



## IN FIGURES

# FIVE ATVs



The ATV cargo missions were bold in their conception, assembling a sophisticated and secure set of innovations. And of course, each mission was conducted in close collaboration with the ATV Control Centre (ATV-CC)

in Toulouse, managed by CNES. The Jules Verne was the first, docking safely with the station. The four subsequent missions simply confirmed the vehicle's technical excellence and the expertise of the ground teams. The final flourish came with the flight of the Georges Lemaître, the fifth and last in the series, which also successfully took part in space debris collision-avoidance operations, without which the consequences could have proved dramatic.

[MORE INFORMATION: ATV.CNES.FR](#)



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## AGREEMENT

Space is an extraordinary laboratory. Which is why, on 12 September 2016, CNES and Inserm opted to further their cooperation in the field of space and health. At the Elysée Palace and in the presence of the French President, Jean-Yves Le Gall and Yves Lévy signed their first ever framework agreement relating to advances in basic research made through the study of humans in space, and to the use of space assets for health issues. The purpose of the agreement is to develop methods, tools and services that draw on health-related space technologies, such as the development of connected devices created mainly for human spaceflight and of medical devices. The agreement will also give rise to a wide range of experiments during Thomas Pesquet's stay on board the International Space Station.

# CUBESAT

With its JANUS<sup>1</sup> project, CNES is encouraging students to build nanosatellites and helping to fund them. JANUS is now part of the QB50 network, funded by Europe. Over 10 schools are taking part and two nanosatellites will soon be ready for release from the ISS. X-CubeSat, built by the École Polytechnique, has involved over 50 students in four years. The second, SpaceCube, is currently under construction at the École des Mines. QB50 has four goals: access to space, in-situ and multi-point measurements in the thermosphere, technology demonstration and education.

1. Jeunes en apprentissage pour la réalisation de nano satellites au sein des universités et des écoles de l'enseignement supérieur

# 15,000

In 30 years, Novespace has flown 15,000 parabolas in CNES's Zero-G aircraft over 160 campaigns and observed the atmospheric re-entry of Ariane 5 main cryogenic stages on three occasions.

# Rotation

**ON THE ISS, EACH ASTRONAUT STAYS FOR AN AVERAGE OF SIX MONTHS**, with half of the crew replaced every three months at each 'rotation'. Thomas Pesquet is part of Expedition 50-51. On arrival, he'll form Expedition 50 with the five other crew members. Then after three months, three of them will be replaced by three new astronauts, signalling the start of Expedition 51.

# 10<sup>-16</sup>

**THE DEGREE OF PRECISION** with which time is expected to be measured in microgravity on the ISS by France's PHARAO, the first-ever laser-cooled caesium-atom clock.

# 60 MICE



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In March 2014, Russia's Bion-M1 automated capsule embarked an unusual group of passengers, taking 60 mice into space where they spent a month in weightlessness. Telemetry

sensors developed by CNES continuously monitored the blood pressure and heart rate of five subjects. On their return, the surviving mice presented cardiovascular disorders similar to those experienced by astronauts. A significant reduction in bone mass and changes in bone structure were also observed. These findings could provide vital input for voyages to Mars. Several French research teams<sup>2</sup> took part in this mission.

2. CNES, Angers University Hospital neurovascular biology laboratory, University of Strasbourg institute of molecular and cellular biology, University of Saint-Etienne bone tissue biology laboratory

[MORE INFORMATION: MTB.CNES.FR](#)

# 500

People from CNES, ESA, Airbus Defence & Space and subcontractors who were involved in the ATV programme. In all, the five ATVs circled Earth 140,000 times between them.