A Summary of the Cassini System-Level Thermal Balance Test: Science instruments

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ABSTRACT

Cassini, NASA's mission to investigate the Saturnian system is scheduled for launch in October 1997. The flight system (including the Orbiter and Titan Probe) is the largest and most sophisticated interplanetary vehicle ever launched. The cruise period from launch to Saturn is approximately seven years and has a wide range of solar/thermal environments (0,6 1 AU to 10 AU). To verify the integrated system-level thermal design, the flight system will be tested in Jet Propulsion Laboratory's 25 foot space simulator facility in January 1997.

For a majority of the science instruments, the bulk thermal design responsibility has been retained by the Jet Propulsion Laboratory. However, there have been a few instances where the thermal design responsibility was given to the instrument team (most notably the Titan Probe, the Cosmic Dust Analyzer, and the Composite Infrared Spectrometer). The large science instrument complements (the Remote Sensing Pallet and the Fields and Particles Pallet) and the appendage science instruments (RADAR, Magnetometers, and Radio and Plasma Wave Science) have undergone thermal development testing. In addition, development tests have been performed for instruments with off-site thermal design responsibility.

The system-level thermal balance test will be the first opportunity to verify the expected flight thermal interaction between the instruments and the spacecraft. Additionally, a test of this magnitude is subject to several constraints which have a significant impact on the planning and execution of the test. The expected worst-cold and worst-hot conditions will be tested rather than all instrument power modes. Off-sun attitude simulation is not feasible because of the size of the flight system.

This paper will present the overall strategy for the system-level thermal balance test from a science instrument perspective. Test objectives, setup descriptions, and timelines will be discussed. Test results will be focused on science instruments and any design modifications resulting from these results will be presented. Finally, design and/or testing lessons learned will be described. An outline of the proposed paper is attached.

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OUTLINE

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1. Science Payload Description

II. Thermal Design Description

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B. General Design Philosophy
1. Integrated Design

C. instrument Thermal Design Descriptions
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2. Appendage Science

III. System-Level Thermal Balance Test

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B. Test Configuration
1. Flight & Non-Night Hardware

C. Test Timeline
1. Worst-Case Conditions

D, Results
1. Summary
2. Design Modifications
3. Operational Constraints

E. Design & Testing Lessons Learned

F. Conclusions