APULIA REGION

pugliasviluppo

A journey into beauty & innovation:

Apulia, the aerospace region

EUROPEAN UNION

APULIA REGION

PUGLIA FESR·FSE 2014/2020

Il **futuro** *alla portata di tutti*

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Action 3.5 "Initiatives for strengthening international business development"

A journey into beauty & innovation:
Apulia, the aerospace region

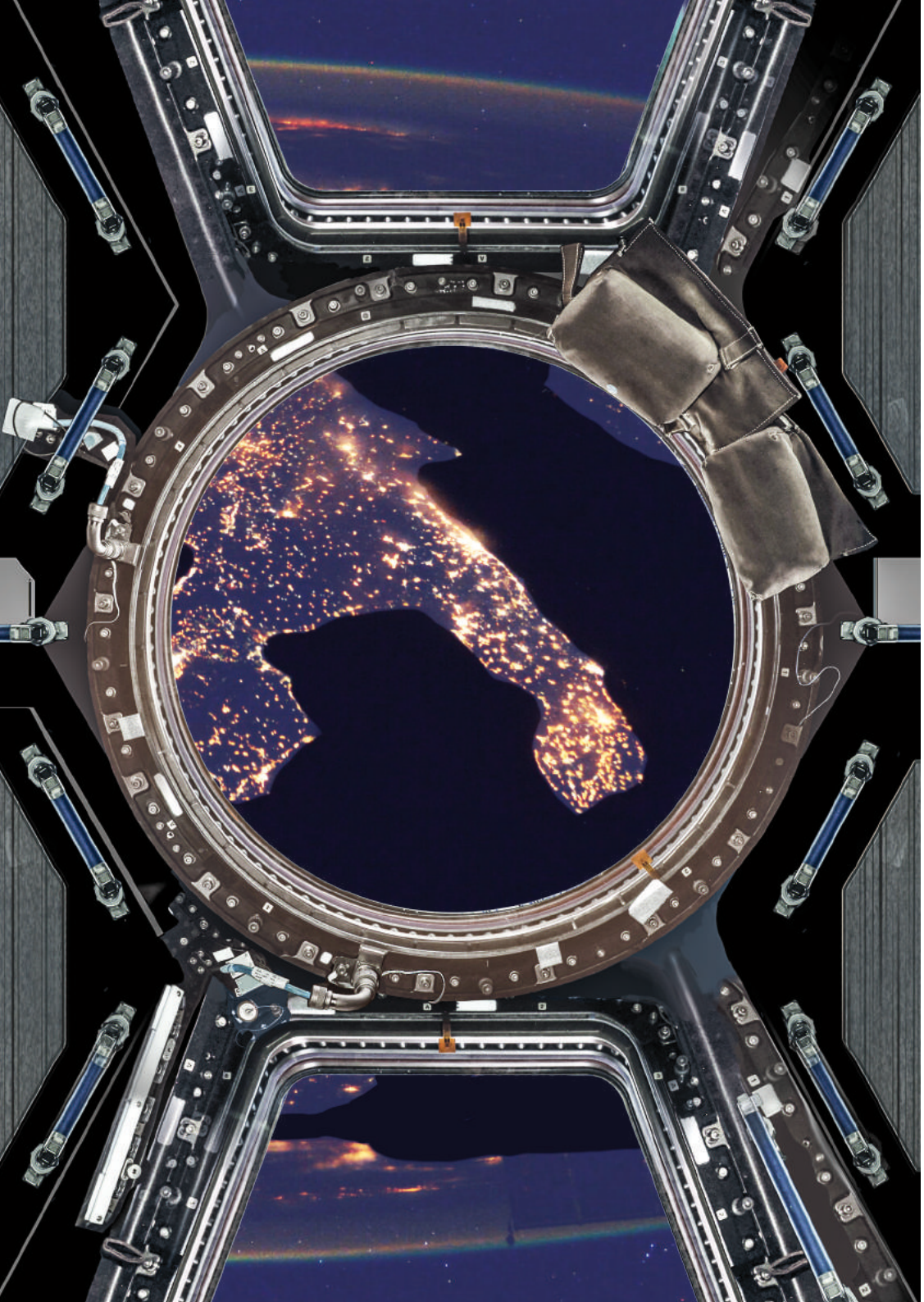
Michele Emiliano
President
Apulia Region

Alessandro Delli Noci
Regional Minister
for Economic Development
Apulia Region

The growing importance of the aerospace industry in Apulia, a region in the South-east of Italy, is a clear example of how regional policies can drive strategic innovation. Over the past few years, thanks to a mix of public funded initiatives and incentives, the regional government has stimulated business investments totalling over 400 million euros in the aerospace industry in Apulia, which has become a global player, accounting for more than 11% of national industry exports in 2020.

In this scenario, the space sector is also becoming increasingly important for Apulia and so our region is preparing to play a key role in the new space economy. Regional investments in innovation have favoured collaboration between local companies, universities and the wider research ecosystem, fuelling technological progress and the entrepreneurial spirit at the heart of the new space economy.

The protagonists of this revolution are small and medium-sized enterprises which, together with an ever-increasing number of innovative start-ups, are becoming instrumental in developing innovative space services, technologies and products. We are bringing regional excellence and the results we have achieved in the aerospace industry to EXPO 2020 Dubai, during the thematic "*Space Week*", scheduled from 17 to 23 October 2021.
Through the exhibition *"A journey into beauty and innovation: Apulia, the aerospace region*", we intend to showcase, in the White Space of the Italian Pavilion, a range of products and prototypes, technologies and inventions, which respond to three major challenges: Living & working in Space; Space for our planet; Innovation & Technology in the new space economy.
On display, in addition to performance clothing and food for astronauts, micro-satellites, technologies for earth observation, management and processing of satellite data, additive manufacturing, as well as products and prototypes in composite materials, all of which have been made possible by the regional R&I system, represented by the Polytechnic of Bari, the University of Salento and the University of Bari, research centres, the Technological Aerospace Cluster, in addition to innovative small and medium-sized enterprises.
We intend to tell the story of the key role of "small" regions and small businesses in the development of the global competitiveness of the aerospace industry. At the same time, we want to make the potential of Apulia known to a wider international audience, taking into account our ambitious plan for the creation of an aerospace industrial park at the airport of Grottaglie (Taranto), Italy's first and only spaceport which is a strong contender to become the European hub for reusable space transportation systems.
Our journey to bring Apulia, the aerospace region, to EXPO 2020 Dubai, aims to foster new opportunities for collaboration and investment in a strategic sector at international level.



The new space economy: global value and key business sectors

Over the past few decades, various factors have led to the formation and growth of the new space economy, such as the development of new space technologies, as well as the continuous improvement of existing ones, in addition to growing consumer demand for products and services based on space-related technologies which has driven up the number of private companies entering the market and integrating the role played exclusively by national space agencies in the past.

The "*new space economy*" has been defined by the OECD as "*the full range of activities and the use of resources that create value and benefits to human beings in the course of exploring, researching, understanding, managing, and utilising space*". In particular, the definition encompasses the activities carried out by both public and private organizations to develop, bring to the market and use space-related products and services. More specifically, the new space economy can be divided into two main business segments: downstream and upstream. The downstream segment refers to the use of space technologies to enable the development and exploitation of innovative products and services related to terrestrial applications. Typical examples are the use of satellites in the telecommunications field, the use of geolocation tools and Earth observation. On the other hand, the upstream segment encompasses scientific research, R&D, manufacturing activities and ground systems related to space operations, services, products and technologies. Examples of upstream activities are the development and production of launch systems, production activities in microgravity conditions and space tourism related services.

Based on recent estimates, the total value of the global new space economy in 2019 was US$ 423.08 billion, up 2.2% compared to the previous year and 95.7% compared to 2009, but could surge to US$ 1,000 billion by 2040.

