

## Germicidal systems – more than keeping it clean

Gangi Group is installing UV-C germicidal and lighting systems to automate the disinfection process in healthcare and aviation for the first time. Billy Friend finds out how the once small family-owned electrical contracting company has expanded to provide breakthrough solutions via an underutilised but proven technology.

**S**EBASTIANO Gangi came to Australia in 1966, and soon after established himself as a hardworking electrician in the South of Melbourne. His son, Robert, fondly recalls memories of working with his father, undoubtedly where a strong sense of work ethic was inherited.

“Growing up, I loved working with my dad,” he said. “I used to work on a Saturday or on school holidays. I remember working in a factory in Seaford and it was about six o'clock and we were still working together. Dad ordered pizzas and I remember singing this song with him which remains a great memory to this day.”

After living overseas, Robert returned to join the family business – with a focus on automation – to expand the integrated electrical solutions the company provides for various industries. A familiar fable, the COVID pandemic caused Robert to reassess and explore different areas for the business. Extensive research led him to identify UV-C light had the capability to expand massively as an industry in Australia, eventually leading to the birth of germicidal light systems under Gangi Germicidal Systems (GGS).

## UV-C Light

UV-C was first used in the late 1800s to kill micro-organisms like bacteria, mould and viruses. Niels Ryberg Finsen – the first to employ UV rays in treating disease – won the Nobel Prize for Medicine in 1903 for inventing a curative lamp, which was successfully used through the 1900s.

The technology uses Ultra-Violet light in the germicidal wavelength range between 200 and 300 nanometres. The optimum wavelength for disinfection is 264 nanometres, which is located within the UV-C spectrum. When microorganisms are exposed to germicidal wavelengths, the high energy associated with UV-C light is absorbed by the DNA of bacteria and viruses.

When heavily researching UV-C, Robert discovered the technology has been proven to work for over 100 years and the first time it was used to disinfect municipal water supply was in Marseille, France, in 1908. So, if the technology has been around for so long, why has it remained such a small market – restricted to mainly food processing and water treatment – in Australia?

“I think we're more risk averse in



Founder Sebastiano Gangi, with his children Robert, Daniel and Carla.

Australia, which has its benefits but means you sometimes don't explore the opportunities of new technologies,” he said. “We saw this as an underutilised technology, to help our healthcare system and beyond. When we started this, I was told it's only a 30-million-dollar industry in Australia – is it really worth it? I think we are kidding ourselves if we think it won't become much, much bigger than that.”

The light sources can be used for both surface and air disinfection. UV-C light sources can be placed within air ducts and HVAC systems to purify air. Because the light sources are contained within an enclosure, the UV-C disinfection can take place whilst spaces are occupied. The method can stop biofilm building up inside of a HVAC system, increasing efficiency and reducing maintenance.

After receiving a proof of concept for a bespoke UVC control system in early 2020, GGS went to market with the idea and was adopted in food processing, commercial offices, sporting clubs, schools and childcare facilities. At the height of the COVID pandemic, the proven technology was a natural solution to restrict the spread of the virus. At Bambini Early Learning Centre in the Royal Melbourne Children's Hospital precinct, a trial program reaped tangible



Robert Gangi with the Clean Cart prototype.

# Manufacturer Focus

results – the centre reporting a reduction in illnesses in the children.

“We went to expand the trial for the centre, but it wasn’t required because the system was working so well. For me, it was validation and something tangible to know how well the system worked, so we used that momentum,” Robert said.

For surface disinfection, knowing exposure time and where to place UV-C fittings is crucial and extreme caution is required when a disinfection cycle is taking place.

UV-C is a light source that is damaging to the skin and eyes, so humans can’t be in a room or have direct contact with the light source. The ozone layer protects us from UV-C produced by the sun in our natural environment. Robert knew to be properly implemented, the system needed to be completely controlled, so the team set about designing and developing control systems specifically for UV-C light sources.

Seemingly, the safety concerns and risks involved in dealing with this technology have limited the scope of its applications. The control system looks to put a stop to this, putting in various failsafe’s such as electronic locking systems and occupancy sensors to mitigate the risk of anyone being in the room while the UV-C was operable. It is the first of its kind to be fully automated in Australia, reporting when the lights are on and off, so the environment can be monitored.

“There was no point of me selling a system only on the basis of ‘when you leave at night, the lights come on,’ because we know that faults happen. It could be a faulty light or electrical circuit, so we had to design a system that not only has safety measures in place but also monitors the operation of the UV-C light sources.

Numerous fail-safes are in place to ensure the system is completely safe and 100 per cent automated, removing human error for a thorough disinfection.



Robert, alongside manufacturing partners Jono Davies and Adrian O'halloran from All Duct Fabrications.



The Lindo Chamber is fit for a patient stretcher.

The business complies with the ARPANSA (Australian Radiation Protection and Nuclear Safety Agency) guidelines, specifically mandated to minimise all human contact.

GGS has worked with different sporting clubs to provide safe, automated disinfection of training facilities and treatment rooms. From a practical standpoint, Robert explained the fail-safes by referencing the system in place at a professional sporting club in Victoria. Gangi installed germicidal UV-C lighting in the HVAC system of the club’s sealed high-altitude training room. As the air circulates through the HVAC system it’s treated with UV-C light, which reduces the chance of airborne pathogens spreading. For high-performance organisations like professional sporting clubs, small changes can make a big difference. To disinfect the surface, the system was installed and automatically turns on when players leave the room.

