A new breath to your flights

key partner for civil and military aviation

Aerospace press kit 2017

Air Liquide
creative oxygen
Air Liquide, an expertise in the supply of gas-related equipment on board aircraft and on the ground for civil and military aviation

World leader in the field of air gas separation technologies, Air Liquide has developed a cutting-edge expertise in aeronautics 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 aeronautics customer support
- Hydrogen energy for aerospace: reducing pollution in airports and in the air

True to its pioneering spirit, Air Liquide has accompanied and supported the Solar Impulse adventure since its origins.
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.
Nitrogen purity: from 90 to 99.9%

Oxygen, water, carbon dioxide

Air

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 oxygen cylinders

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.

Portable Oxygen Cylinder Assembly (POCA*) – CC Series
Portable oxygen equipment designed to deliver oxygen to passengers or crew on board for emergency applications.

*Portable Oxygen Cylinder Assembly

Portable Pulse Oxygen Cylinder – DE Series
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.

Around
300
airline companies equipped with PBE hoods

Some
75,000
hoods manufactured since 1986
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.

Aeronautics customer support

The aeronautics 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.
Hydrogen energy for aerospace

Reducing pollution on airports and in the air

In order to reduce dependence on fossil fuels, and kerosene in particular, clean and sustainable alternative energies must be found. Air Liquide is applying its hydrogen expertise to the aerospace industry and developing more environmentally friendly solutions.

Hydrogen, support on board aircraft

Hydrogen is a clean source of energy with great potential for applications in the aerospace industry. Air Liquide is developing high-pressure storage systems for liquid and gaseous hydrogen to power fuel cells on board aircraft. Used in a fuel cell, hydrogen combines with oxygen from the air to produce electricity, with water as the only by-product. The electricity produced can be used for a variety of applications, in particular when the aircraft is grounded.

Air Liquide is participating in the European project Hycarus in partnership with Zodiac Aerospace, Dassault Aviation, the CEA, INTA, JRC and ARTTIC. The aim of this project is to demonstrate that hydrogen charging stations in airports are safe and efficient and that fuel cells are easy to use on board an aircraft. For this aircraft, Air Liquide designed the storage system for the hydrogen that will be used on board with a fuel cell to enable the aircraft’s non-vital equipment – such as the galleys - to function in flight. Air Liquide is also developing mobile charging solutions that can be used in airports. To fuel these tanks, Air Liquide has developed a high pressure mobile charging station that will be tested during the maiden flight of Hycarus in late 2017.

Hydrogen, ground support at airports

Ground logistics in airports (forklift trucks, platforms and baggage handling carts) can use hydrogen energy, which reduces pollution. Captive fleets that run on hydrogen increase productivity while reducing emissions at their place of use. Air Liquide supplies hydrogen charging stations suitable for fleets of utility vehicles and the specific requirements of the aerospace industry. Integrated directly on site, they can charge vehicles in less than 5 minutes.

Hydrogen is a versatile, clean, and safe energy carrier that can be used as fuel for power or in industry as feedstock, as well as it can be easily stored on large scale. Hydrogen can be produced from (renewable) electricity and from carbon-abated fossil fuels and produces zero emissions at point of use. The uses for hydrogen continue to grow as it can be stored and transported at high energy density in liquid or gaseous form and can be combusted or used in fuel cells to generate heat and electricity. Hydrogen has potential for land mobility. Air Liquide designs and installs hydrogen stations to power hydrogen electric vehicles worldwide.
Air Liquide flies with Solar Impulse around the world

Accompanying the pioneers

Air Liquide, as an official supporter, supplied the aeronautic oxygen used for the various stages of the first trip around the world made by Solar Impulse. Air Liquide has been a supporter of the Solar Impulse challenge from the outset and shares the project’s pioneer spirit and love of innovation.

Solar Impulse completed its trip around the world on July 26, 2016, after having flown more than 40,000 kilometers. Air Liquide provided the aeronautic oxygen that was loaded on board and supplied the aircraft at various stages of the journey. Solar Impulse combines several clean technologies that get their energy directly from the sun. 269.5 square meters of solar panels mounted on its wings allow Solar Impulse to generate energy. Charged during the day, the batteries take over at night at a speed of up to 140 km/hour. In order to navigate during 14 hours of darkness, the flight’s cycle was studied and adapted: Solar Impulse can climb as high as 9,000 meters during the light phase and thus gain 4 hours of gliding, with the engines throttled down. Only when the plane reaches an altitude of 1,500 meters does it begin to use the energy stored during the day.

Provide oxygen to the pilot

Air Liquide provides several thousand liters of aeronautic oxygen; a vital oxygen for the pilot at an altitude of more than 3,000 meters. Very pure, like its therapeutic counterpart, it is also very dry. Usually a disadvantage – because dry oxygen is less comfortable – here this is an advantage. There is no risk of freezing despite the conditions that may prevail in the Solar Impulse cockpit.

Flight 9 of the Solar Impulse from Hawaii to San Francisco.
Facts and figures

Air Liquide and aeronautics

Air Liquide, world leader in onboard gas generation for more than 30 years

Around 300 airline companies equipped with PBE hoods

Some 75,000 hoods manufactured since 1986

More than 1,000 motorized valves produced annually

More than 500 fighter jets equipped with OBOGS systems and equipment

More than 380 helicopters equipped with OBIGGS

More than 5,000 commercial jets with tanks inerted using Air Liquide equipment (Medal membranes)

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

Air Liquide, official supporter of the Solar Impulse aircraft and partner for the HYCARUS project

First in-flight OBIGGS system in Italy

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

25 years of flying for Air Liquide’s oxygen generating system OBOGS

Protective Breathing Equipment, production peak year: 5,000 units

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

Solar Impulse completed the first ever round-the-world solar flight

Press kit / 9
Advanced Technologies belongs to the Air Liquide advanced Business and Technologies (aB&T) network, which counts more than 1,500 employees and 12 subsidiaries on 3 continents.

Advanced Business & Technology is a business unit consisting of international teams within the Global Markets & Technologies entity of Air Liquide. With a strong expertise in cutting-edge technologies and inspired by disruptive mindsets, advanced Business & Technologies (aB&T) opens new business frontiers for the Group. Our purpose is to develop, shape and incubate significant new markets, sustainable for Air Liquide and for the society.
The Air Liquide group

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

Present in **80 countries**

Approximately **65,000 employees**

Over **3 million** customers & patients

**9** Research & Development sites

**15** main Engineering centers

Around **300 patents** per year

2016 Revenue **18,135 M€**

2016 Net profit **1,844 M€**
FOR FURTHER INFORMATION,

please contact:

Corporate Communications
Caroline Philips + 33 (0)1 40 62 50 84

Air Liquide advanced Business & Technologies Communications
Agnès Renard +33 (0)4 76 43 59 28
agnes.renard@airliquide.com
Camille Giry +33 (0)4 38 03 12 08
camille.giry@airliquide.com

@AirLiqueGroup

www.advancedtech.airliquide.com