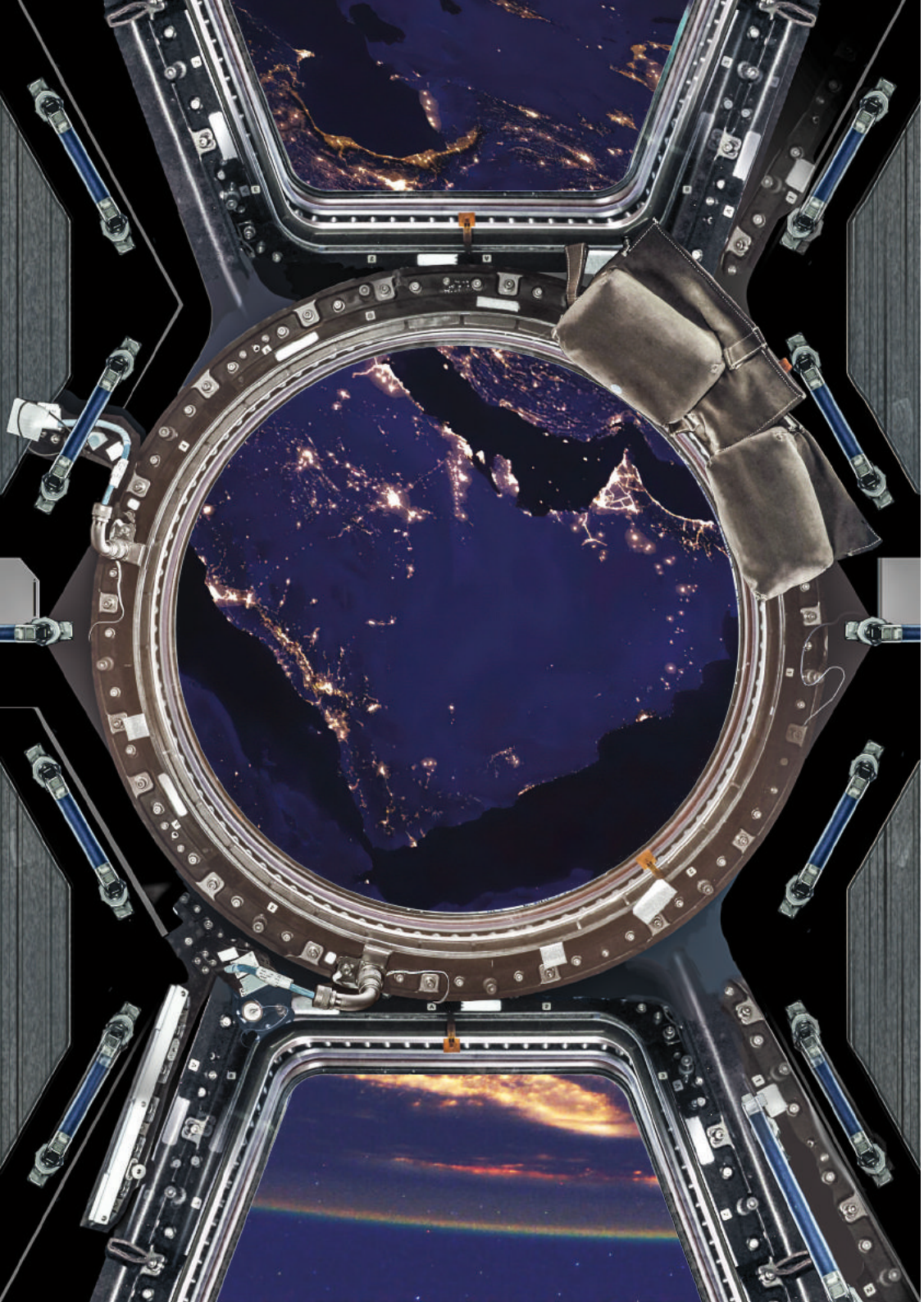
The space economy in Italy

Italy has a long-standing, consolidated role in the Space Economy. Indeed, Italy was one of the founding countries of the European Space Agency (ESA), as well as one of the first countries to launch a satellite into space with the San Marco 1 mission. Recent research by the Italian Ministry of Economic Development (MISE) shows that over 200 companies are active in the space sector at national level, of which 80% are SMEs, employing more than 7,000 employees (with an increase of 15% between 2015 and 2020). The annual turnover of the space industry in Italy is estimated at 2 billion euros, ranking our country in 3rd place in Europe and 7th in the world. The landscape of the Italian space industry is characterized by a wide variety of companies that cover the entire supply chain, making the national industry complete in all its components, with companies operating in both downstream and upstream activities. Currently, the downstream sector has an economic potential equivalent to 4 or 5 times that of the upstream sector, although strong growth in the latter is expected over the next decade. Furthermore, another distinctive aspect of the Italian space industry is that, in geographical terms, it is fairly well distributed, which generates a positive economic impact of the Space Economy on a higher number of Italian regions, contributing organically to national growth.
Finally, the Space Economy is becoming increasingly important at policy level, as demonstrated by the recent Space Economy Strategic Plan, promoted by MISE in 2016, which outlined an investment plan of 4.7 billion euros, 50% of which to be covered by public resources. This intention was also reiterated in the more recent National Recovery and Resilience Plan for Italy.

Apulia, the aerospace region

In recent years, Apulia has emerged as one of the leading Italian regions in the space sector. Taking into consideration the broader aerospace sector, Apulia is home to an industrial eco-system, consisting of 550 active companies, occupying 7,900 employees (accounting for 10% of the overall number of employees in the national aerospace sector), that export goods and services for a value of 738 million euros, representing a 12% share of national sector exports (as of 2019). Today, there are numerous international players, such as GE Avio, Leonardo and Angel Group, operating in Apulia in diverse industrial specializations, making up the Space Economy (design, construction, assembly and testing of aircraft engines, design and construction of aerostructures and light aircraft in carbon fibre, software design, microsatellites and propulsion systems, Earth observation and space data management systems). The regional industry is boosted by the presence of the Aerospace Technological District (DTA), which brings together companies, universities and research centres and focuses on activities related to the emerging dynamics of the Space Economy, fostering collaboration between different organizations which is central to regional development in this sector. Moreover, looking at the growth of the space economy in Apulia, it is worth highlighting the collaboration between the European Space Agency (ESA) and the Polytechnic University of Bari which has led to the setting up of the third ESA Lab in Italy, aimed at supporting scientific research and technology transfer in the space sector. Apulia also stands out for the presence of the first Italian spaceport at the Taranto-Grottaglie airport, a role designated by the Italian Ministry of Transport and regulated by ENAC (Italian Civil Aviation Authority), which will further develop the region's role in the new space economy. Taranto-Grottaglie airport also operates as a test bed for the trial and development of UAV systems and earth observation technologies, representing a significant driver of innovation in the Space Economy, with potential benefits at regional and national level. Finally, the Taranto-Grottaglie spaceport, destined to become the point of departure and arrival for reusable spacecraft to be used for high-frequency space research missions and suborbital flights for private individuals, will benefit the economic growth of the region both directly, through industrial activities related to the space economy, and indirectly, with the development of new activities and services related to the space value chain.

Antonio Messeni Petruzzelli
Professor of Innovation Management
Polytechnic University of Bari



The Exhibition

A journey into beauty and innovation: Apulia the aerospace region

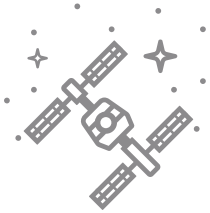
People have dreamed of flying and travelling to space for centuries. The history of aviation extends to over two thousand years, from the early attempts at kite flying in Ancient China, dating back to several hundred years B.C., to Leonardo Da Vinci's dream of flying and designs for various forms of flying machines, dating from 1488, from the modern aeroplane, the first of which was famously invented and flown by the Wright brothers in 1903, to today's new generation of spacecrafts which is making space exploration and space travel a reality for budding "space tourists" and not just for astronauts.

The beauty of space has always been a source of inspiration to explorers and scientists and the evolution of flight and space travel has been powered by technological advancements, research and innovation. From physics to chemistry, from material sciences to engineering, the pursuit of air travel and space exploration has produced revolutionary technologies and vastly broadened scientific knowledge, improving our everyday life in many ways.

The aerospace industry is a highly capital-intensive industry and, until recently, was synonymous with government spending and major public investments. Today, new technologies and a new entrepreneurial spirit are rapidly shaping the new space economy where SMEs are exploiting frontier technologies and the data revolution to play a key role, especially in the development of downstream services and applications.

In this context, small regions, such as Apulia, with a highly developed ecosystem for research and innovation, and small businesses are becoming essential to the competitiveness of the global space industry.