## Entering manufacturing

Whilst developing and implementing systems for GGS, Robert and long-time friend Nathan Brown developed and manufactured the world’s first UVC patient stretcher disinfection chamber, now called the Lindo Chamber. Entering manufacturing for the first time, the start-up faced the challenge of partnering with the right manufacturer. Robert said he is learning from Melbourne-based All Duct Fabrications as well as Swinburne University, so that GGS will open its own facility to continue to grow manufacturing capacity for Lindo products.

“I wouldn’t be here without collaboration,” Robert noted. “We continue to work with research organisations and brilliant minds at universities, but I think it’s important to collaborate and learn from other businesses as well. Whether in the disinfection ecosystem or any other start-

up business, I think you can learn from each other. We identified early that we didn't have the full skill set."

All Duct Fabrications re-designed the chamber so it could be put together in under 12 minutes. Originally called Clean Cart, the UV-C disinfection chamber was initially designed for shopping trolleys. After collection, the trolleys are rolled into the chamber and securely sealed for a button to activate the UV-C light to properly clean the trolleys.

To gain evidenced-based research, GGS engaged contract research organisation Eurofins Scientific to test the product in its laboratories. The chamber was proven to work, removing salmonella and E.coli from the trolleys in Eurofins' testing environment.

The trajectory of the Clean Cart product took a turn when Robert had a conversation with a friend who flies with Air Ambulance Victoria.

"He saw the chamber, and said 'Rob, that's a perfect size for a patient stretcher.' It dawned on us that healthcare could be terrific for this technology," Robert explained. "The idea is to reduce resources, stress and costs by replacing the paramedic's task of disinfecting a stretcher. A job which can take up to half an hour can be done by the chamber in under five minutes and the only manual labour involved is inserting the stretcher and removing it. Everything else is automated."

Without the chamber, paramedics use chemical gloves and PPE to wipe down every surface, exposing them to potentially harmful pathogens and surfaces.

"Different paramedics have told us the reason they left the job was because they felt exposed to harmful chemicals, ruining their hands and feeling it in their lungs."

GGS acquired Clean Cart in its entirety in 2022 and rebranded it to Lindo. Lindo was created to design, develop and manufacture innovative BioTech and MedTech products, using UV-C and "Bluelight" light sources.

The Lindo Chamber provides surface disinfection to a variety of health care equipment, including but not limited to, patient transport stretchers. Using germicidal lighting technology, the chemical-free form of disinfection not only reduces manual labour



for paramedics and other healthcare professionals, but also has a positive impact on the climate by reducing waste. Combined with an asset management and tracing system, the chamber is currently in use as a trial at Air Ambulance Victoria (AAV). It has been used successfully since October last year, with paramedics also using the chamber to disinfect other healthcare equipment like monitors and laptops. The success of the trial lead AAV to ask GGS to provide a permanent solution. Robert explained that the chamber is more than just a disinfection solution.

"We've expanded the monitoring system so that each stretcher provides an alert each time a stretcher is disinfected, saving that information to a database. We can then set the system to provide an alert when a stretcher hasn't been disinfected for a certain number of days and provide a record of each time the stretcher was disinfected. This enables easy quality assurance, monitoring, and health and safety reporting."

## The next generation of Lindo

In May 2022, GGS was awarded an innovations connections grant by CSIRO to further investigate the viability of

blue light as germicidal light. The goal of the study is to analyse the difference between UV-C and blue light in disinfection and develop systems which work with blue light. According to Robert, blue light is a promising disinfection alternative in situations with little space and energy.

"Blue light has the same germicidal properties as UV-C, but takes a little longer to be effective. Because it is LED, we are now developing a chip in conjunction with a company in Finland that runs purely off 24 volts. So when you talk about the installation process into an aircraft, you can run it off of the power system without any transformers or drivers."

The innovations grant will be used to fund a research project between GGS, the University of Melbourne, and the Peter Doherty Institute.

"Through CSIRO, by extension you get to work with universities and research organisations with a plethora of knowledge," he said. "We are also working with the Swinburne University to build the next generation of the Lindo Chamber. We recently had a two-day workshop with them, which was fantastic. Founders of start-ups are

so involved, it can be hard to take a step outside and look in, which is incredibly important."

After dissecting every aspect of the chamber with the university, GGS is now working on a more sustainable version of the Lindo Chamber, working with another local company to deploy an asset tracking and compliance digital platform. If a paramedic, for instance, notices something wrong with a stretcher, the chamber can take a photo and lodge a request so that the stretcher won't be able to service again until it's fixed. A product which started as a disinfection tool for supermarket trolleys has quickly transitioned to a completely new industry, and now has the ability to survey abnormalities in equipment to further reduce risks.

The collaboration also aims to establish a servitisation business model for LINDO and GGS.

"We haven't found similar products on the market that offer the same level of technology. Along with the benefits for the healthcare industry, we believe that there will be a positive impact on not only the emergency patient transport industry but also other healthcare industries like Aged Care." **M**