Reports from NASA[1] (National Aeronautics and Space Administration), ESA[2] (European Space Agency) and ICARE (FAI Astronautics Records Commission)

Orion

ESA and NASA plan to send astronauts farther into space than ever before, in Orion spacecraft powered by European Automated Transfer Vehicle technology. When it blasts off atop the Space Launch System rocket in 2017, NASA's Orion spacecraft will be using a Service Module built in Europe, derived from ESA's Automated Transfer Vehicle (ATV).

Orion is the name given to the Multi-Purpose Crew Vehicle, a crewed spacecraft that will transport up to four astronauts from the Earth's surface to a nearby destination or staging point and bring the crew safely back to Earth at the end of a mission. Orion consists of a Crew Module, a Crew Module Adapter, a Service Module, a Spacecraft Adapter, Spacecraft Adapter Jettisoned Fairings and a Launch Abort System.

The first Orion flight will be Exploration Flight Test-1 in 2014, in which an uncrewed Orion will launch on a Delta IV heavy rocket and fly to an altitude of around 5700 km above Earth's surface, farther than a manned spacecraft has gone in 40 years. For Flight Test-1, the system will not include a Service Module, but only a structural test adapter that connects the capsule to the launcher. The main objective of this mission is to test the Crew Module at re-entry speeds representative of returns from beyond low-Earth orbit missions.

IXV: affordable and routine access to space

In the 1990s, the development of atmospheric reentry enabling technologies started with the Hermes programme and continued within the Manned Space Transportation Programme, the Atmospheric Reentry Demonstrator (ARD), the X38/Crew Return Vehicle and the Experimental Reentry Testbed (Expert).

In 2005, the Intermediate eXperimental Vehicle (IXV) mission definition started in ESA's Future Launchers Preparatory Programme. IXV is seen

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1) NASA report thanks to Greg Oliver, NASA & FAI ICARE

2) Reference: ESA Bulletin number 153, February 2013

as the first step towards a miniature robotic spaceplane, capable of orbital operations and returning to Earth on a conventional runway, opens scenarios where access to space can be routine and competitive compared to today's expendable solutions.

The design of IXV was conceived as an advance from the ARD flown in 1998, increasing the system performance and verifying the critical atmospheric reentry technology in a reentry corridor that was wider than that for classical quasi-ballistic capsules. IXV is currently in manufacturing, integration and testing, heading for a launch campaign in mid-2014

ATV 4

One of the most reliable and complex spacecraft ever built in Europe is set for another trip to the International Space Station. Named after the famous physicist, ATV Albert Einstein is the fourth Automated Transfer vehicle and it is being made ready to lift off from Europe's Spaceport in French Guiana this summer. Europe's space freighter plays a vital role in Station logistics: it serves as cargo carrier, storage facility and 'space tug'.

Launched on an Ariane 5, the objectives of this mission are to deliver 6.6 tonnes of cargo and maintain the Station's orbit for six months. AT V Albert Einstein will carry more dry cargo than any ATV to date. The spacecraft is being well loaded to keep the Station and its permanent crew of six working at full capacity. For the first time, its two water tanks are filled with more than 500 litres of drinking water for the astronauts. The 20-tonne vehicle will navigate on its own in low-Earth orbit and dock automatically with the Space Station a week or so later. Once attached, more than three tonnes of propellant delivered by ATV Albert Einstein will refuel the Russian module of the Station

ISS

Following the first demonstration flight of the commercial SpaceX Dragon in May, the first operational flight of Dragon spacecraft (SpaceX-1) to the ISS was launched from Florida on 8 October. SpaceX-1 remained at the ISS until 28 October when it returned to Earth bringing back research samples, excess equipment and waste from the ISS, including some samples from ESA experiments and facilities.

Human life science research on the ISS

- Cardiovascular research to quantify the cardiovascular response to fluid shifts in the body during long-term exposure to weightlessness, with the aim to optimise countermeasures to the adverse effects of spaceflight.
- Pulmonary measurements taken during varying degrees of exercise.
- Circadian Rhythms research whose main objective is to get a better understanding of alterations in circadian rhythms in humans during long spaceflights.
- Another experiment aims to determine the energy requirements of astronauts on long spaceflights.
- ESA's new neuroscience experiment, called Reversible Figures, is investigating the adaptive nature of the human neurovestibular system in the processing of gravitational information related to 3D visual perception. Additional experiments are investigating the ways in which crew members' three-dimensional perception is affected by long-duration stays in space.
- Samples from ESA's Immuno experiment were returned to Earth on 19 December. The samples covered four different test subjects from the Russian crews in Expeditions 29/30 and 31/32. Immuno determines changes in stress and immune responses, during and after a stay on the ISS. The results will help develop pharmacological tools to counter unwanted immunological side-effects during long-duration spaceflights.

Fluids research

Investigation of the flow of an incompressible viscous fluid held between two concentric spheres rotating about a common axis as a representation of a planet.

Materials research

The study of different aspects of the solidification process in metal alloys which will help to optimise industrial casting processes.

Radiation research

The radiation dose distribution is measured inside the ISS using the active radiation detectors located in the European Physiology Modules

Astronauts

Luca Parmitano (IT) completed duties as back-up Flight Engineer for CSA astronaut Chris Hadfield following Hadfield's launch to the ISS in December. Parmitano continued training in payloads and mission support at EAC in October.

Alexander Gerst (DE), scheduled to launch in May 2014 on Exp. 40/41, and Samantha Cristoforetti (IT), scheduled to launch in November 2014 on Exp. 42/43, completed training in Russia and are now training at Johnson Space Center, Houston.

Timothy Peake (UK) completed Extravehicular Mobility Unit EVA training in Houston.

Thomas Pesquet (FR) took part in weightlessness training during three parabolic flights at Novespace, Bordeaux.

Since October, a number of international astronauts were trained at EAC.

- Cosmonauts Pavel Vinogradov and Alexander Misurkin (Exp. 35/36) received the first part of ATV training;
- NASA astronaut Karen Nyberg (Exp. 36/37) received payload and ATV training;
- Cosmonauts Oleg Kotov, Sergei Ryazansky (Exp. 37/38) and Mikhail Tyurin (Exp. 38/39) received Columbus user training (with Kotov receiving additional ATV training);
- NASA astronauts Michael Hopkins (Exp. 37/38) and Richard Mastracchio (Exp. 38/39) received Columbus specialist training;
- NASA astronaut Steve Swanson (Exp. 39/40) received Columbus and payload training

John Miles, FAI ICARE
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