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SPACE SYSTEMS SYMPOSIUM (D1)
Lessons Learned in Space Systems (5)

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THE CANADIAN CONTRIBUTION TO THE JAMES WEBB SPACE TELESCOPE: THE FINE GUIDANCE SENSOR (FGS) AND THE NEAR-INFRARED IMAGER AND SLITLESS SPECTROGRAPH (NIRISS)

Abstract

The James Webb Space Telescope, also called JWST or Webb, will be the premier observatory of the next decade, enabling us to probe the origins of galaxies, stars, and planetary systems, with unprecedented angular resolution and sensitivity in the infrared spectrum. To achieve this, the observatory will orbit the Lagrange L2 earth-sun point and be passively cooled to cryogenic temperature. As part of an international collaboration with NASA and the European Space Agency (ESA), the Canadian Space Agency (CSA), with its prime Contractor COM DEV, is contributing two astronomical instruments for the telescope: the Fine Guidance Sensor (FGS) and the Near-InfraRed Imager and Slitless Spectrograph (NIRISS), which are scheduled for delivery to NASA by mid-2012.

As an essential element of the telescope's attitude control system, the FGS will perform star identification and provide continuous pointing information, more specifically, guide star centroids, with a precision better than 4.0 milliarcseconds. The other instrument, the NIRISS, is a wide field broadband camera, which will provide imagery over the 0.7 to 5 micrometers spectral range. Its slitless spectroscopy and sparse aperture interferometry capabilities will allow surveys of primeaval galaxies, the study of transiting planetary systems, and the detection of extra-solar planets.

The ambitious objectives of the Webb program imposed challenging instrument system requirements, high technical risk, the necessity to resort to innovative technologies, and the inherent complexity of testing highly sophisticated optical space systems at cryogenic temperature. This paper will summarize the scientific objectives, present the key technical specifications for the FGS and the TFI, and describe the key engineering technologies and steps that have successfully contributed to the production of the Canadian flight instruments. Major data and test results will be presented to explain how engineering analyses, optical measurements, hardware and software integration, and environmental testing were conducted to meet the required system performance.

Finally, the paper will briefly report on a study conducted by the Canadian Space Agency, in collaboration with COM DEV, which demonstrates how technologies and capabilities developed for the FGS could be used for future space astronomy missions.