PUSHING BACK THE FRONTIERS

A key partner for life support in aerospace

Aerospace
press kit

June 2019

Air Liquide
creative oxygen

Air Liquide, a major player in aerospace and space

A world leader in gases, technologies and services for Industry and Health, Air Liquide is a major partner in civil and military aviation and has participated in the space adventure for more than 50 years.

Air Liquide designs systems that generate gas for use both onboard aircraft and on the ground. Air Liquide has also established its reputation in the field of space thanks to its expertise with rocket launchers (ground resources and Ariane launchers), in the design of cryogenic equipment for satellites as well as space exploration (MTG, Herschel, Planck, Melfi, Curiosity, ExoMars, etc.).

The Group continues to innovate and is constantly pushing back the frontiers of technology, helping to shape the contours of the world of tomorrow by developing industrial solutions that address the major economic and environmental challenges of today.

On the occasion of this new edition of SIAE, Air Liquide will present its latest innovations in space and aerospace, such as the use of hydrogen as a viable energy alternative for aircraft, solutions for the additive manufacturing of exchangers/reactors and for using supercritical carbon dioxide when cleaning metal parts. You will also discover new technologies developed for the future Ariane 6 launcher or for electric propulsion for satellites and it projects in connection with space exploration (moon village analogue, Mars, etc.).

Air Liquide, a key partner for life support in aerospace

A world leader in the field of air gas separation technologies, Air Liquide has developed cutting-edge expertise in aerospace and, today, is a favored partner in civil and military aviation. Air Liquide offers equipment and systems related to the supply of gas on aircraft or helicopters and on the ground.

- On board gas generation for aircraft: the OBOGS for the supply of oxygen on board aircraft, the OBIGGS for the protection of aircraft fuel tanks,
- Portable oxygen equipment for cabin crew or for passengers,
- Gas generation for ground devices, cryogenics for optronics and aerospace customer support,
- Hydrogen energy for aerospace: reducing pollution in airports and in the air.

Onboard gas generation for aircraft

OBOGS brings oxygen on board aircraft

The autonomous generation system OBOGS (On Board Oxygen Generating System) produces unlimited oxygen enriched air for use on board aircraft. Designed to replace the liquid oxygen reserves on board and thus to reduce the weight of breathing gear, it meets all the physiological needs of pilots (breathable gas and anti-G protection). Selected for use in numerous military aviation programs, the Air Liquide OBOGS will soon equip more than half of all new generation aircraft and also aspires to equip civil aircraft in the near future.

