UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Biomedical Engineering Service Trip to Tonga

A word from the Programme Director

I would like to express my sincere gratitude to all the donors who helped make our biomedical outreach programme in Tonga a success. We truly could not have achieved this without your generous support.

This year's team included eight students and three staff members who travelled to Tonga, supported by many others who contributed in important ways. These included staff who supervised research projects, taught the Tongan language, delivered hands-on technical workshops, and shared expertise in travel preparation, sustainable development, cultural awareness, and development work in the Pacific.

The challenges faced in Tonga are similar to those across many Pacific nations that rely heavily on donated medical equipment. These donations arrive from around the world from generous donors, but the equipment often arrives damaged, incomplete, or missing consumables. As a result, it must be tested and repaired before it can be entered into the asset registry and distributed to where it is needed. In some cases, this may involve transport to island groups that are up to a 12-hour boat journey away. At present, the biomedical workshop at the main hospital does not have an environmentally controlled space for staging equipment removed from shipping containers for assessment, so at times twenty or more containers may be waiting to be unloaded.

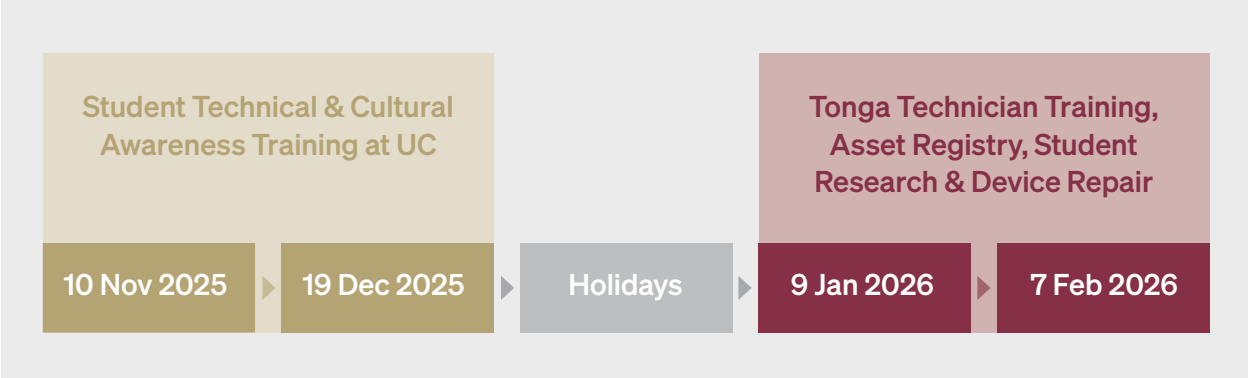
Even when donations are usable, they often require repair. Many devices are older, lack manufacturer technical support, and originate from a wide range of countries, making maintenance far more complex and requiring innovative solutions. This is where our programme seeks to contribute.

Through partnership with Tongan biomedical technicians, we work together to develop innovative solutions, provide upskilling opportunities, and introduce sustainable practices. Our shared goal is to support Tonga in building the capability to independently maintain and manage its medical equipment in the future.

Debbie

DEBORAH MUNRO, D.ENG.
ASSOCIATE PROFESSOR

Timeline for the 2025 – 2026 Trip



In November and December 2025, eight Mechanical and Mechatronics Engineering students undertook a six-week training and project development phase in preparation for the 2026 Biomedical Service Trip to Tonga.

During this period, the students learnt about medical devices, electrical systems, and their repair. They had hands-on electrical labs with Tait Communications, as well as a two-day workshop at the CDHB Bioengineering Lab and with the CDHB Nursing team. They attended several talks with guest speakers covering Sustainable Development, Humanitarian Engineering, Travel Advisory, the Pacific Development Team, and Cultural Awareness. Lastly, the students received Tongan language classes with Siale Faitotonu, Lava, and had visits from the Biomedical Technician from the hospital they would be working with in Tonga, Vaiola Hospital.

During these pre-trip workshops the students worked on a wide range of things including:

- Fault-finding on simple electronic devices with embedded faults
- Electrical connections workshop (crimping, DIN rail, soldering, splicing)
- Kitset multimeter builds: PCB assembly, rework, component ID
- Medical ventilator repair attempts: diagnostics and resilience

In January 2026, students travelled to Tonga for a four-week placement delivering hands-on biomedical engineering support in clinical settings. The programme was delivered in partnership with the Tonga Ministry of Health, with the team primarily based at Vaiola Hospital and also supporting several local health centres.

The placement began with kick-off meetings with the Ministry of Health Vaiola Biomedical Engineering Team, followed by the implementation of the students' research projects. During the placement, the students toured and assessed hospital wards and several clinics and also met with Tonga National University.

