Case Study:

A High Radiance Calibration Sphere Source
for a High Vacuum Collimator System

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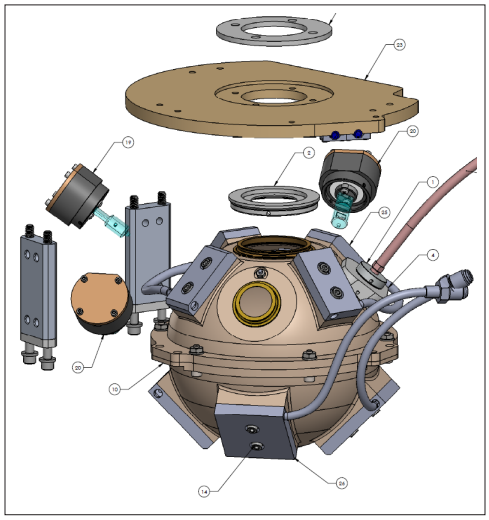
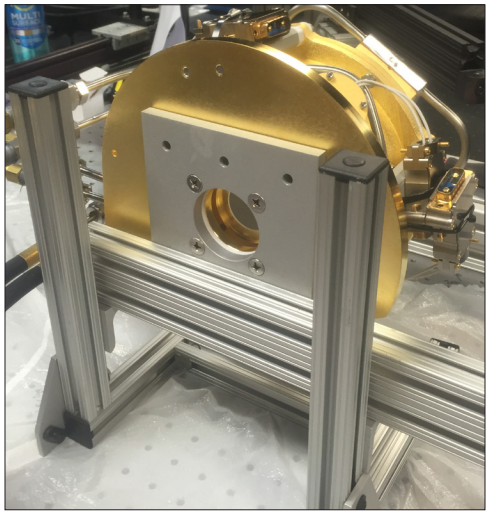




Technical Situation

A uniform source was needed to fill a large collimator assembly for the testing of the Radiation Budget Instrument (RBI) on the JPSS-2 upcoming satellite mission (https://ceres.larc.nasa.gov/documents/STM/2015-09/2a_Priestley_STM_Seattle_090115.pdf). Labsphere created a liquid-cooled absolute radiance standard to meet aggressive light levels and to fit in a very confined 10e-8 Torr thermal vacuum chamber.

Business Challenge

Many large satellites today are continually challenged with the need to lower uncertainty on long term missions involved in monitoring climate change. While a great deal of testing is conducted in ambient conditions, ultimately, the system must be put through its paces in thermal vacuum. The RBI instrument will be looking at broad band radiance of earth targets to determine the energy that is absorbed or released from the earth's climate. Understanding this balance (or budget) is a critical part of understanding why and how the earth's climate is changing.

Labsphere's Solution

The radiance requirement for this system required a smaller sphere with an aggressive number of lamps as the collimator had to deliver high irradiance to the sensor plane. The radiance and thermal load required extensive analysis of an appropriate cooling system and low emissivity surfaces. The tight space afforded to the system and the focal location of the collimator also posed many challenges mechanically.

The compact design ultimately required an additive manufacturing solution – a 3D printed metal sphere. We also had to route a water cooled system with formed stainless steel tubing, a fiber optic monitoring solution and the electrical connections to set connection panels and bulkheads that complied with the customer's vacuum chamber.

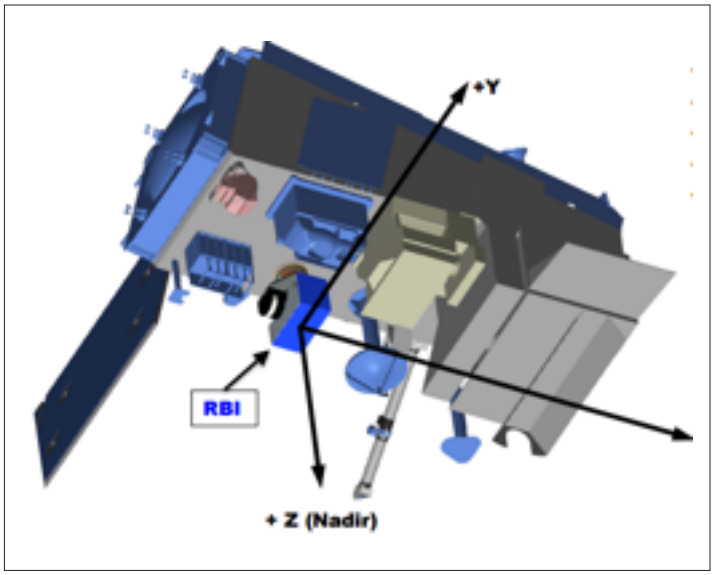
Benefits

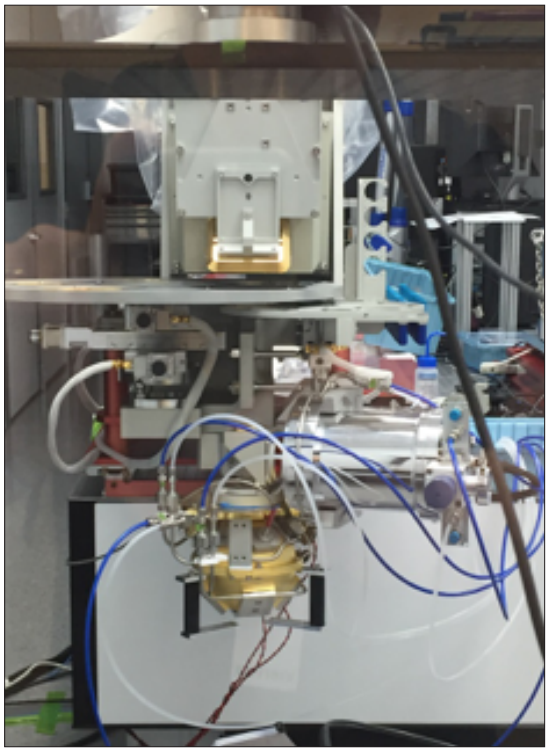
The working final system was completed to all specifications and delivered a great deal of features:

- Vacuum compatible to 10e-8 Torr
    - o Vacuum tested under operation
    - o Vacuum baked final system
- Sphere output radiance greater than 5x extra-terrestrial solar levels in customer's required bands.
    - o Multiple level control through lamp combinations.
- Fiber-optically fed stability monitoring system outside the vacuum chamber.
    - o Multiple band monitoring
- >99% uniformity at the exit port.
- Low Emissivity exterior surfaces
- Spectraflect® internal surfaces
- Aggressive cooling system
- Precision apertures and optical alignment fixtures.
- Electronic control system (Ambient) using HELIOS® components and HELIOSense software.

Objective	Benefits Received
High Radiance Source for Collimator	Highly collimated irradiance levels at Sensor Plane
Vacuum Compliant	Traceable radiance in vacuum chamber
Long life (15 years)	Support of multiple programs
HELIOS® Modular System	Easy control and service for long life performance

Ask Labsphere how we can help solve your remote sensing challenges, create efficiency, and save time and money on your programs.





Sphere System Mounted on Collimator

Labsphere
advancing the technology of light