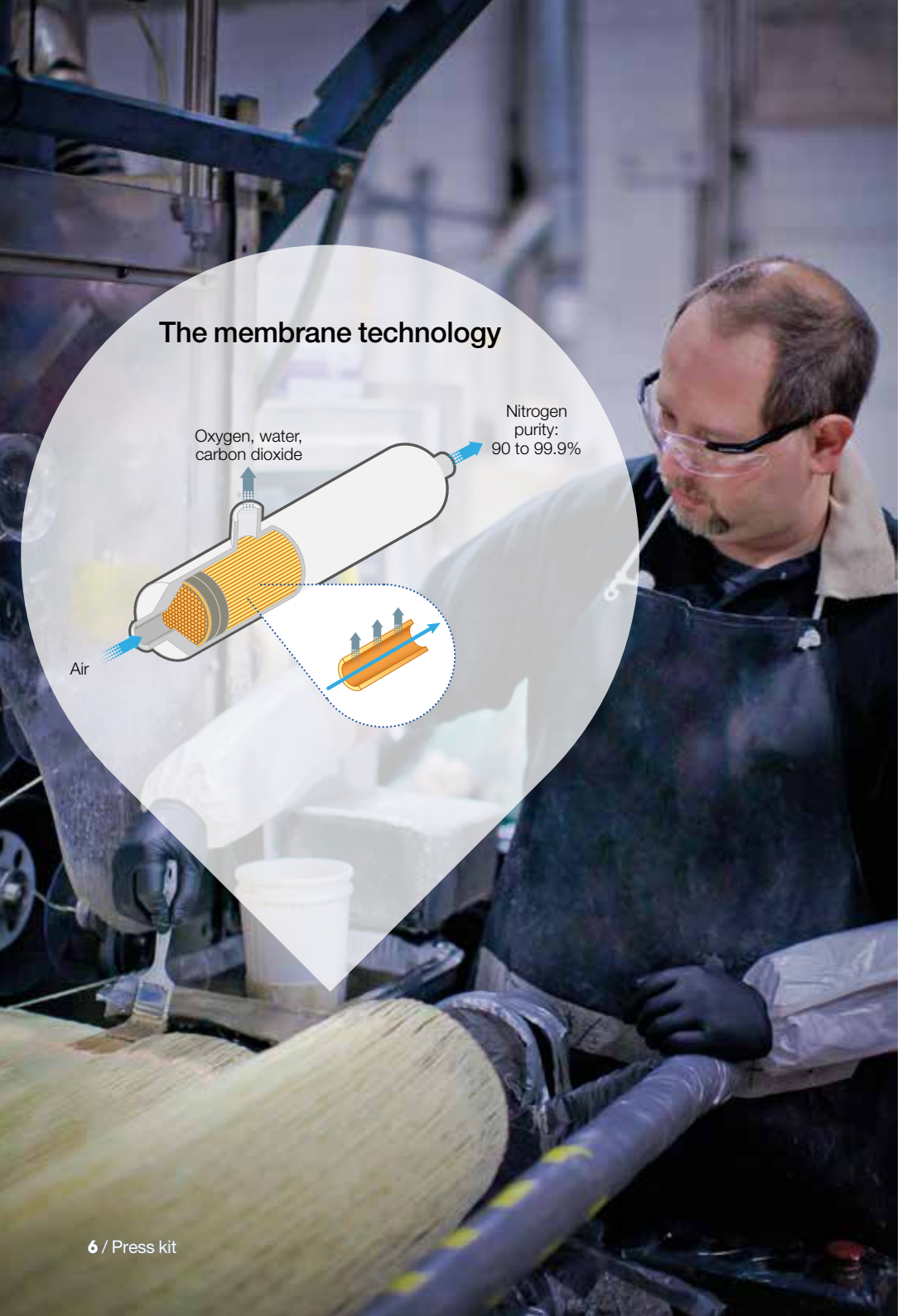
The OBOGS prototype flew for the first time aboard a Mirage 2000 in 1989, before being selected by Dassault the very next year to equip the Rafale (maiden flight in 1993). More than 500 fighter jets are equipped with OBOGS equipment and systems (Rafale, F35, L159, M346).

OBIGGS protects aircraft fuel tanks

The OBIGGS (On Board Inert Gas Generating System) line improves the safety of airplanes and helicopters thanks to an interting system that protects aircraft fuel tanks against any risk of fire or explosion. Based on Air Liquide's hollow fiber separation process MEDAL™, the OBIGGS produces the flow of Nitrogen Enriched Air (NEA) required inflight to protect the aircraft.

The Air Liquide OBIGGS was delivered in 1991 to Eurocopter in order to equip the German Tiger aircraft. To date, Air Liquide has supplied the OBIGGS to more than 380 military helicopters (ALH, Tiger, KUH Surion/KHP). This equipment was recently sold for use in civil aviation and today is installed on the Boeing B-737.

OBOGS equipment.



The Air Liquide membrane technology for gas separation

The membranes of Air Liquide Advanced Separations lie at the heart of the OBIGGS system. Made of hollow polymer fibers, the OBIGGS reduce the oxygen content in fumes in aircraft fuel tanks. OBIGGS systems prevent these fumes or vapors from igniting and thus reduce the risk of fire or explosion.

Air Liquide Advanced Separations, a subsidiary of the Group which is the merger of two US entities, MEDAL and PoroGen, designs and manufactures an extended range of hollow fiber membranes required for gas separation and purification.

How does it work?

The polymer used to make the membrane is what determines the degree of separation. By manipulating the degree of pressure, the gases selectively pass through the membrane based on differences in size, shape and solubility, using the driving force of the partial pressure. As an example, oxygen molecules pass through membranes 2 to 9 times faster than larger, less soluble nitrogen molecules.

