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SAPIENZA SPACE SYSTEMS AND SPACE SURVEILLANCE NETWORK (S5N): A HIGH COVERAGE INFRASTRUCTURE FOR SPACE DEBRIS MONITORING.

Abstract

The most common methodologies for space debris identification and monitoring involve radar and laser ranging and optical observations. Although representing the only passive method for debris tracking, optical observations are constrained to reduced time windows, when targets are exposed to sunlight and the observatory is in darkness. On this purpose, an increased amount of optical data can only be assured by a multiplicity of observing stations. The Sapienza Space Systems and Space Surveillance Laboratory (S5Lab) Research Team at Sapienza - University of Rome has established the Sapienza Space Systems and Space Surveillance Network (S5N), an international network of optical observatories addressed at debris surveillance. The first six S5N observatories are managed by S5Lab and located in Rome and surroundings. Moreover, two observatories developed by the S5Lab research team in the framework of the Equatorial Observatory (EQUO) project managed by the Italian Space Agency are part of the S5N and located at the Broglio Space Center in Malindi, Kenya, allowing to provide coverage of the equatorial orbital region. Finally, five optical observatories located in Bologna (Italy), Ann Arbour (Michigan, USA), Cerro Tololo (Chile) and Bern (Switzerland) and a radar located in Bonn (Germany) are collaborating with the S5Lab research team as part of the network. Such a spread distribution of the observatory sites allows increasing the obtainable orbital parameters accuracy. Moreover, the network observatories distribution allows to increase the European space surveillance capabilities, both allowing to achieve data from sites characterised by different meteorological conditions, and to obtain less sparse measurements from longer orbit arcs, facilitating the orbit determination procedure. The whole network has been tested with several observation campaigns, including the Tiangong-1 re-entry campaign performed supporting the Inter-

Agency space Debris Committee (IADC). The heterogeneous capabilities of the different observatories represent an advantage for acquiring a wider set of debris monitoring data. Two observing modalities can be applied: a direct tracking can be performed by following the target during its pass or the debris tracklet can be recorded with sidereal tracking. A strong synergy between our institution and the Italian specialized industry has also revealed to be very productive in the context of the network establishment. The present paper will describe the network infrastructure and the opportunities, improvements and future perspectives for research institutions or space industry of this wide observatories network will be discussed.