



NSTP-2 pathfinder: Application of Vantablack® to a large-aperture flight black body

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Introduction

Black body calibration targets provide the fundamental reference for all thermal infrared satellite radiometers. Satellite black body targets have evolved very little in the past 25 years. There is now an opportunity to introduce a range of new technologies to improve radiometric performance and to reduce the volume, mass and power consumption of the overall black body sub-systems. This presentation outlines a NSTP-2 path finder project to utilise vantablack® coating.

Example black coatings

Manufacture	Product name	Emissivity
Mankiewicz, Germany	Nextal Velvet Coating 811-21	0.966 at 10um
Equinox Interscience, USA	Deep Sky Black Enhanced	0.95 at 10um
Acktar Ltd, Israel	Fractal black	0.988 at 10um
Surrey nano- systems	Vantablack S- VIS	0.99 at 14um

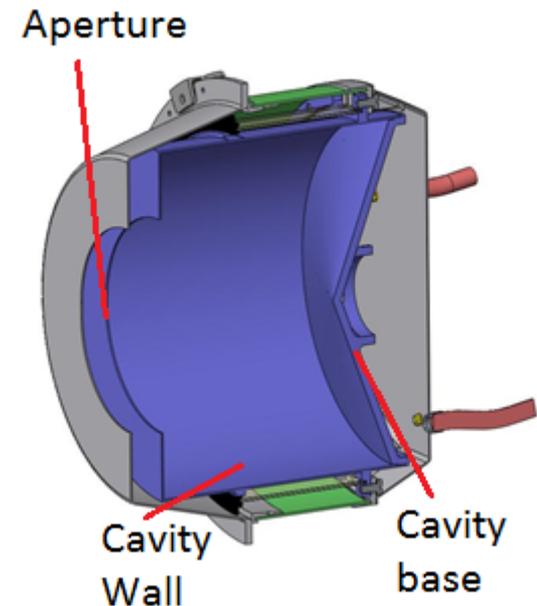
Cavity gain

- We use geometry to enhance the emissivity of a cavity (i.e. create multiple bounces).
- Simple first order model of cavity gain:

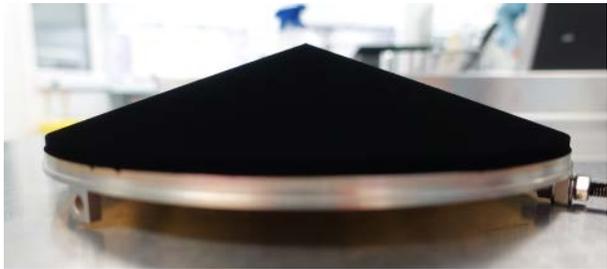
$$G = \frac{\epsilon_{coating} - 1}{\epsilon_{cavity} - 1}$$

- For SLSTR this is around 7.5

note this model is an over simplification!



SVIS Successfully applied to SLSTR cavity



Coated base and wall to complete flight like cavity

Summary

- Project Objective
 - Demonstrate application of Vantablack® on large area flight black body (RAL Space/SNS)
 - Determine performance enhancement (NPL)
- Main Technology Developments
 - Coating SLSTR-like flight-representative cavity
 - Collate current qualification level
- Current Status
 - Qualification review complete (RAL Space)
 - Parts coated (SNS)
 - Coating optical properties measured (NPL)
 - Project completed

Future

- Full qualification S-IR (new enhanced SVIS for flight)

