

## Leonardo 2018 Innovation Award Winners

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### Award for university students

Established in 2015, this Award is aimed at university students studying the sciences and (for the first time this year) economics, in order to draw on their talent and ideas. The competition asked the candidates, who were divided into two categories (**Students/Recent Graduates** and **PhD students**), to develop an innovative project in one of a number of specific areas of research which have been identified as having potential for Leonardo's future business: **Virtual Reality, Blockchain, Cognitive Systems, Circular Economy**.

**First Place Students/Recent Graduates: Matteo Sacchetti** (Polytechnic University of Milan), **Virtual Reality, Glove Controller**. The project involves a remote control flight system, in the form of a sensory glove, which can manage complex processes such as control of a drone. The project comprises a sensory glove and a drone managed by an 'Arduino' single-board flight controller, as well as a series of additional sensors. The proposed solution allows for the management of more complex tasks than those which are typically possible with conventional methods such as joysticks. The project is aligned with the needs of Leonardo in the management of remote control platforms.

**Second Place Students/Recent Graduates: Matteo Buffagni** (University of Modena and Reggio Emilia), **Blockchain, Blockchain for aeronautical maintenance**. The aim of the project is to apply *blockchain* technology in order to store data related to the overhaul and maintenance of aircraft, in a fixed and secure way, in digital and distributed records. A physical maintenance record of an aircraft can be lost or destroyed, and, if it is paper-based, this greatly complicates inspections in terms of cost and time. Physical records are also vulnerable to fraudulent activity, potentially damaging their credibility in the eyes of external stakeholders. This project therefore improves the security, accessibility and integrity of maintenance data.

**Third Place Students/Recent graduates: Vincenzo Pantone, Amelita Grazia Laurenza and Teresa Pantone**, (University of Bari) **Circular Economy, SOBRERO**. The current social, economic and environmental landscape requires that industry pivots toward a *Green Chemistry* approach, aiming to use raw materials of plant origin. This is what is meant by moving from a linear economy model to a circular economy model. The SOBRERO project focuses on the idea of synthesising *bio-based* binders to be used in solid propellants, which are currently used for propulsion in the aerospace field. Replacing the petrochemical-based polyurethane binder with a similar binder made from renewable sources would bring numerous advantages in terms of environmental sustainability. In addition, the synthesis of *bio-based* products as an alternative to the naturally limited synthesis of raw fossil materials supports the long-term sustainability of propulsion solutions.

**First Place PhD students: Antonino Galletta**, (University of Messina), **Blockchain, How Blockchain Can Revolutionise Air Transport**. The idea behind the project was to create a platform based on *blockchain* technology that allows airport operators to quickly and reliably verify the identity of passengers, resulting in economic savings for the community at large. The solution will also help address the problem of passengers who manage to evade controls and enter foreign countries without a visa or with false documents.

**Second Place PhD students: Nicola Felice Capece and Monica Grusso**, (University of Basilicata), **Cognitive Systems, Use of deep learning to support airport security checks**. A *deep learning* approach could help identify possible threats while screening baggage at airports, using X-ray instrumentation. The solution involves software architecture made up of several artificial neural networks, which work together to create a more precise ability to identify dangerous objects inside luggage.

**Third Place PhD students: Paola Vesco and Gabriele Accarino** (University of Venice), **Cognitive Systems, An artificial intelligence tool for migration analysis and projections**. The project explores the predictive potential offered by *deep learning*, applying mechanisms from the field to address the challenge of forecasting in the social sciences, and in particular the forecasting of international migration flows. An

artificial neural network model is the basis for modelling the probable direction and timing of migration and identifying the most probable countries of origin and arrival in the medium-to-long term.

### **Award for Employees**

For fourteen years, Leonardo has been rewarding the innovative projects of its employees all over the world. For the fourth year running, projects have been divided into categories: **incremental innovation**, which aims to improve existing products; **radical innovation**, which involves generating new products or creating opportunities in new markets for existing products, and the **idea** category, relating to projects that do not have an impact on the business in the short term but could produce a competitive advantage in the future. In addition, there is a prize for the **best patent**, and, new for the 2018 edition, an award in the **processes** category.

