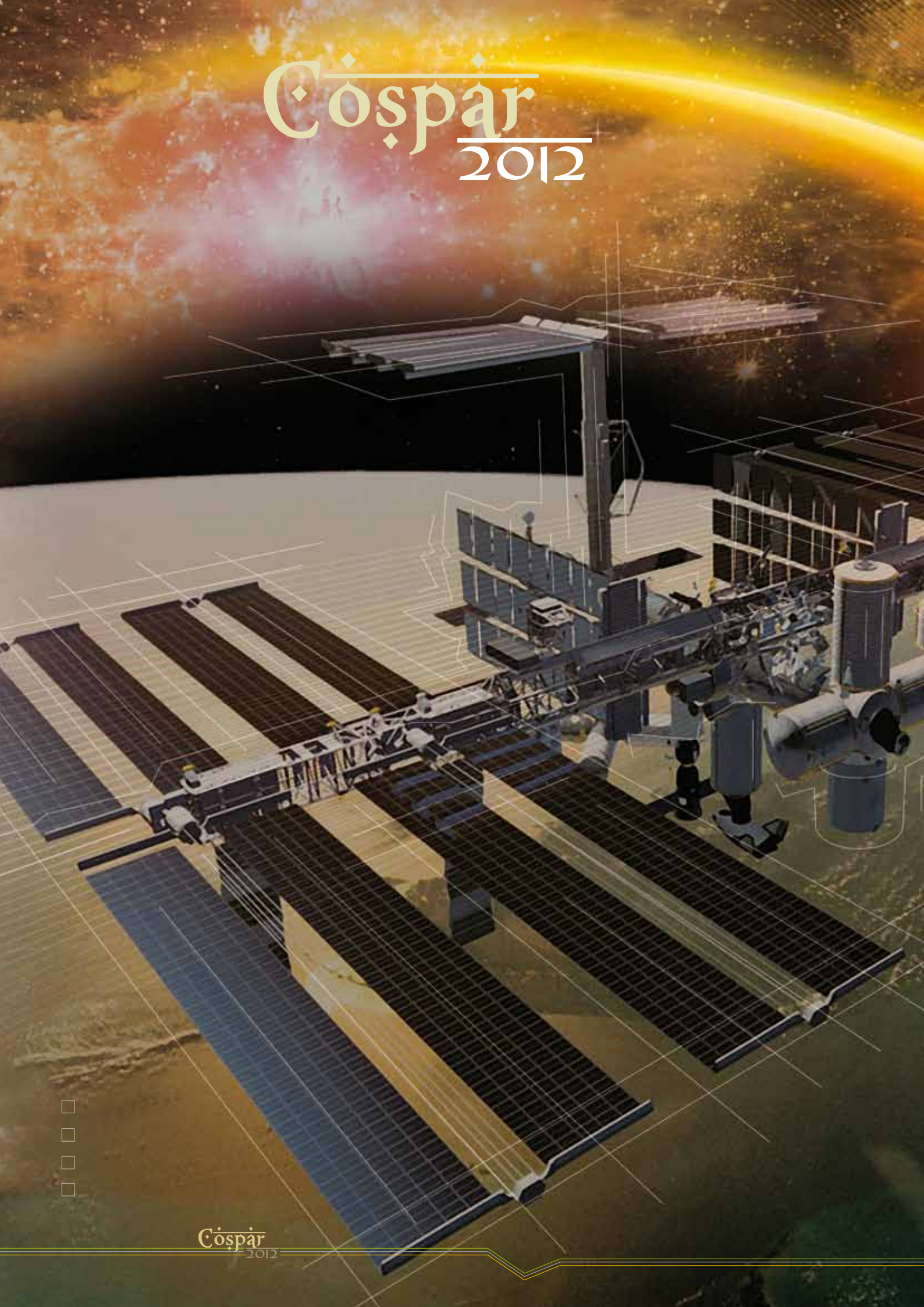
Cospar 2012

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Microgravity Sciences - Sciences en Micropesanteur

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[Fig. 1]

The International Space Station, parabolic flights, automated capsules and sounding rockets, not to mention prolonged bed-rest: these are just some of the tools used by scientists doing research on microgravity to study phenomena as diverse as the role of gravity in organism development or supercritical fluids.

Indeed, **while physicists investigating materials see space** as a laboratory for the study of complex phenomena in the absence of gravity, it is also essential to understand the physico-chemical phenomena involved in the space systems themselves, to ensure that they operate correctly. Life sciences in microgravity and space medicine are beginning to discern the conditions necessary for life in the hostile space environment, as well as the role of gravity in the development and functioning of living organisms.

CNES is providing financial and organisational support in many areas, either by directly funding the French scientific community, through cooperation with key partners such as the USA, Russia, Japan and China, or in the framework of ESA programmes such as ELIPS. At the Toulouse Space Centre, the Centre for the Development of Microgravity Applications and Space Operations (CADMOS) monitors many scientific and technical space experiments undertaken during manned flights. And finally, each year French scientists conduct over twenty experiments during parabolic flights on the Airbus A300 Zero-G, either during the two annual flight campaigns funded by CNES or the two ESA campaigns.

As for the International Space Station, whose operation is now planned to continue until 2020, a recent milestone was the launch on 16 February 2011 of the second European cargo supply ship, the Automated Transfer Vehicle (ATV) Johannes Kepler and on 23 March 2012 of the third European cargo supply ship, the ATV 3, Edoardo Amaldi. Having crews of six people enables greater use of the ISS for scientific experiments.

For material sciences, this means operation of the DECLIC instrument's three inserts (the third of which, ALI, was

installed in 2010) and two laboratories dedicated to the study of materials (MSL) and fluid physics (FSL). Also on the ISS, French scientists are continuing many experiments in biology and human physiology, including the CARDIOMED equipment for medical monitoring of astronauts, in cooperation with Russia.

Other bilateral projects include continuing development with China of the CARDIOSPACE instrument, for cardiovascular monitoring of Chinese astronauts, and the Mice Telemetry in Bion (MTB) experiment with Russia, which is nearing the end of development and should be launched in August 2012.

[Fig. 3]

[Fig. 2]

[Fig. 1]
Image taken by DECLIC instrument onboard the ISS. Direct observation of water at 99 mK (99 thousandths of a ° C) below the critical temperature, following a cooling ramp crossing the critical temperature.
The first appearance of bubbles, starting from a higher temperature than the critical temperature, allows, among other techniques, to determine the critical temperature.
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[Fig. 2]
Cardomed being tested at IMBP in Moscow by Russian doctors.
The LBNP (Lower Body Negative Pressure) is being tested with Tchibiss instruments, Doppler blood pressure and Holter Cardiopres of Cardiomed.
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[Fig. 3]
The MIce Telemetry in Bion experiment (MTB).
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