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INTERFACES FOR ENHANCING SPACECRAFT OPERATIONS SYSTEM USING STK VISUALIZATIONS

Abstract

The Indian remote sensing (IRS) satellite system is one of the largest constellations of remote sensing satellites the world today. Presently IRS constellation includes twelve satellites that provide remote sensing images in a variety of resolutions and spectral bands. The launch and on-orbit operations of satellites are challenging and complex in nature. To enhance the situational awareness in spacecraft operations, different simulation and visualization tools are adopted by different space agencies. This paper describes an STK based real-time visualization system, used for visualization of various satellite operations. This system is established and is being used operationally at the spacecraft Mission Operation Complex of ISRO. The paper details the end to end design of the system including various software elements and interface modules.

Satellite Tool Kit (STK) is a physics based software geometry engine that can display and analyze space assets in real or simulated time. It has the capability to accurately and consistently model and display the relative geometry of various ground and space elements. It is also capable of articulating the payload and sensor mountings and payload scanning mechanisms. These capabilities of STK are harnessed to provide a better situational awareness of the state of the spacecraft during various operational scenarios. This is done by developing a set of software elements and interface modules to acquire, process and reformat the telemetry data and channeling it to the STK engine for real-time visualization.

This has been used during various specialized operations in different satellites. A few applications of the system are highlighted in this paper. They include: 1) Flip Operation in MeghaTropiques, 2) Side looking RADAR payload operation in RISAT-1, 3) MADRAS Scanning Mechanism in MeghaTropiques, 4) Solar Glint Prediction, 5) Launch Operation from lift off to spacecraft injection and solar panel deployment and 6) Moon pointing and Calibration for Oceansat-2.

This paper is organized in five sections. The first section provides the background of spacecraft operations and the need for a graphical visualization system. The second section describes the design methodology. The third section briefly describes the various software elements and interface modules involved in the design. Some of the operational applications are illustrated in section 4. The fifth and final section provides the conclusions.