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VALIDATING GNC TECHNOLOGIES FOR FUTURE LUNAR EXPLORATION MISSIONS

Abstract

Over the last few years, GMV has placed a remarkable effort in validating different components of the GNC system for Lunar exploration. The Guidance Navigation and Control (GNC) system, in autonomous landing, is the key technology in order to achieve a precise, soft and safe landing. GMV has been involved in many projects in the frame of ESA, national projects and private initiatives where all the different components of the GNC system for future lunar exploitation missions have been detailed developed and preliminary breadboarded in space representative hardware. The multiplicities of activities carried out have brought to an advanced, generic and complete GNC system which is applicable to most of the Lunar landing mission scenarios. Up today, the developed GNC system has been successfully validated through simulation over different mission scenarios like ESA-LL, Lunar Resurs and BMT-GLXP. Obviously, the GNC breadboarding in space representative hardware is much more strictly related to the hardware architecture of the mission and cannot target the wide-spectrum usage mentioned above. Despite of this, the GNC breadboarding using a specific architecture provides the confidence needed that the GNC system can be executed in Real-Time environment and can achieve the desired accuracy. In this paper, a generic functional architecture of the developed GNC system is firstly presented. In following sections, each of the sub-systems will be analysed with more details and results showing their performance will be provided. The list of the subsystems further analysed includes: The Vision Based Absolute Navigation System (also known as ANTARES), the Vision Based Relative Navigation System, the Navigation, the Guidance and the Mode Management functions. Furthermore for each of the sub-system the actual status of the development and the applicability to other mission scenarios will be evaluated also explaining the modification required when the mission scenario changes. Additionally, the sub-systems breadboarded in space representative hardware will be benchmarked ant the real time constraints imposed by the hardware will be explained.