The project gave students valuable real-world engineering experience while also delivering direct practical benefits to healthcare services in Tonga. Across the placement, the team delivered five key engineering projects focused on improving the reliability, maintainability and local sustainability of hospital equipment.

Student Report and Projects

Our Mission | Collaborate to improve Tongan healthcare through innovative biomedical solutions, education and sustainable practices

Our Vision | To create a future where Tonga can independently support its medical device maintenance and implement programs to educate future biomedical technicians.

Our Personal Growth | Simplicity matters – complex designs often fail in low-resource settings.

Design for repairability – systems must be fixable with basic tools and local skills.

Use locally available parts - to avoid reliance on difficult supply chains.

Design with the user – clinicians and technicians shaped better solutions.

Real-world engineering judgement – adapting designs to constraints, not ideal conditions.

PROJECT 1

Hospital Beds

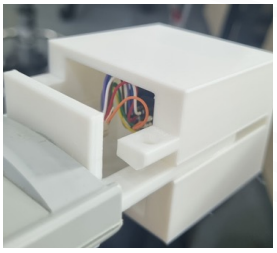
Led by Caleb Corban and Caitlin van Rijs

The team focused on restoring function to nonfunctional hospital beds. They would take non-functional beds from the wards and check key components like the hand control, control box, and motors. Then they would replace with working parts and retest the bed.

They often found problems with the batteries, broken transformers, and a MOSFET current limiting problem.

To remedy this, they used 8 core wire & connectors and the 3D printer to create an interchangeable controller.

The team successfully developed a diagnostic and repair process for failed electrical components; all ward beds were returned to operational condition, and local technicians are now confident in ongoing maintenance.



PROJECT 2

3D Printing

Group Project

As part of this project, UC was able to donate a Prusa Core One 3D printer and filament used to make items. The students set up the printer and created the first prints. They then worked alongside biomedical technicians to deliver CAD (Onshape) and slicer training to enable local staff to design and manufacture replacement parts on site.

PROJECT 3

Otoscopes and Nurse Training (Mahino Project)

Led by Matisse Laskey and Fergus McMullan

An otoscope is a device that is crucial to ear health in Tonga. Under the direction of an audiologist and alongside local technicians, the team adapted an open-source 3D-printed otoscope for durability in high-humidity environments. They improved the design and electrical system so it lasts much longer. An ENT specialist successfully used the device in clinical assessment.

This project also focused on improving and fixing equipment that the local nursing school use for their training. They were able to repair a 30-year-old mannequin with some 3D printed parts they designed as well as model and replace brackets on surgical head torches.

PROJECT 4

VG70 Ventilator Repair

Led by Emma Gardiner and Philip Brand

This project aimed to restore donated ventilators that had been in storage at Vaiola Hospital since COVID as they had unfortunately been non-functional out of the box. Of the 13 in storage, the aim was to repair 5 ventilators and get them into the hospital, and have the other 8 ready to go, only needing fresh O2 sensors.

The team was able to restore 7 ventilators to fully functional status with 5 more functional but just awaiting shipment of new oxygen sensors and diodes. This was an extraordinary outcome. The team worked with the hospital to run pre-use tests and calibration and to get them approved and signed off for hospital use.

4 are currently being used in the ICU, 1 in Ha'apai and 2 awaiting delivery to Vava'u and 'Eua.

PROJECT 5

Autoclaves

Led by Josh Bergerson and Liam Bately

An autoclave is a high-pressure chamber used to sterilise equipment. In Tonga before the trip, there were no health clinics using medical autoclaves. Only two of the clinics actually had them but both of them were unable to be used due to lack of training and issues with installation of the correct power outlet.

The clinics were relying on the CSSD at Vaiola hospital for sterilisation which created bottlenecks and high workloads. All the clinics indicated a strong desire to have an autoclave at their clinic to reduce the time spent driving instruments to and from the CSSD. This was especially difficult for the distant clinics such as Kolonga and Kolovai who were making the drive multiple times a week.

The team were able to locate, source and repair enough autoclaves on the trip that there is now enough for all health centers to have one of their own. The team installed them all and created a simple 10-step training for the staff at each clinic.