The exhibition "***A journey into beauty and innovation: Apulia, the aerospace region***" displays a range of inventions by Apulian SMEs, Universities and research centres which respond to three major challenges:

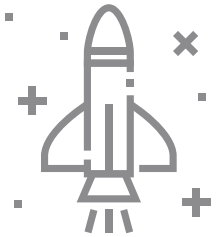


Living & working in space:

products and technologies for improving the health and wellbeing of astronauts during space missions;

Space for our planet:

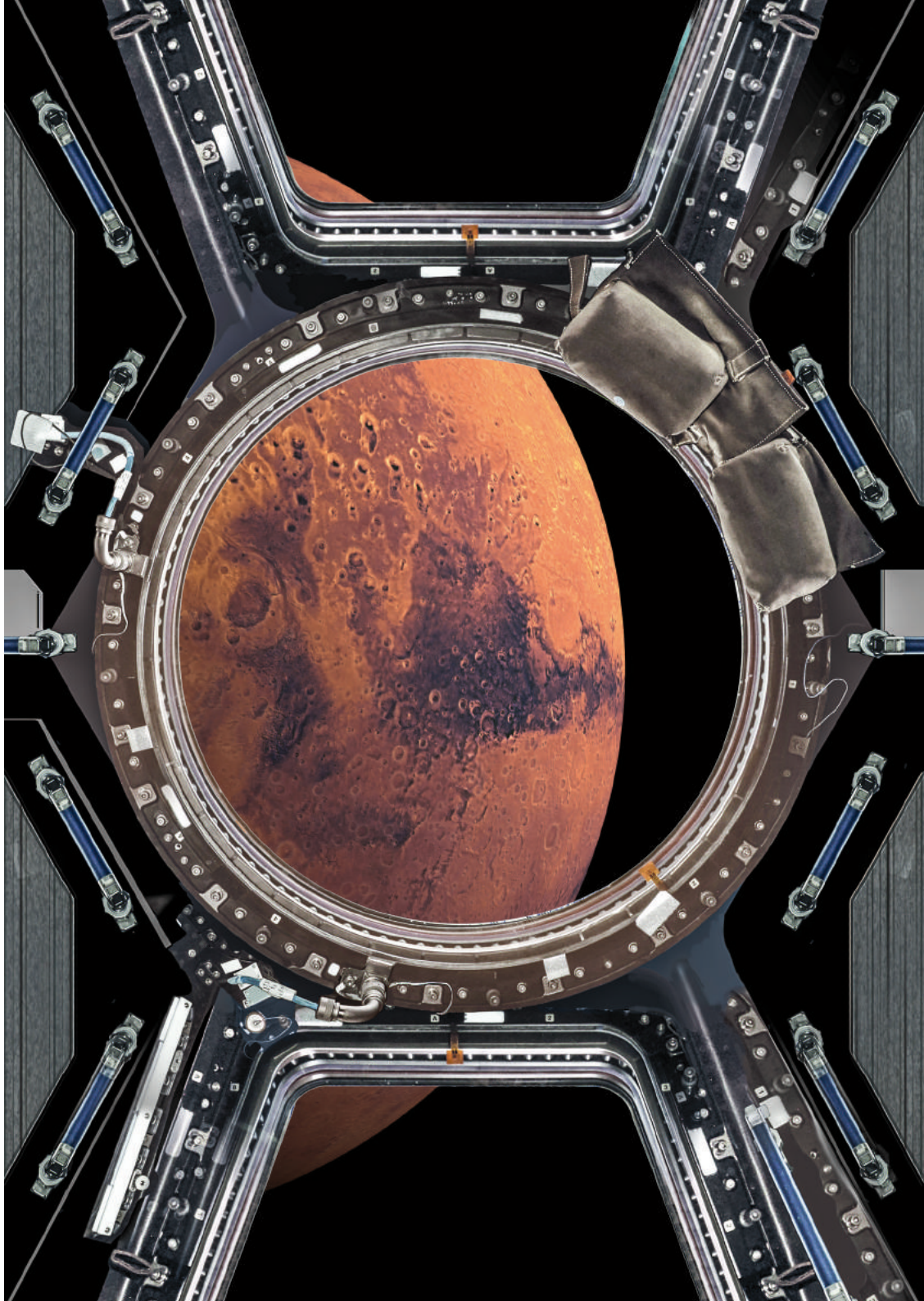
solutions that use space data for smart cities, for monitoring and overcoming climate change and environmental conditions;



Innovation & Technology in the new space economy:

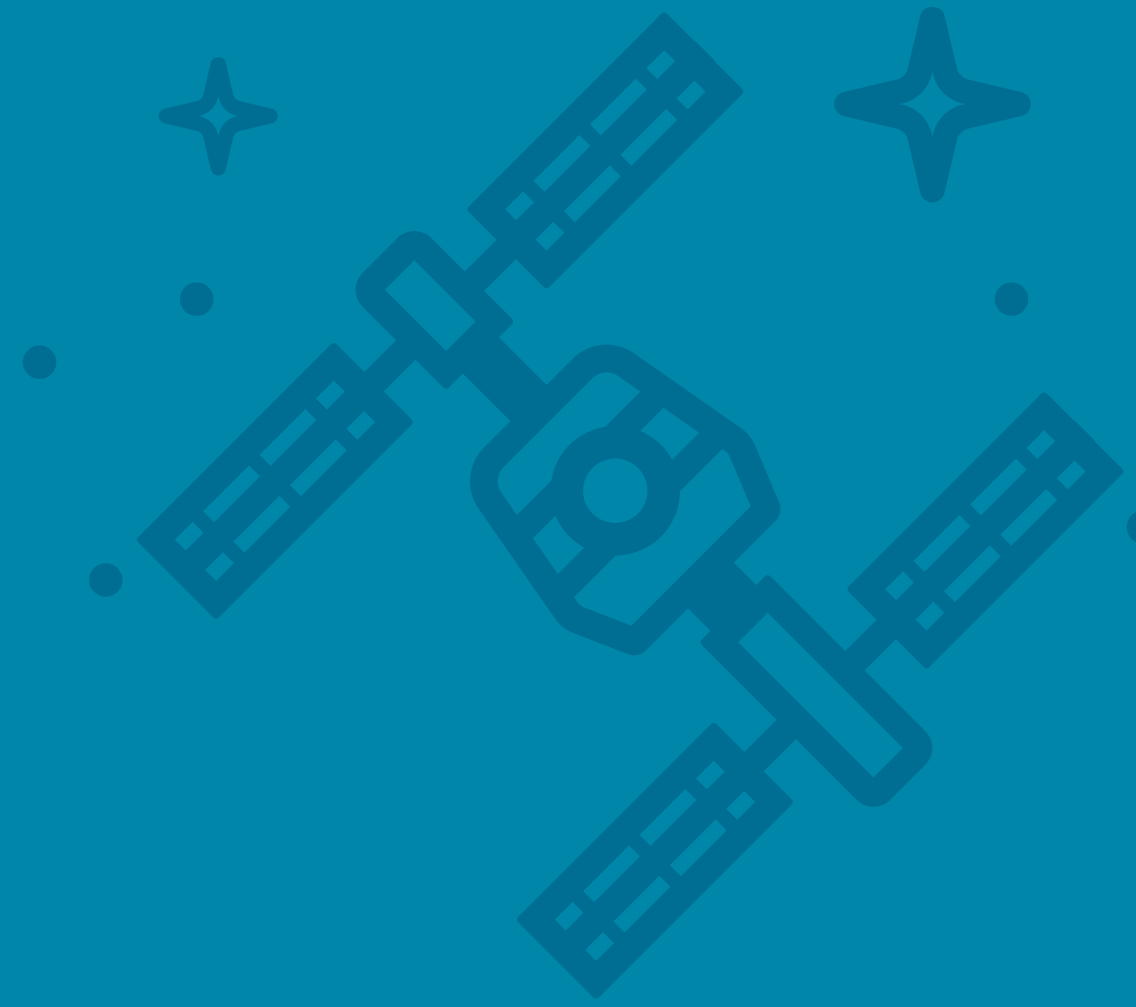
new materials, new technologies and prototypes of aircraft components and aircrafts which are furthering space research and responding to new needs in modern and sustainable air transportation.

The exhibition, promoted by the Apulia Region, intends to show the extraordinary contribution of innovative SMEs and start-ups, based in Apulia, together with local research institutions, to the modern aerospace industry, bringing the journey into the beauty of space one step closer for all of us.



