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Paul Flick / Autonomous Systems, CSIRO

CASE STUDY

# Revolutionizing Robotics

The Commonwealth Scientific and Industrial Research Organization (CSIRO) is one of the largest and most diverse scientific agencies the world. CSIRO researches a variety of disciplines from agriculture to energy, manufacturing to space, improving the future for Australians and the world. CSIRO'S accomplishments include pioneering radio astronomy work leading to the invention of WiFi, development of extended-wear contact lenses and a vaccine that protects against the deadly Hendra virus.

3D printing has played a key role in CSIRO's Autonomous Systems Lab since 2011, accelerating research and reducing costs.



### **3D Printing Streamlines Research**

In many CSIRO studies, researchers developed testable prototypes and gathered data by securely attaching multiple sensors to moving robotic devices in order to finalize designs. Prototypes created for tests were often held together with double-sided tape or zip ties, because using traditional fabrication methods (such as milling or cutting) or outsourcing were too costly and time consuming.

Paul Flick, a senior mechatronic engineer for CSIRO, implemented FDM<sup>®</sup> and PolyJet<sup>™</sup> technologies to streamline prototype production. Researchers now create models quickly in-house from 3D CAD designs, minimizing lead time and outsourcing.

"Efficiency has been a huge factor contributing to the success of a research project for us, and 3D printing has been the integral accelerator for some of our projects with its highly reliable technology and durable ABS materials," Flick said.

# A Smart Approach

CSIRO adopted two 3D printing methods to aid its research. FDM builds durable prototypes with mechanically strong, production-grade thermoplastics for projects that need higher tensile or impact strength or bio-compatibility. PolyJet creates models with fine details that can undergo functional tests, such as assembly and snap fit. With these two complementary technologies on site, Flick and his team create concept models and functional prototypes more confidently.

"Now, if someone comes up with a brilliant idea at the end of the day, it is possible to send the CAD file to one of the 3D printers and have the part ready the next day," Flick said.

This agility sped the development of a GPS-enabled cattle monitoring sensor. A key goal was to design a collar that could house the solar panels, electronics and batteries while withstanding the rough movements of the animal. This system tracks the movement of the cow via GPS, accelerometer and barometer information that is then transferred to a base station for studies. Finalizing this design took many iterations that would have taken the team weeks or even months using a traditional fabrication method. Instead, it took only days to print, assemble and test to confirm the design using 3D printing, allowing the team to begin developing the data-reading parameter ahead of schedule.

# Extending the Robotic Reach

Since the Queensland lab facilities added 3D printing, its machines have been running nonstop, providing predictable results faster and more cost-effectively. For example, assembly tests for a hexapod, which can travel on uneven terrain to collect natural-science data where wheeled robots can't go, took advantage of strong ABS material to ensure the robot prototype could withstand high impact and oscillation.



A hexapod robot developed by CSIRO's robotics team with 3D printed components.



CSIRO's GPS-enabled sensors track animal movements and health.

# **strata**sys

"At CSIRO, research is the religion as we endeavor to improve people's living standards by investigating science and nature. 3D printing has been an indispensable tool and the driving force that helps us prototype better and faster, eventually pushing the limits of possibility in the many sectors that we work in," Flick said.

While the CSIRO lab continues to seek answers to some of the world's most challenging questions, 3D printing is enabling its researchers the ability to create applications and systems with greater efficiency.



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### HEADQUARTERS

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