

SPACE SYSTEMS SYMPOSIUM (D1)  
Training, Achievements, and Lessons Learned in Space Systems (5)

Author: Dr. Francesco Diprima  
University of Rome "La Sapienza", Italy, diprima.fra@gmail.com

Dr. Tommaso Cardona  
University of Rome "La Sapienza", Italy, tommaso.cardona@gmail.com

LESSONS LEARNED IN AUTOMATIC OPERATION OF OBSERVATORIES FOR SPACE DEBRIS  
OBSERVATION

**Abstract**

In the last years, the growing number of operative Italian's satellites has triggered the necessity of a space debris observation facility. The first Italian's observatory totally dedicated to space debris was the Spade observatory in Matera. To understand in depth the space debris environment it was need install another observatory for increase the surveying capability, the EQUO observatory. The EQUO observatory, which is part of the ASI-Sapienza Agreement, is an Equatorial Observatory at the Broglio Space Center in Malindi (Kenya) developed by Sapienza Space Systems and Space Surveillance Laboratory (S5Lab) research group. The Project's target is twofold: the primary goal is to detect and characterize space debris using optical methods: this data are the input for the orbital determination phase that allow to calculate far fewer and far more accurate conjunction warnings due to realistic covariance and probability of collisions; the secondary goal is the training of the Sapienza's students in the framework of space activities, characterized of totally automation procedure and the best patterns and practices for fault tolerant systems with high availability that we used in designing software for the EQUO project. For a precise characterization of the space debris is need to calculate their position from real data, in addition the possibility of observe the same object from two different location increase the position accuracy; for this reason the EQUO observatory will improve the Italian and European capability in the SST program. The observatory is equipped with a 200mm diameter f/4 optical tube in Newtonian configuration mounted on a motorized altazimuth mount. It use a CCD sensor with a wide Field of View (FOV) of about 9 degrees squared. Everything is housed in a robotized dome and it is command by a rugged pc that allow to resist at the hard environmental conditions. The final result is the realization of an automatic observatory able to acquire image of space debris remotely from Italy. In this paper we discuss the design requirements of robotic observatory aimed to operate automatically with concentration on efficiency and robustness and all the lessons learnt during all the project phases from design to normal operation.