"Dream of impossible things because those are the ones that change you and your future and, when you wake up, work hard to make them happen"

Paolo Nespoli, Astronaut
(Wired Digital Day, Bari-Apulia, 2020)



Living & working in space

Aquarius S.r.l.s.

Aquarius is an innovative company, set-up in 2014, with the aim of developing and implementing new technologies for the design and manufacturing of a range of high-performance sportswear. The Bio-suit is part of a new range of clothing and protective garments for humans, living and working in space, under the brand "REA" which focuses on smart clothes.

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BIO-SUIT

Bio-suit is a highly advanced smart garment, specifically developed for astronauts and space personnel operating in a zero-gravity environment, which guarantees both support to the musculoskeletal system and the correct circulation of body fluids. Through the use of a complex system of electrodes, sensors and semi-rigid structures, applied to the fabric that makes up the bio-suit, an artificial intelligence system is able to reproduce muscle activity similar to that produced on earth, helping astronauts overcome potential health risks connected with exposure to environments with zero-gravity or microgravity.

Center for Biomolecular Nanotechnologies

Fondazione Istituto Italiano di Tecnologia (IIT-CBN)

The **Centre for Biomolecular Nanotechnologies** (CBN) is part of the Italian Institute of Technology (IIT), a public research network. Established in 2009, CBN develops materials and devices at the micro and nanoscale for enabling technologies for the human body, fostering real time monitoring of health, wellness and sport performance.

ISTITUTO ITALIANO
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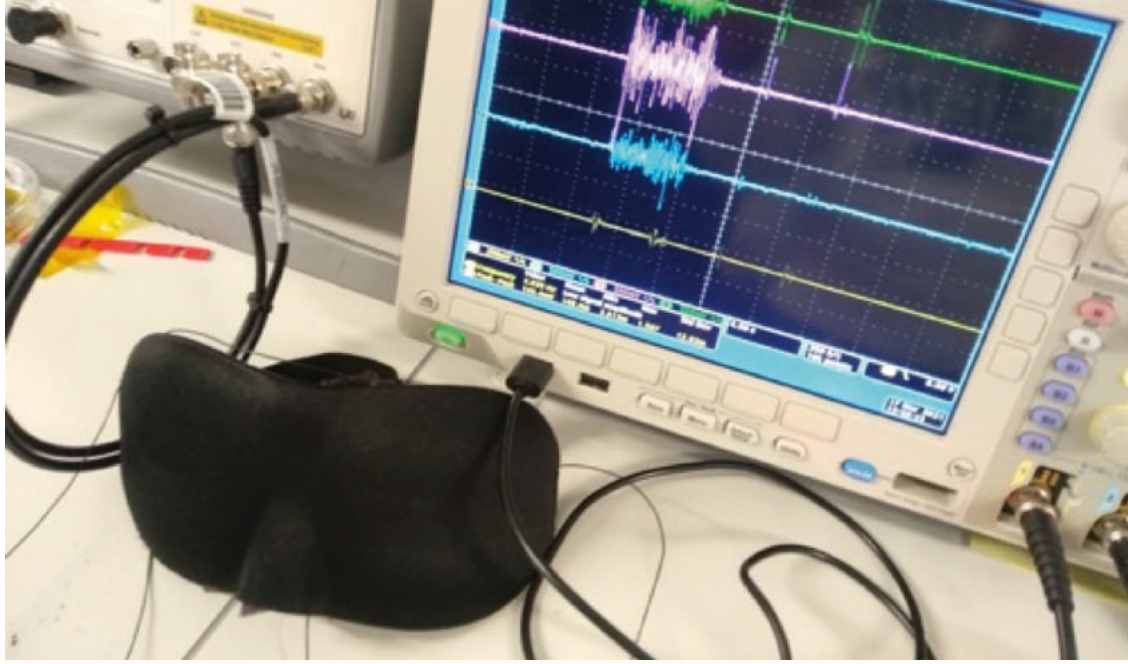

SMART SLEEP MASK

Sleep disturbances are common among astronauts in space. If sleep disturbances are protracted - such as during interplanetary travel – significant health consequences can ensue. Although important, sleep monitoring by polysomnography is not usually part of an astronaut's check-up routine since it requires wearing uncomfortable hardware. The SMART SLEEP MASK solves this problem by integrating piezoelectric sensors corresponding to selected positions of the face of astronauts to monitor sleep and specific parameters such as cardiovascular signals, eye movements and respiration, in a completely unobtrusive way.

Sudalimenta s.r.l.

The Tiberino family has been involved in fine foods since the late 1800's. In 1999, the company, **Sudalimenta**, setup production of a new line of specialty foods, ready to prepare Italian dishes, based on premium natural ingredients, and more recently developed a range of pre-cooked meals, carefully studied for astronauts on space missions.

OUTFOOD LINE

Food for astronauts has long been the subject of studies in research centers around the world, especially taking into account the conditions in which it has to be prepared and consumed. With the help of nutritionists, Tiberino was the first company to study, develop and create an entire menu of pre-cooked meals for astronauts, first of all for NASA and then for ESA. Based on aerospace protocols for food preparation, the meals are able to resist pasteurization and maintain the organoleptic characteristics unaltered, ensuring the correct supply of vitamins and minerals and tasty Italian cuisine for each cosmonaut.

From the experience and the collaboration with NASA, ESA and ASI, OUTFOOD line by Tiberino1888 was born. The OUTFOOD line is perfect for extreme situations in which the main requirements are the rapidity and simplicity of preparation with no particular devices available, the same compact packaging is used both to prepare and consume the meal thanks to its stand-up form. All OUTFOOD meals are 100% natural, balanced to provide the right nutrition for most of the needs and available in VEGAN and PROTEIN+ variants for satisfying all energy and diet requirements.

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"We don't want to go to space to get away from our planet, but to improve the conditions of life on Earth"

Dan Hart,
President & CEO, Virgin Orbit
(Mediterranean Aerospace Matching, Grottaglie-Apulia, 2021)

Space for our planet

Exprivia

Exprivia is the head of an international group specialized in ICT able to address the drivers of change in the business of its customers thanks to digital technologies. The group has a team of experts specialized in different technological and domain fields, from Capital Market, Credit & Risk Management to IT Governance, from BPO to CyberSecurity, from Big Data to the Cloud, from IoT to Mobile, from networking to business collaboration up to the SAP world. The group supports its customers in the Banking & Finance, Telco & Media, Energy & Utilities, Aerospace & Defense, Manufacturing & Distribution, Healthcare and Public Sector sectors. The offer includes solutions consisting of own and third-party products, engineering and consulting services. Exprivia, listed on the Italian Stock Exchange on the MTA (XPR) market, has 2,400 professionals distributed in 7 countries worldwide.

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INNOVATIVE SOLUTIONS AND SERVICES PROVIDER FOR EARTH OBSERVATION DATA ACQUISITION, PROCESSING AND PRESERVATION

Exprivia's Defence and Aerospace Digital Factory is a software and systems design and integration unit. Its core business is the design and development of turnkey solutions for Earth Observation (EO) satellite data acquisition and processing systems, applications and services. Specifically, it develops ground stations, subsystems and components for international agencies in the EO, environmental and military sectors, develops and integrates satellite data acquisition, distribution and processing systems, provides solutions for geospatial data management and processing, designs and develops complex real-time data management infrastructures.

DF's offer includes Augmented & VR, DH and Processing, C2I End-to-end Monitoring, Cartographic LBA and is completed by maintenance and engineering services, integration and installation of HW COTS, support to Commissioning and Operation phases.

Planetek Italia S.r.l.

Planetek Italia is an SME founded in 1994 that employs over 60 men and women, passionate and competent in Geomatics, Earth sciences and software for space missions.
We provide software solutions that extract the most of the value of geospatial data across all stages of the Earth Observation data lifecycle: acquisition, storage, management, analysis and sharing.
We operate in many fields of applications, ranging from environmental and territorial monitoring, to open-government and smart cities, to solutions for defense and security, engineering and construction, transport, utilities and energy, food resources, up to scientific and space exploration satellite missions.
The Planetek group is made up of four companies based in Italy and Greece and is active in the national and international market.
Our services are provided by Rheticus® www.rheticus.eu, the EO portal of Planetek Services.

