

Innovative approaches to cutting aircraft maintenance costs

Laser cladding technology is fast becoming a preferred process for the repair and refurbishment of metal aircraft parts damaged due to wear, corrosion, stress, or impact, as it can reduce replacement costs, shorten turnaround times and even improve structural integrity extending part life.

As a world leader in laser cladding technology, RUAG Australia was successful in 2016 in winning a highly competitive Capability Technology Demonstrator (CTD) grant from the Commonwealth Government to develop a new laser repair technology using Direct Energy Deposition where powdered metal is applied under controlled conditions.

With a track record of research and development in additive repair technologies RUAG's research and innovation team have already successfully developed an alternative technology for the rapid repair of corroded, worn and damaged components using a cold spray technique, known as Supersonic Particle Deposition. The process is currently being used to restore structural integrity of corroded panels on aircraft. The recent CTD grant focuses on laser deposition of hard steels used in aircraft structures, such as SS4340 and 300M, to develop a rapid repair technology for the recovery of corroded or worn structural parts.

Corrosion is recognised as a significant contributor to the lifecycle cost of defence aircraft; in March 2017, the Minister for Defence Industry Christopher Pyne estimated that the cost of aircraft corrosion to the Australian Defence Force was around \$254m a year. This underlines the importance of research and innovation into techniques that could make significant reductions to repair costs.

However, Australia is not alone. In 2008, in response to concerns over the high cost of corrosion, the US Congress enacted legislation to encourage the prevention and mitigation of the effects of corrosion on military equipment and infrastructure. This concern was borne out in a 2013-14 review detailing the continued increase in the costs of corrosion repair and maintenance for US Air Force aircraft and missiles, which placed the total bill at US\$6bn.

The CTD grant has allowed RUAG to purchase a Laserline LDF 4000-30 from Raymax Applications in Sydney for use in its project. Aside from the system containing the required specifications, and the company's willingness to meet RUAG's particular requirements, Laserline has a proven track record in Australia in additive processes, being used for the repair of large components in applications ranging from oil rigs, to turbine shafts and heavy field equipment.

Led by research and technology engineer Nicolas Orchowski, the CTD project is being undertaken at the RUAG Australia research and technology department in Bayswater, Victoria, and is highly focused on aircraft parts. All aircraft components are subject to certification conditions that determine their 'life-limit' – specified as the operational time or number of operational cycles, or the number of times a part can be serviced before replacement.

The project's focus is on using additive deposition for recovery of worn, damaged or corroded aircraft parts, the aim being to improve part integrity and restore lost material eventually returning the part to its original design specification. The project is currently well under way, with the Laserline system installed and operating effectively.

Comprising two fibre laser outputs, a CCD camera and an optical pyrometer for closed loop control and process monitoring, the Laserline system uses a uniquely designed nozzle that simultaneously dispenses metal powder and inert gas along side the laser beam allowing accurate deposition at a very high heat. Metal fusion occurs in a small, localised area, resulting in minimal heat



RUAG Australia has extensive experience in aircraft repair



The R&D project in operation, showing the Laserline system with the uniquely designed nozzle mounted on a robotic arm.

effects to the original stratum, while the bonding process increases the strength of the fused area. As with all Laserline installations the RUAG process occurs remotely via a robotic arm that guides the nozzle on its prescribed path via a computer program.

Sitting alongside the robotic arm, Orchowski says he is happy with the progress of the project and pleased he can call on support at any time from Dr Cédric Chaminade, a laser physicist from Raymax Applications, now that the system is up and running.

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