**In the Incremental Innovation category: Stefano Pastore, Bruno Addivinola, Augusto Albolini, Antonio Ciliberto, Lucia Cutillo, Giuseppe Stefano Gallo**, Aircraft Division, *Tartaric-Sulphuric Anodising process for the protection of aluminium alloys*. The innovation is the development and validation of an environmentally-friendly galvanic process which protects parts made from aluminium alloys against corrosion. The new process is called Tartaric-Sulphuric Anodising (TSA) and is an alternative to the traditional Chromium Anodic Oxidation (CAA) process. The galvanic process is a technique that allows a surface to be covered with a thin layer of a metal via electrolytic deposition. In aircraft manufacturing, the system is used to protect aluminium aerostructures from oxidation processes. By eliminating chromium from production cycles, the innovation is in line with Leonardo's strategic objective to develop technologies, materials and processes that ensure compliance with REACH regulations (Registration, Evaluation, Authorisation and Restriction of Chemicals). Together, these aim to improve knowledge of the hazards and risks arising from chemical products and represent a significant contribution to reducing environmental impact.

**In the Radical Innovation category: Filippo Rodriguez Stefano Di Rollo, Osman Kalden, Douwe Lambers, Gian Paolo Plaia, Luca Preziosi, Roberto Ronchini, Vanessa Sicurello**, Telespazio, *Ionosphere prediction service for GNSS (Global Navigation Satellite System) users*. The innovation is a platform which can predict when solar explosions interacting with the ionosphere will interfere with terrestrial systems. The activity of the sun produces significant effects on the ionosphere, which is the highest ionised layer of the Earth's atmosphere. This can influence the behaviour of satellite navigation systems, drastically reducing their accuracy or interrupting their proper functioning. Today, predicting weather conditions in space is of special interest: systems are therefore needed to help anticipate and measure the effect of solar activity on applications and services that use satellite navigation systems. The beneficiaries of these forecasts would include the operators of vehicles, aircraft and vessels which use receivers based on GPS, Galileo and other systems to navigate. The service is based on advanced proprietary algorithms that draw on data provided by various *open source* sensors and historical data. The output is forecasts which are useful in mitigating the effects of magnetic interference.

**In the Idea category: Marco Lopez, Eden Mei**, Leonardo DRS, *Quantum WVA-based (Weak Value Amplification) inertial navigation at a chip scale using photonic waveguides*. The aim of the project is to integrate, at chip level, an optical gyroscope (a sensor which is fundamental to the workings of inertial guidance systems, Inertial Monitoring Unit-IMU) with performance which is potentially far superior to that of high-end IMUs and much greater in scope. The idea is to use the WVA (*Weak Value Amplification*) methodology to measure ultra-small phase shifts in the optical interferometer, which is the basis of a gyroscope.

**In the Best Patent category: Luke Alexander Pillans** Land and Naval Defence Electronics Division, *Thermal imaging calibration system and method*. The patent relates to a solution that calibrates a *thermal* (infrared) *imaging* system. Focal Plane Arrays (FPA) are made up of a matrix of pixels that often show a non-uniformity of operation between them. It is therefore common to use calibration techniques to correct non-uniformities and improve the quality of the image, typically performed only once, during the production phase of the thermal chamber. However, with many detector technologies it has been found that pixel uniformity can change over time and performance can be improved by performing additional *on-site* calibrations before or during each use. The new calibration system includes a shutter that can be moved mechanically in and out of the optical path in question. The calibration system covered by the invention can also allow a reduction in the size of the lens used in the cameras in Leonardo's FIREFLY family.

**In the Processes category: Vincenzo Sabbatino, Vincenzo Arrichiello, Paolo Casanova, Alessandro Garibbo, Daniele La Rosa, Paola Savoia, Leonardo, *Lunch Time Seminar*.** Lunch time seminars are popular presentations given every fortnight by experienced colleagues, broadcast via video conference to allow the largest number of employees to take part. They serve as an innovative Knowledge Management tool to spread technological know-how and promote a culture of innovation. They also help to build a wide understanding of the company's activities, supporting the integration of different businesses.

**Special Mention: Roberto Sanguini, Fabio Bello, Zaira Burlo, Alberto Clocchiatti, Salvatore D'Onofrio, Ludovica Rendine, Fabio Russo, Gabriele Tonini, Raffaele Vertucci, Helicopter Division, *Support And Learning Anywhere Integrated (SALAI)*.** SALAI is an innovative platform which, drawing on the division's experience and products, aims to become the "One Leonardo" answer to the support and remote training needs of the Company's maintenance technicians.