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# LONG TERM ASTROPHYSICAL MISSIONS, THEIR CHALLENGES AND (NEW) OPERATIONS STRATEGIES

**Abstract**

Astrophysical missions such as ESAs XMM-Newton X-ray and INTEGRAL gamma ray space observatories are sometimes operated for a very long time; of the order of 1-2 decades. The designed life time and even the extended life time have in both cases passed. However if spacecraft and payload are operating without major degradation and scientific demand is still high new possibilities of mission extensions and ways of operations are required. This puts challenges on both the spacecraft with its payload and the ground system.

We will describe the health status of the missions in combination with estimates on the possible life time of important spacecraft sub components. New ideas to extend the operational life time significantly further are presented. This concerns technical spacecraft issues like the power and fuel management as well as the maintenance of the ground segment with migration to up to date operating systems and control architecture.

In addition, continuous consolidation and maintenance of knowledge is required within the Flight

Control Teams. Various types of training are therefore required. We will describe the implemented training and knowledge maintenance measures that guarantee a long-term perspective of efficient and safe spacecraft operations for ESAs XMM-Newton and INTEGRAL missions.

Note: After launch from Kourou, French Guiana on 10 December 1999, XMM-Newton is the most powerful X-ray telescope ever placed in orbit. The mission is solving many cosmic mysteries of the hot X-ray universe observing objects like neutron stars, black holes or active galaxies. INTEGRAL was launched in 2002 and observes the gamma ray sky with its very high energetic phenomena including X-ray binaries, gamma ray bursts as well as black holes. Both missions have a common platform design and since 2008 are being operated by a joint flight control team from the European Space Operations Centre in Darmstadt/Germany.