

Development of the ESA Robotic Test Facility for the Real-Time Verification & Validation of GNC Prototypes

ESA devotes research on the development of soft and high precision landing techniques and technologies, and on the protection of the space environment by means of space debris removal. Early prototyping of the GNC systems and techniques that need to perform these complex missions autonomously in space is necessary to develop technology for these new missions. In this context, ESA has developed a robotic test facility that will support the real-time verification and validation of these GNC early prototypes. The facility includes an industrial robotic arm with 6-DOF motion, carrying a vision-based sensor, that is controlled to approach a scaled model of either a spacecraft (for rendezvous and docking) or a celestial body terrain (for descent and landing). Accurate kinematics and dynamics of the spacecraft (lander or chaser) are simulated in a real-time processor and transformed to the robotic arm movement. Initial proof-of-concept scenarios of this facility include Mars and Moon landings, and a short range rendezvous and docking manoeuvre in LEO.