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SPACEDGE

SPACEDGE is a space ecosystem implementing the concept of Satellite as-a-Service. It is composed by satellites and a ground market place and all the ground and in-orbit resources are made available to the users through blockchain based mechanisms. In this way satellite data are immediately converted into useful information by reducing both costs and barriers to access to space in line with the concepts of the "NewSpace Economy".
Users can choose to use a customized set of Spacedge™ components by configuring the best possible value chain in terms of cost/benefits, i.e. defining the best acquisition and processing workflow for each specific application scenario.

By SPACEDGE™ it is possible to test and apply artificial intelligence algorithms in real operational scenarios of Earth Observation, being able to make them available to the community in the SPACEDGE™ market place.

"Space transportation is at the centre of a process of democratization... The world of aerospace is becoming closer, more accessible and within the reach of more people than in the past, when it really was just a dream"

Giorgio Saccoccia,
President, Italian Space Agency
(Mediterranean Aerospace Matching,
Grottaglie Apulia, 2021)

Innovation & Technology in the new space economy

B@AT Investment S.r.l.

B@AT Investment S.r.l. is a fast-growing start-up, located in Apulia, operating in the aerospace sector, committed to developing a new class of fully autonomous solar powered marine platforms capable of achieving perpetual navigation with heavy mission-dedicated payload capacity.

b@at investment s.r.l.

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ROb@at

ROb@at is a smart solar-powered boat, equipped with artificial intelligence capable of operating in completely autonomous, semi-autonomous or supervised mode to carry out environmental monitoring and control missions at sea. With the use of a dedicated aerial drone, ROb@at can enhance its performance especially in some missions dedicated to capturing environmental data and pollution control.

Novotech

Aerospace Advanced Technology S.r.l.

NOVOTECH is an SME specialized in design, production, testing and certification of primary structural components, mainly for the aerospace sector. Currently, it is developing the SEAGULL aircraft , an innovative seaplane, conceived for civil and military applications. The program started in 2018 and the first prototype was released in December 2020. A 2nd aircraft is currently under production and the certification process has begun. In parallel, the Company is working on a 4 pax version and on a full electric vertical take-off and landing (EVTOL) configuration.

SEAGULL

The SEAGULL aircraft has been designed to promote communication and interaction between people, by overcoming the current barriers of public and private transport, in full autonomy. The SEAGULL is a unique seaplane, characterized by an automated system for folding wings, hybrid-electric or full electric propulsion, manufactured with an extensive use of composite materials and eco-compatible production processes.

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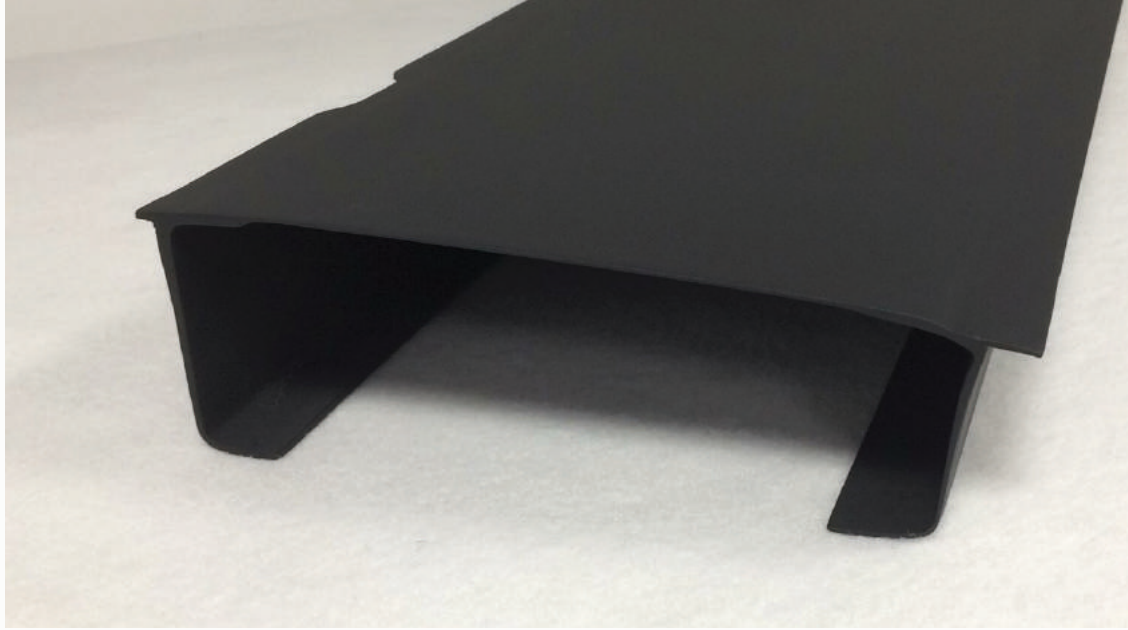
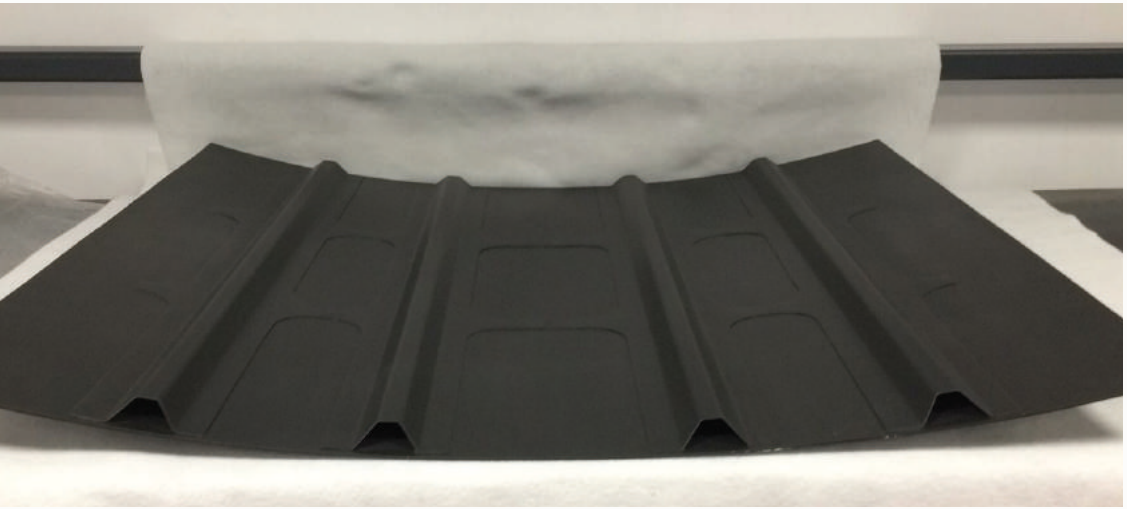


NHYTE

NHYTE acts as a door opener for highly-automated, more cost-efficient and greener manufacturing processes of complex thermoplastic structures for the aerospace sector.

With the aim of taking the use of composite materials in aero-structures to the next level, the EU-funded NHYTE research project has lead to the development of a novel recyclable hybrid thermoplastic composite material with multifunctional capabilities, suited for the production of greener, light-weight aircraft parts.



SWING
(Smart WING for new generation civil UAV)

SWING represents a smart wing for a new generation of UAVs (Unmanned Ariel Vehicles) for civil aviation. SWING has been developed in composite materials, produced by out of autoclave and automated technology.

Polytechnic University of Bari (Poliba)

The **Polytechnic University of Bari** (PoliBa) is a public university, founded in 1990, which excels in several research areas, such as mechatronics and automation, sensors and sensor systems, with more than 25 research laboratories, including the Optoelectronics Laboratory which carries out research in collaboration with leading space companies and international space agencies.

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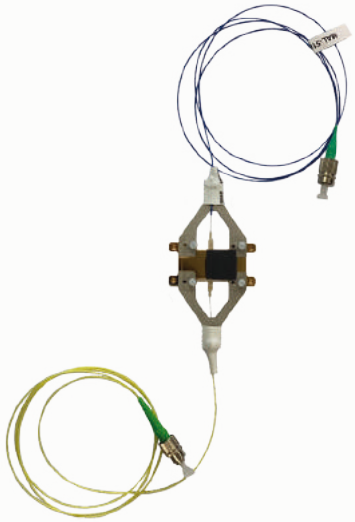
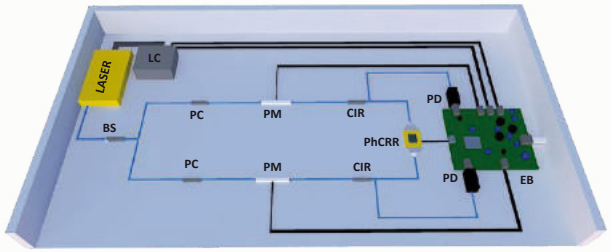
GYROSCOPE

The gyroscope sensor is a device which uses gravity to sense and determine direction. The prototype, developed by the Polytechnic University of Bari, represents the sensitive element of a monoaxial gyroscope, including other photonic components, with an estimated resolution of about 1°/h, to be used in Space applications.