The advantages of Air Liquide's membrane technology:

- Light and compact system
- Productive and energy efficient membrane
- Adaptable solution and integration

Portable oxygen equipment

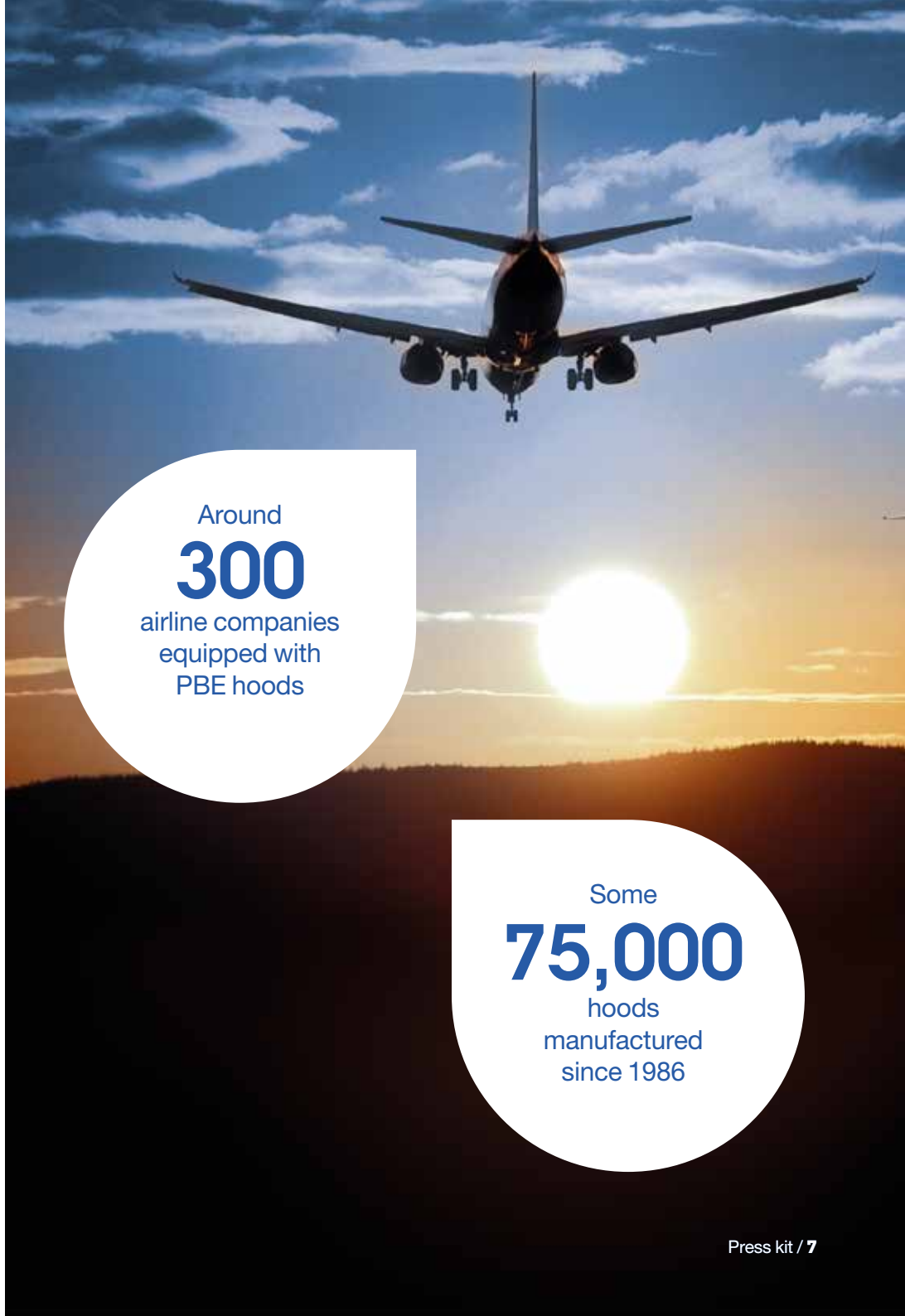
Protection breathing equipment for cabin crew (PBE hoods)

Air Liquide designs and manufactures protective smoke hoods, specially designed for cabin crew. This PBE uses compressed aeronautical quality oxygen and delivers this oxygen to commercial flight crew members, as soon as it is put on, for 15 minutes of operating time.
This is an autonomous oxygen delivery in closed-loop systems for contaminated areas or forced sea landings thanks to the smoke hood who offers flight personnel the protection required for organization of evacuation operations in the event of fire.

