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ORCISS: a collision avoidance proposal for the manned planetary exploration missions.

Christian Muller (1), Didier Moreau (1), William Thuillot (2), Juergen Oberst (3), Apostolos Christou (4), Anne Lemaître (5), Daniel Hestroffer (2), Jérémie Vaubaillon (2), Florent Deleflie (2), and Alain Vienne (2)

(1) B.USOC-IASB-BIRA, Brussels, Belgium (christian.muller@busoc.be, 00 32-2 3748423), (2) IMCCE-Paris Observatory, France (thuillot@imcce.fr), (3) DLR, Institute of Planetary Research, Berlin, Germany, (jurgen.oberst@dler.de), (4) Armagh Observatory , Armagh, UK (aac@arm.ac.uk), (5) University and Research Centre (NAXIS), FUNDP, Namur, Belgium (anne.lemaitre@fundp.ac.be)

Manned exploration scenarios to the Moon, asteroids and Mars involve the cruise of a heavy transfer vehicle between Earth and the target. They also involve the possibility of a waiting orbital flight around Mars in order to check the landing conditions. A direct manned flight will indeed be acceptable only after Mars weather can be predicted at least one Earth year in advance.
The safety of the crew depends thus on the avoidance of collisions during cruise to target and Mars or earth orbital operations. The potential colliders range from space debris in Earth orbit, micrometeoroids or even Near Earth Objects (NEO). In Earth orbit, for the present ISS and automatic satellites, operations centres keep a record of all potential colliders and modify the orbit parameters in time to avoid collisions, however near misses have already occurred and even in Earth orbit, a device autonomously assessing the risk of collisions would add to the flight safety of the Earth orbital missions.

In the case of Mars, while no debris exist, the detection of small objects from Earth and even the detection of small asteroids is impossible. An example is given by the loss of the ESA BEAGLE-2 which was imaged leaving Mars-Express on a correct trajectory to the planet and of which even now the impact has escaped detection by neither Mars-Express HRSC nor NASA HIRISE.

The ORCISS will combine optical detectors with radar detector and will be fitted with an own expert system recognizing unexpected elements. It will have also the capability of detecting further objects which could be Near-Earth Objects.

Estimates of the collision risks in cruise to target (Moon, asteroid or Mars) and Mars orbit will be given and compared to similar risks in earth orbit.

The concept of colliders autonomous detection and avoidance could be tested from the ISS as an experimental collision avoidance help.