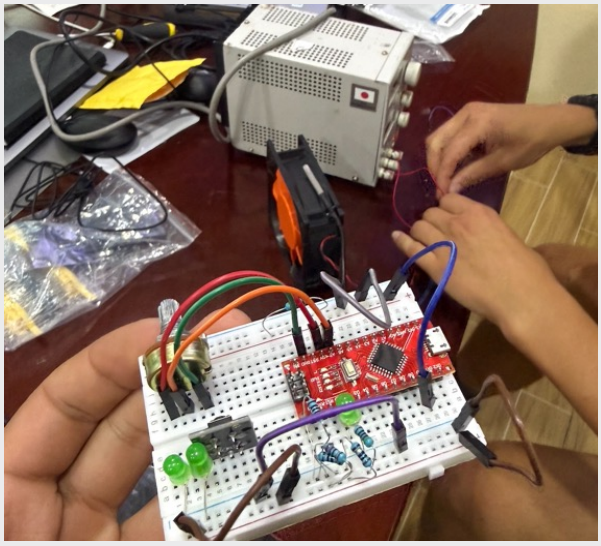
This amazing outcome will help the clinics be more self-sufficient as they can do their own instrument sterilisation, lightening workload for the CSSD at Vaiola.

Additional Projects Undertaken

Arduino Tutorials

Led by Josh Bergerson and Philip Brand

The team worked to teach local technicians to program to allow them to create their own air conditioners. Working on integrated systems with an Arduino microcontroller, the team were able to teach the technicians how to work with switches, LEDS, sensors and fans.



Asset Management – Veitongo Storage Facility

Group Project

Tonga receives many equipment donations from other countries, but because of a range of practical challenges, much of this material is never put into use. During the placement, the team helped sort through more than 20 shipping containers filled with equipment and consumables, identifying items that were usable and needed, and transporting them to the hospital.

Takeaways

The project placed strong emphasis on building local capability through training, documentation, and practical collaboration with hospital staff and technicians. This approach ensured that the benefits of the trip extended beyond immediate repairs, supporting more sustainable equipment maintenance and improved access to functional clinical equipment across multiple health centres.

The Biomedical Service Trip continues to demonstrate the value of applied engineering in resource-constrained healthcare environments, while providing students with meaningful professional development, cross-cultural experience, and exposure to real-world biomedical engineering challenges.

We would like to once again thank everyone that was involved in making this trip happen.

Student Testimonials

The biomedical service trip to Tonga was an incredibly rewarding experience. From an engineering perspective, I was challenged to approach problems differently, and introduced to new ways of thinking that I will carry with me for the rest of my engineering career. I learnt how to solve engineering problems in contexts vastly different to my own, and gained insight into how the broader structure and resources of a country shape its engineering practices.

It was important to consider how our work fit into a larger system of aid and donations. Collaboration with the community was essential for the sustainability of this program. I was lucky enough to be able to create so many meaningful connections with the biomedical staff at Vaiola Hospital, technical staff at TNU, and our hosts at Tongata'eapa Church. Everyone we met was radically generous, and it quickly became clear how vital community and relationships are in Tongan culture.

I'm incredibly proud of the impact our team was able to have, with success across our projects and valuable learning shared.

MATISSE LASKEY

2025/2026 PARTICIPANT

After spending all year planning and coordinating the Biomedical Service Trip to Tonga, it was incredibly rewarding to see it come to fruition. We were honoured by the hospitality and warm nature of the community in Tonga.

From my perspective, the experience has given all of us students an incredibly valuable mindset for future engineering projects. After seeing how products are reused and repaired in low resource settings, we realised how important the serviceability of a product truly is. Many of the devices we encountered had been kept operational for years through creative repairs and adaptations, often with limited tools or spare parts. It reinforced that good engineering is not only about performance, but also about durability, simplicity, and the ability to maintain systems long after they are deployed.

Working directly alongside biomedical technicians and healthcare staff also gave us a deeper appreciation for how engineering decisions affect real people. Seeing equipment returned to service and knowing it would directly support patient care made the experience especially meaningful.

The trip was both technically and personally transformative. It challenged the way I think about engineering and strengthened my belief that engineers have an important role to play in improving healthcare access around the world.

LIAM BATELY

2025/2026 PARTICIPANT &
STUDENT COORDINATOR

Timeline for the 2026/2027 Trip

Planning for the next Biomedical Service Trip to Tonga is already underway. Students will complete a six-week training and preparation phase at the University of Canterbury from 9 November to 18 December 2026, before traveling to Tonga from 8 January to 6 February 2027.

This preparation period will equip students with the technical, cultural and practical skills needed to contribute effectively in a low-resource healthcare setting. As with this year's programme, students will work alongside experienced staff, industry partners and Tongan collaborators to develop projects that respond to real needs and support long-term local capability.

With continued support, the programme will again provide students with life-changing professional experience while delivering meaningful practical benefits for healthcare services in Tonga. The next trip will build on the strong foundations established through this year's partnership, with a continued focus on repairability, training, sustainability and locally led problem-solving.

Thank you for helping make this work possible.

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