Portable Pulse Oxygen Cylinders - DE Series

Air Liquide has acquired the portable oxygen systems of Avia Technique, which specializes in mechanical gas distribution. Its signature technology is aircraft emergency, first aid and therapeutic oxygen delivery on board commercial aircraft.

A pulse dose therapeutic oxygen conserving system designed for passengers who have a pre-existing medical condition and pre-book oxygen for their flight(s). It can also be used for emergency purposes (First Aid). Its innovation is based on “pulse” oxygen distribution, which allows the individual user to trigger the delivery of oxygen while controlling the amount of oxygen that is delivered. The benefit is immediate: these onboard oxygen cylinders offer 5 times the autonomy of other systems.



Gas generation for ground devices

In order to meet the logistic requirements of both armies and airlines, Air liquide has developed ground devices: gaseous Nitrogen Mobile generators are used for equipment service operations such as damper and tire inflation, and high pressure capacity filling. Gaseous or liquid Oxygen Mobile Generators are used to fill the pilot and crew oxygen bottles and converters. Air Liquide meets both army and airlines restraints by relieving them of heavy logistics.

- Elimination of logistics restraints related to liquid nitrogen and oxygen storage and cylinder transportation systems.
- Oxygen and nitrogen production in harsh environments such as aircraft carriers.
- Supply of high purity oxygen in large quantities for field hospitals.

Cryogenics for optronics

Air Liquide offers a wide range of miniature cryocoolers, able to cool down below 100K infrared detectors designed for various optronic applications.Cooling down infrared detectors or electronic components, on the ground or on board, in harsh conditions.

Aerospace customer support

The aerospace customer support provides preventive and curative maintenance for on-board gas generating systems, ground production and storage in order to maintain the equipment in operational conditions.

Filling of an on-board oxygen converter via an autonomous generation system.

Hydrogen energy for aerospace

Reducing pollution on airports and in the air

Hydrogen could be used for the next generation of aircraft looking for alternative sources to power non-propulsive aircraft systems. Air Liquide develops high-tech hydrogen storage and distribution systems for aircraft manufacturers investigating the use of non-fossil fuels to generate electrical power on board for several applications.

Air Liquide also conducts studies on hydrogen supply chain options including the airport hydrogen infrastructures for the applicationsmentioned above.

About hydrogen

Hydrogen is a clean energy source that can be sustainable. It is also an effective means of storing energy. As an energy solution, hydrogen shows high potential and offers many advantages, from its low environmental impact to its durable nature.

It can be produced from many sources that are available in large quantities on Earth: water and electricity, biomass, biogas, natural gas, etc.

Facts and figures

Air Liquide and aerospace

WORLD LEADER IN ONBOARD GAS GENERATION FOR MORE THAN **30** YEARS

AROUND **300** AIRLINE COMPANIES EQUIPPED WITH PBE HOODS

AROUND **75,000** HOODS MANUFACTURED SINCE 1986

1,000 MOTORIZED VALVES PRODUCED ANNUALLY

MORE THAN **500** FIGHTER JETS EQUIPPED WITH OBOGS SYSTEMS AND EQUIPMENT

MORE THAN **380** HELICOPTERS EQUIPPED WITH OBBIGS

MORE THAN **5,000** COMMERCIAL JETS WITH TANKS INERTED USING AIR LIQUIDE EQUIPMENT (MEDAL MEMBRANES)

1987 – Breathing protection for cabin crews designed by Air Liquide are selected by Air France

1990 – OBOGS adopted on the Rafale program, to be fitted on over 200 planes

2001 – First in-flight OBIGGS system in Italy

2003 – US Air Force gets fitted out with oxygen analysers designed by Air Liquide (F-35 JSF)

2014 – 25 years of flying for Air Liquide's oxygen generating system OBOGS

2018 – Protective breathing equipment production peak year: 7,000 units

The Air Liquide group

A **world leader**
in gases, technologies
and services for
Industry and Health

Present in
80
countries

Approximately
66,000
employees

More than
3.6
million
customers
& patients

9
Research & Development
sites
15
main
Engineering centers

Around
300
patents
per year

2018 Revenue
€21 billion

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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 80 countries with approximately 66,000 employees and serves more than 3.6 million customers and patients.

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