LC	Laser controller	**BS**	Beam splitter	**PM**	Phase modulator	**PC**	Polarization controller
CIR	Circulator	**EB**	Electronic Board	**PD**	Photodiode	**PhCRR**	Photonic Crystal Ring Resonator

Roboze

Roboze designs and manufactures the world's most accurate 3D printers for producing parts with composite and super polymer materials to replace metals in industries with extreme working conditions. The main goal is to shape a new paradigm into digital manufacturing.

DRONE FRAME
CUBESAT STRUCTURE

The drone frame and cubesat structure have been produced based on Roboze 3D printing technology for super polymers and composites.

The ARGO 500 printing station solution was developed by Roboze to produce large and medium custom parts directly on site and is the first 3D printer for wide range metal component replacement, which brings industrial automation to 3D printing.

Roboze

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Sitael S.p.A.

SITAEL is the largest privately-owned Space Company in Italy and worldwide leader in the Small Satellites sector, involved in the development of small satellite platforms, advanced propulsion systems and on-board avionics, providing turn-key solutions for Earth observation, telecom and science. SITAEL belongs to Angel Group, an Italian holding world leader in Railway, Aerospace and Aeronautics markets.

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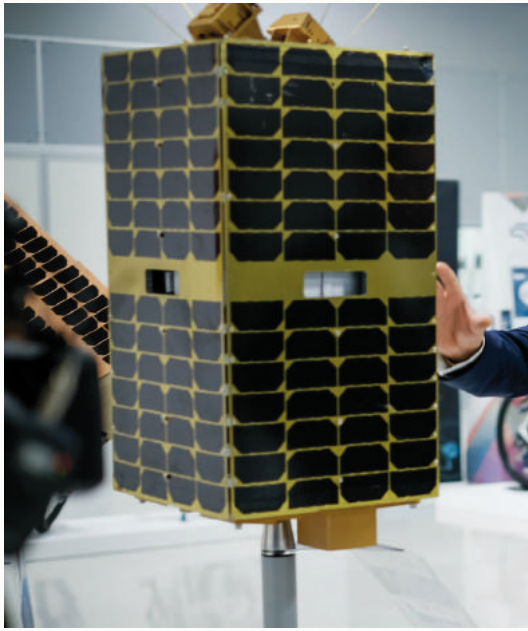
STRIVING

STRIVING is an innovative end-to-end in-orbit validation service that uses smart satellite platforms to test and validate new solutions in the telecommunications sector or other applications in an operational environment using in-orbit assets. Striving is part of a range of space services and applications through Smart Microsatellite Solutions, developed by SITAEL S.p.A., Planetek, IMT and Tyvak together with ESA (European Space Agency).



University of Bari

The **University of Bari** (UniBa), founded in 1924, has decades long experience in space research activities.

Researchers at the Department of Physics have been actively involved in numerous successful missions for space exploration, including Pamela, which was launched in 2006 with a Soyuz class rocket and the Fermi satellite, a NASA mission launched in 2008, and more recently, the DArk Matter Particle Explorer (DAMPE) satellite, a Chinese mission launched in 2015.

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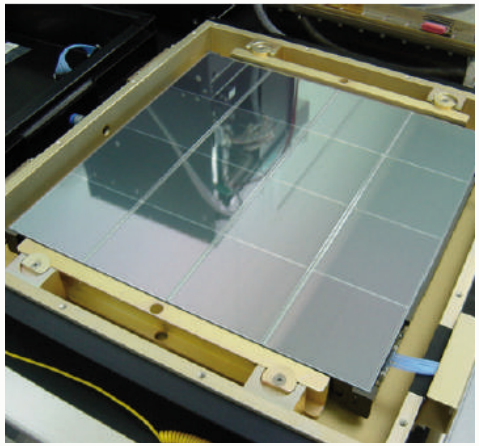
FERMI

The silicon-strip detectors (SSDs), developed at the University of Bari, are active elements of a converter-tracker, which forms part of a large area telescope (LAT) and allows for the conversion of incoming gamma-rays into electron-positron pairs.

The LAT was the primary instrument on the FERMI gamma-ray Space Telescope mission, which was launched on in 2008, and stayed in operation for 13 years, contributing to a huge number of breakthrough discoveries, thanks to detailed studies on gamma-ray bursts, active galactic nuclei and local Galactic objects such as pulsars and Supernova Remnants.



Additional R&I Initiatives
(not featured in the exhibition)

CETMA - Technologies Design and Materials European Research Centre

CETMA is among the largest private non-profit research centers in Italy with 25 years of experience on materials, processes, techniques and methods to support the innovation processes of industrial enterprises. It has 4,000 square meters laboratories and offices and 65 employees as researchers, engineers, designers and project managers. CETMA's mission is to increase and integrate enabling technologies such as Materials and Structures Engineering, Information Technology, Industrial Design. It is UNI EN ISO 9001 certified for research and development in the field of integrated engineering projects for industrial applications. In the last 20 years CETMA invested in composite material field in terms of facilities and competencies, becoming a point of reference for aerospace companies willing to invest in innovate materials and processes.

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DEWTECOMP

In aerospace, there is a delay in the exploitation of thermoplastic composites (TPC), since the final efficiency and robustness of the component is a priority. A greater exploitation of TPC must be related in the development of new processes. Joining by welding has proved to be a critical step in the process of manufacturing TPC. In order to overcome the limitations in the use of Induction welding (IW) in the aerospace industry, Dewtecomp project aims at the development of:

- Fully automated IW system with software/hardware integration between the IW machine and a robot in order to perform structural bond of reinforcement parts to structural frames to obtain highly integrated Door Surround Structure.
- A process control system based on the use of a thermal camera, which taking the real time image check of temperature at the surface of the component being welded and get process control.

IMT Srl

IMT Srl is a forward-looking company focused on three main types of activities:

- Space: design and development of Nano/ Microsatellites and relevant On-board Units for Space Commercial, Scientific and Defense applications.
- Parts Engineering: Characterization and Testing of Electrical, Electronic and Electro-Mechanical components.
- Satellite IoT Solutions: design and development of IoT Solutions for Smart Cities, Environmental Monitoring, Infrastructure Monitoring and Agriculture.

IMT can offer to the market very innovative and competitive solutions that meet the performances required for a wide range of applications:

- Earth Observation
- Remote Sensing
- Deep Space Exploration Missions
- Environmental Monitoring
- Internet of Things
- Custom Payloads & Subsystems
- EEE Parts Engineering

IMT
Ingegneria Marketing Tecnologia

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IMT 3U PLATFORM: The IMT 3U Platform meets a wide range of mission typologies: Science, Earth Observation, TLC and Technology Demonstration. Thanks to the IMT know how the mechanical and electrical architecture can support a very wide range of LEO orbit altitudes and inclinations.

IMT 6U PLATFORM: The IMT 6U Platform is a flexible solution that meets the performance required for a wide range of applications. Currently, a new Space Mission can be fully developed in few months, with low budget requirements. IMT uses COTS components to develop CubeSat Platforms, to go to the market with a very competitive solution.

IMT µSADA: Thanks to a contract with the European Space Agency, IMT developed a miniaturized Solar Array Drive Assembly for CubeSat sized 6U and 12U. The IMT µSADA aims to increase the on-board available power energy, thanks to 6 solar panels (3 for each wing) that increase the active area needed for the power generation. The pointing and tracking of the solar arrays toward to the Sun allows to be very competitive on the market, with a product that can guarantee very high performances.

C-DST X-BAND TRANSPONDER: The C-DST X-BAND Transponder is compliant with CubeSat spacecrafts and can guarantee very high performances. This subsystem can be used for the Deep Space Exploration and Earth Observation missions. It is a revolutionary equipment for CubeSats.

