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OPERATIONS IN SPACE OF SPACESTAR: THE NEW STAR TRACKER FOR FUTURE RECURRENT PLATFORMS

Abstract

Star Trackers experienced a strong evolution in the recent years, from configurations based on ground processing to "fully autonomous" equipment like AA-STR, which is based on an Active Pixel Sensor detector (APS) and features a robust and accurate three axis attitude determination, offering a very low mass and power consumption with respect to conventional CCD units belonging to the same class. SPACESTAR represents an innovative, medium Field of View star tracker architecture - originally developed for a high volume constellation program - through an integrated configuration to Attitude Control System computers. The SPACESTAR sensor consists of up to three Optical Heads (OH) and the Software running in the Attitude Control System Computer of the spacecraft. The new architecture was conceived to provide significant value to new space programs, including optimized hardware and the elimination of unnecessary redundant hardware to: minimize recurring costs, reduce size, weight and power, and to offer the advantages of system level efficiencies by providing a centralized control of multiple Star Tracker Optical Heads in the single OH units. The SPACESTAR OH delivers "compressed sky images" to be processed via a dedicated SW routine that is hosted in the AOCS Computer. The SW performs all the computation necessary to convert the information coming from the Optical Heads, up to the quaternion solution delivery. SPACESTAR s/w is optimized to match CPU time allocation, sharing resources with all the other satellite AOCS activities, without penalizing robustness and reliability of the system. The SPACESTAR is an evolution of AA-STR stra tracker with the necessary adaptations to minimize production costs. This strategy allowed preserving some very key design items of the already qualified AA-STR unit, reversing the electro-optical performance of the AA-STR to the new program while minimizing development risks. SPACESTAR's integrated configuration with AOCS computers allows Customers to take advantage of significant benefits, including high resistance to EMC/EMI thanks to the complete elimination of analog electronics, significant size and mass reductions. This paper describes the challenges and lessons learned during the development of this product, qualified in 2013 and, being the launch of the first Iridium NEXT satellites scheduled in April 2016, the first-ever experience in flight.