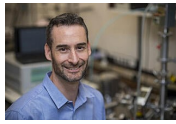
[Find out more](#)

Staff Spotlight



It's official! **Dr Annette Koo** accepted the permanent appointment to the MSL and Protoshop Director role on 1 August 2022. Annette had been acting in this role for a few months prior to this appointment and proved to be extremely capable.

Her experience in metrology, leadership and international involvement in the global metrology community gives her an excellent background and skill set to be successful in this role. We congratulate Annette on her appointment to this important leadership role within Callaghan Innovation.




In June, **Tom Stewart** undertook a remote audit of the National Metrology Institute of Thailand (NMIT). NMIs worldwide audit each other to ensure their processes are robust and consistent. Being asked to do this audit is a significant recognition of Tom's reputation in the international metrology community.



CPS/MSA Conference 2023

Extended call for papers and registrations open!

Make this an event not to be missed. It's been three years since the last MSA conference so there are plenty of stories and advancements to share. We have a full contingent of sponsors – save your lab upgrades until you come along and visit the dedicated trade stand space. There's a super social programme including a tour to the MSL labs, a visit to WETA Workshops, conference dinner and AGM breakfast. As well as an exciting line-up of plenary speakers. Submit your abstract by 10 October and grab an early bird registration by 2 November.

 [Find out more](#)

Research Technician (Length) – Wanted!

We have just started recruiting for a Research Technician (Length), to join our team at Gracefield Innovation Quarter in Lower Hutt. We're happy for you to share this position with your networks.

 [Find out more](#)



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