University of Salento (Unisalento)

From law to science, economics to engineering, humanities to media studies, provides academic pathways to a range of professions as well as post-graduate and specialist courses.
Open and reliant on international cooperation, the Dept. of Engineering for Innovation (DefI) offers several education and exchange opportunities for study, traineeship and research, in virtual and blended modality.
DEfI research and labs cover the following fields: Renewable Energies, Materials Science & Technologies, ICTs, Internet of Things, High-Performance Computing, Virtual & Augmented Reality, Nanotechnologies, Automation & Robotics, Machine Processing Systems & Technologies, Mechanical & Aerospace Design, Intelligent & Clean Manufacturing Technologies, Management Engineering, Design and Testing in Mechanical & Civil Engineering, Fluid Dynamics & Machinery, Bio-applications.

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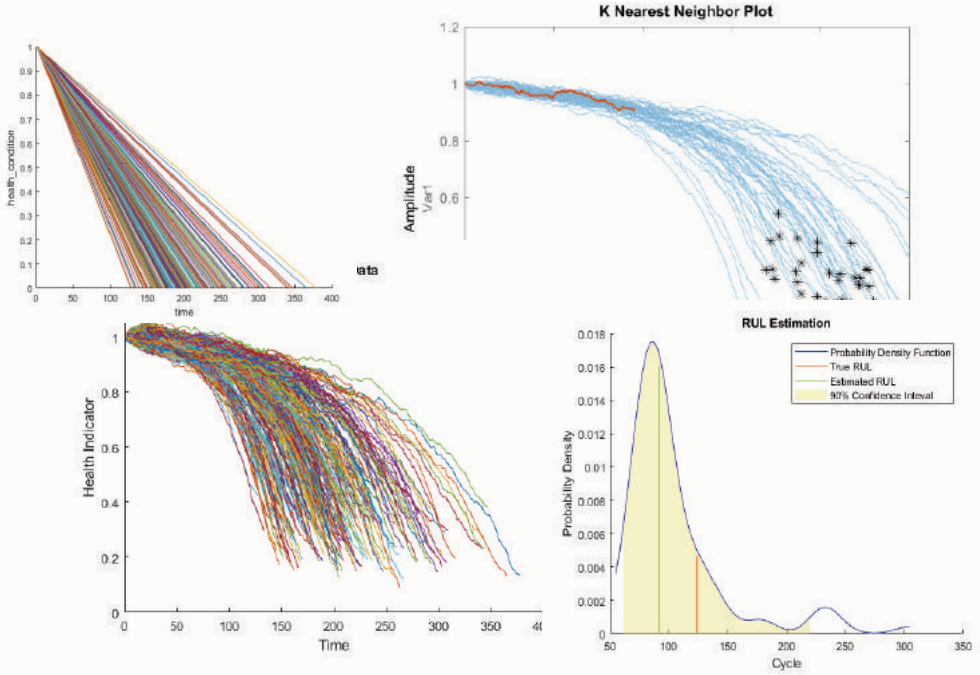
HEALTH MONITORING AND FLEET MANGEMENT

The research activities focus on the service support process. The information obtained through Health Monitoring and Fleet Mangement activities will be used together with data from logistical data (lead time supplies and repair work), engineering data (modifications and manuals) to develop a maintenance strategy that has the least impact on fleet operation, reduce supply lead times, and optimize warehouse management.

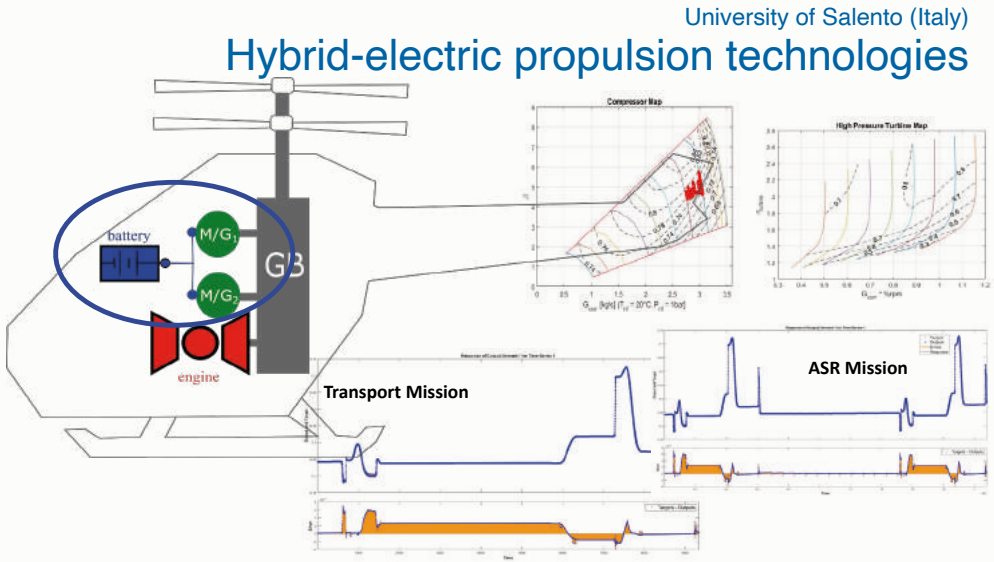
A new methodology approach to the process of maintenance outside the factory is intended to provide operators who are directly involved in the maintenance process, new Internet-based tools for Internet Things, with the aim of maximizing the efficiency of the systems and make full use of the information available in the different areas of the manufacturing process.

University of Salento (Italy)
Health Monitoring and Fleet Mangement



HYBRID-ELECTRIC PROPULSION TECHNOLOGIES

Hybrid-electric propulsion technologies for different applications, particularly for new integrated concepts for general aviation, immune system control systems based on distributed architectures, systems based on distributed architectures, multi-core controllers, propulsion system sensors for weight reduction, increased security, and the implementation of advanced diagnostic and prognostic capabilities. The development of all these solutions requires the definition of electric machines and the resolution of integration issues with thermal motors, with distribution lines, gearboxes for motor and generator connection, design of engine architectures adapted the use of the electrical system and the simulation and evaluation of the implementations of integrated systems during the mission with the use of developed software tools and models.



INTELLIGENT AUTONOMOUS SPACE DEBRIS REMOVAL BASED ON HIGHLY EXPANDABLE, TOUGH, STICKY, BIO-INSPIRED UNDERACTUATED STRUCTURES

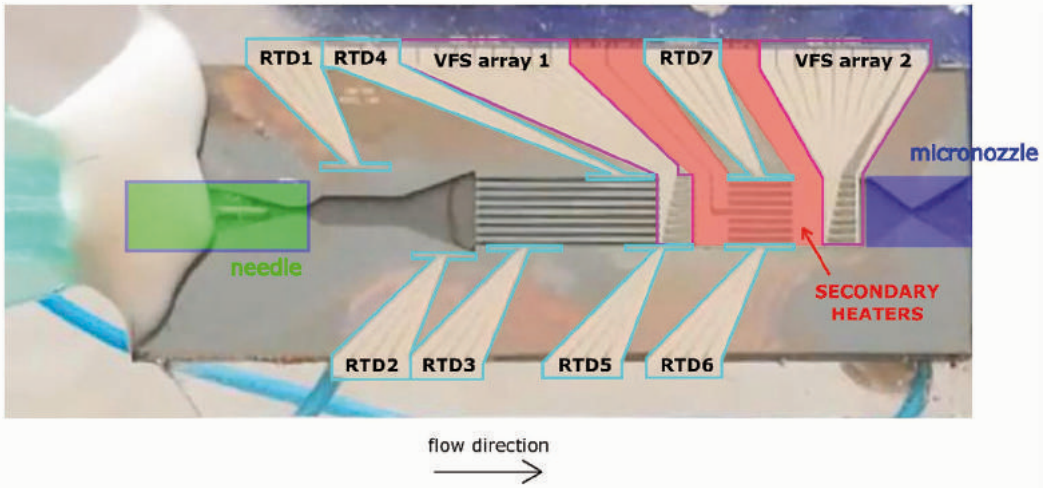
The research project aims at finding nature-inspired passive/active underactuated structures, and their capturing/removal maneuver control algorithms, to mitigate the proliferation of space debris. Space debris poses many threats to human safety and infrastructure, both in space and on ground, ranging from space weather and Near Earth Objects to threats from uncontrolled objects and fragments thereof. This project tackles some of the aspects of this issue by developing novel AI-controlled strategies and nature-inspired highly-compliant tacky (strongly adhesive) structures for the on-flight capturing and removal of multiscale space debris. Keywords: space debris removal, AI, bio-inspired adhesion, tribology, space debris mechanics.

