SOLAR CELL EXPOSURE TO COMBUSTION BY-PRODUCTS EVALUATION

SUMMARY

Solar cells and other spacecraft materials may be exposed to the combustion by-products of rocket engines during on-orbit operations. This exposure is of particular concern when multiple spacecraft are operating in close proximity as occurs during rendezvous and docking operations. The International Space Station and on-orbit serviceable satellites such as the Hubble Space Telescope that rely on solar power have delicate optics, or have very large solar arrays that are particularly vulnerable.

Materials of interest ranging from small samples to large solar panels can be placed in a simulated space environment and subjected to direct or indirect impingement from rocket engine exhaust gases, byproducts of combustion, or uncombusted propellants. Because of the vacuum of space, even surfaces that are well protected from direct impingement can be exposed to indirect impingement of the rapidly expanding exhaust gases.

Following the exposure, samples can be removed or analyzed *in situ* depending on the type of sample and analysis being performed. Analysis can include evaluation of the loss of transmittance, reflectance, surface corrosion, and analysis of chemical buildup. Analysis can also include performance evaluation of the samples, such as photovoltaic output, or radiant output.

TEST APPARATUS AND PROCEDURE

The testing is performed in one of the White Sands Test Facility's (WSTF) altitude simulation chambers. The test article is placed in position in the chamber, the test cell is evacuated to simulate the vacuum of space, and a rocket engine firing is conducted that simulates exhaust gas exposure which would occur during the actual spacecraft mission. Test materials are then analyzed either *in situ* or after removal from the test stand.

TEST SAMPLES

Test samples can range from small material coupons to full-sized solar arrays up to 30 ft in length. Rocket engine configuration, desired analysis, or other factors may impact sample configuration.

TEST RESULTS

Test results may include real-time measurement of transmittance, reflectance, or electrical output of a solar cell. Other possible results include quantification of deposited materials and posttest surface analyses.

APPLICATIONS

Effect of short- or long-term exposure of materials to rocket engine exhaust products can be evaluated.

CONTACT

David L. Baker, NASA White Sands Test Facility, Chief, Propulsion Test Office, david.l.baker@nasa.gov, (575) 524-5605