Expert's reentry flap endures hot baptism

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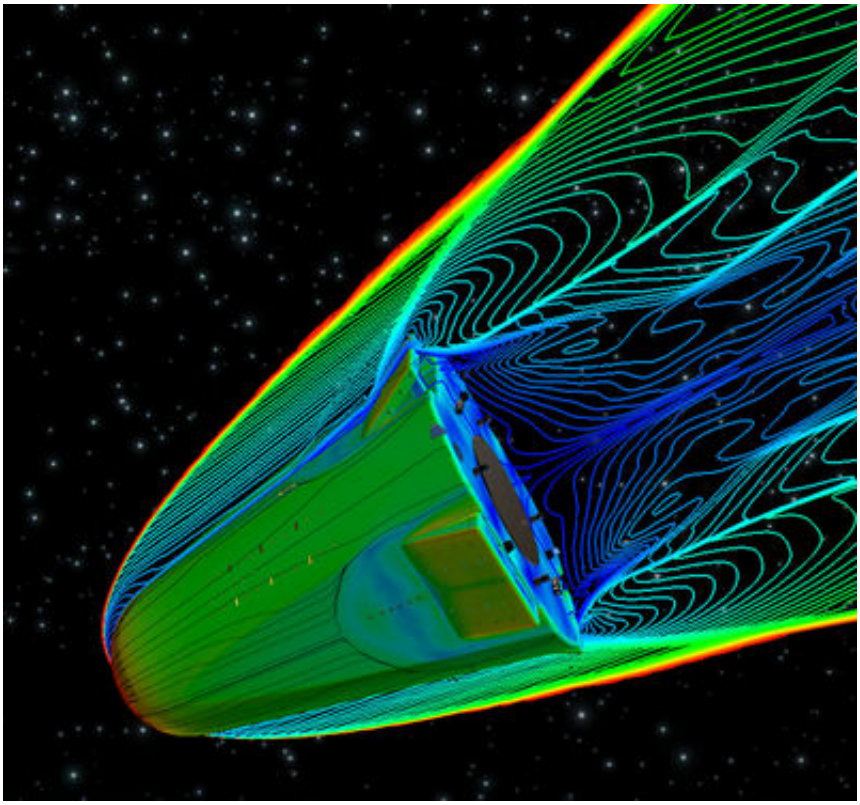

The Expert spacecraft during reentry flight (artist's impression)

(PhysOrg.com) -- A spacecraft control flap designed for the super-heated hypersonic fall through Earth's atmosphere has come through testing in the world's largest plasma wind tunnel to be ready for its first flight next year.

This flap and its advanced sensors are destined to fly on ESA's Expert –

the European Experimental Reentry Testbed – a blunt-nosed capsule being shot up to the edge of space next spring on a Russian Volna rocket to gather data on atmospheric reentry at 5 km/s.

Expert carries experimental side flaps to help show that they can steer larger ESA reentry vehicles such as the IXV Intermediate eXperimental Vehicle in 2013.

“This flap is fitted with a variety of instruments, including cameras, pressure monitors and an ultraviolet spectrometer to gather data during the hottest two minutes of Expert’s 15-minute flight,” explained Jan Thoemel, Expert Project Scientist.

“We needed to prove this instrumentation will indeed function as planned, and check our mathematical modelling was accurate. “This meant recreating the extreme environment of atmospheric reentry down on the ground.”

Italy’s Scirocco plasma wind tunnel in Capua, near Naples, is one of the few sites worldwide where such testing is possible.

Named for the hot Mediterranean wind and operated by the CIRA aerospace research centre, Scirocco runs vast amounts of power through an arc heater, heating up air into a blowtorch-like plasma that jets through its 2 m-diameter tunnel.

Its arc heater was taken up to 10 000ºC with 38 MW of electricity, creating a plasma flow seven times the speed of sound and bringing the temperature of the flap up to 1200ºC.

Identical to the flight version, the test flap is made from heat-resistant ceramics. Its instruments include a miniature infrared camera provided by RUAG Space Switzerland and pressure and high-temperature sensors

developed by the German Aerospace Center DLR and CIRA.

“After years of preparation we performed four test runs on 13 April, comfortably exceeding the heat loads we anticipate the flap will encounter during its spaceflight aboard Expert,” explained Jan.

“Each test reached 1.75 times the flight heat load, amounting to seven times the flight heat load overall.

“Despite this, our instrumentation performed excellently, validating it for actual flight.

“In the months that followed we’ve been comparing the test results to our software models to highlight any discrepancies, as a way of improving the computational fluid dynamics design tools used for Expert.”

Running on the equivalent energy consumption of a small town, Scirocco’s construction was co-funded by ESA and the Italian Ministry for University and Research, with ‘wind-on’ occurring in March 2001.

The facility serves a wide variety of customers worldwide. Its operator CIRA is playing a wider role in preparing for Expert’s flight.

“This test campaign represented a particular challenge because it was approaching the limits of the facility’s capabilities,” explained Giulano Marino of CIRA.

“Many new components had to be installed first, requiring extensive testing, but the results speak for themselves.”

The Scirocco testing was funded through ESA’s Basic Technology Research Program, which supports new technology development.

The Expert capsule, studded with around 150 different sensors, is due to fly in spring 2012, sea-launched from a Russian submarine for recovery on Russia's Kamchatka peninsula.

Provided by European Space Agency