MICROTHRUSTER

The lifetime and performance of vaporizing liquid microthrusters (VLMs) are dramatically reduced by the occurrence of flow boiling instabilities. Our project concerns with the development of a sensed VLM equipped with actively controlled heating characterized by:

- decoupling of liquid vaporization from gas superheating using two heating steps, enabling for Isp maximization with device temperature reduction.
- Fast pulsed actively controlled heating to maximize the thermal efficiency and stabilize the boiling flow.

This control is based on in-channel heaters and sensors (temperature, void fraction), real-time management electronics, and control algorithms built on machine learning techniques. Further performance enhancement will be achieved via the optimization study of channel geometries, in combination with the assessment of alternative green propellants.



DTA s.c.a.r.l.

DTA s.c.a r.l. is a non-profit making consortium company joined by the main enterprises in the aerospace field, universities, public and private research centers. Our mission is to increase the competitiveness of its members and of the aerospace value network by improving innovation capacity, developing new competences, developing research infrastructures, pushing internationalization of the regional system.
Actions: provide engineering services to its members and to the market (engineering business unit since 2016); launching and leading research and innovation projects; bridging the gap between industrial, research and education participants; consulting with public administrations on innovation policy, building relationships. Through the scientific and technological excellence, it strengthens the competitiveness of the production system. DTA proposes and implements research, training and innovation projects for: the development of key technologies; the creation of new professional figures; the construction of infrastructures at the service of research and innovation.

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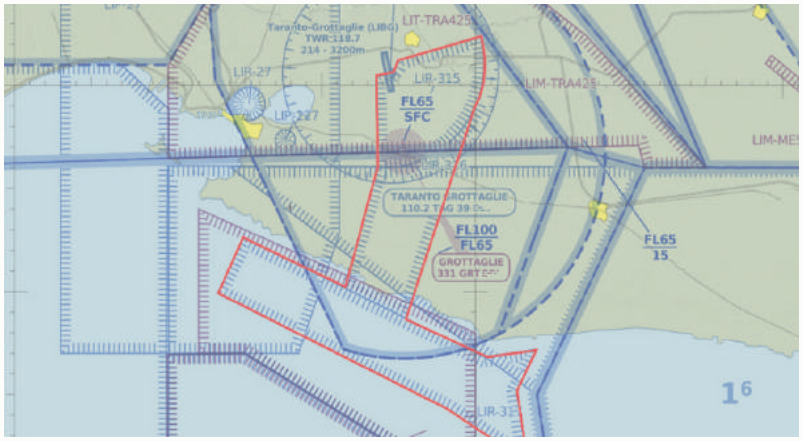
BARI INNOVATION HUB

Bari Innovation Hub (BIH) will be the place where researchers, industry and public stakeholders will experiment with innovative solutions exploiting artificial intelligence, IoT and Blockchain and having the 5G communication network as an enabling technology, with the goal of promoting innovative solutions in the framework of Bari Smart City. Within the project, a city area will be equipped and organized to offer information as well as education services in the field of technologies and business development and as experimental area where innovative solutions can be experimented in real and operative scenario. Novel UAM services are among the to be experimented services. Outcome of the project: Experimenting with innovative solutions – related to artificial intelligence, IoT and Blockchain – which will have 5G (or in general nomadic networks) as a common denominator and enabling technology; A more dynamic industrial panorama populated by novel start-ups and new products and services tailored to the city of Bari.



RPAS IN AIR INTEGRATION OF REMOTELY PILOTED AIRCRAFT SYSTEMS IN NON-SEGREGATED AIRSPACE FOR SERVICE

RPASinAir develops technologies and solutions pushing the insertion of RPAS into unsegregated airspace with focus on BRLOS operations. Expected results are:

- an infrastructure and laboratory for RPAS BRLOS operation simulation,
- SATCOM and SATNAV aviation receiver requirements,
- innovative ATC solutions and applications,
- payload sensors and data computing systems and applications. The final objective is to design and enable innovative monitoring services (risk prevention, emergency management, ...). Aerial services will be demonstrated through real flights operated from Grottaglie Airport and exploiting segregated airspace.

The activities are:

- For the simulation and validation of RPAS air operations (BRLOS included) in complex ground and air traffic scenarios,
- Development of advanced air traffic control (ATC) functionalities and applications to control air traffic of RPAS,
- Realization of a center to collect, fuse and compute on satellite and aerial Earth Observation data, exploiting AI technologies and developing innovate EO services,
- Demonstrate the capacity to insert RPAS into ATM to provide aerial services aimed at risk management by exploiting the Laboratory for aerial operations simulation, Innovative ATC Prototype, Airport of Grottaglie, Segregated air space.

CRUISE CYBER SECURITY IN UAS MISSIONS BY SATELLITE LINK

The project CRUISE (January 2019, June 2022) is facing the European need for higher cyber security of remotely Piloted Aircraft Systems (RPAS). The CyberSec Test Range will be designed, developed and validated through live demonstrations. It will set up a combination of infrastructures (ICT, SATCOM, SATNAV and airport facility) to provide services to assess cyber-vulnerability and resiliency of UAVs, namely the analysis of overall aerial platform, included ground pilot station, on-board avionics and payload sensors, during VLOS, RLOS, BRLOS operations. Quality, consistency and integrity of data collected by payloads will be verified as well.

- CyberSec vulnerability assessment for simulated (digital) products or new UAS in aerial operation simulation environment
- CyberSec vulnerability assessment through emulated operations, focus on UAS and SATCOM receivers datalink in aerial operations and manoeuvring emulation
- CyberSec vulnerability assessment complete test campaign for any class of UAS, in real test flights (segregated air space) and in VLOS, RLOS or BRLOS aerial operations (including SATCOM attacks)
- CyberSecurity test engineering, permit to fly, test data collection and analysis services as required.services tailored to the city of Bari.

TEBAKA: TERRITORIAL BASIC KNOWLEDGE ACQUISITION

Activities:

- Acquisition of knowledge (experimentally validated models, algorithms, calculation codes) relating crops' life cycle conditions (grain, vine and olive) to significant variables of related area / environment;
- Integrated multiscale platform (satellite, aerial and ground sensors' system + mobile control center);
- Definition and implementation of a networked architecture for modelling and decision supporting based on machine learning;
- Network-based service for farmers to provide them with an easy.

GROTTAGLIE AIRPORT TEST BED

Grottaglie Airport Test Bed (GATB): technological infrastructure, nested with airport and airspace, to favour, lead, and support UAS/UAM/AAM operators in industrializing products and services. Develop UASs and UAM services, Flight trials in real life environment; Industrial development platform. Physical assets: Fully equipped, low traffic airport; Large runway (45 X 3200 m); Large air space (~370Km2; on land, cost, sea), Sparsely populated area. Support services: Flight test design and risk assessment; UAS operation authorization; Experimental environment set-up; Flight operations coordination (with ENAV and AdP) , Flight test reporting; Technology assets: Equipped office; Data center; Space services (SATCOM, GNSS) – TPZ to provide; GNSS interference monitoring; Drone available. Drone Living Lab a cooperative framework in which research, industry, institutions and end users work together (co-design, do-development, real scenario test) to accelerate the uptake of new aerospace-based solutions.

SPACE2WAVES

Space2Waves is funded by the European Union's COSME Programme under agreement n°951122. It is the continuation of SpaceWave which has successfully developed an internationalization strategy to accelerate the Earth Observation (EO) technologies global deployment in Blue Growth and to support European SMEs competitiveness. Four countries have been identified as promising targets with the highest potential for 30 European SMEs: Australia, Canada, South Africa, and the United Arab Emirates. EO technologies represent an answer to many issues the maritime environment is facing. They contribute to the implementation of a sustainable Blue Economy as they are one of the most available, feasible, and cost-efficient technologies to explore, monitor, control, and study the exploitation of oceans and their resources. Space2Waves brings together six European clusters with a perfect balance between maritime and space sectors.

NOTES

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Il **futuro** *alla portata di tutti*

Project co-financed by the E.U., in accordance with the Operational Programme Puglia 2014-2020
Action 3.5 "Initiatives for strengthening international business development"