

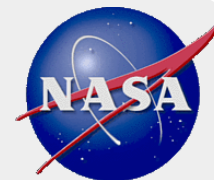
NASA Measurement Activities 2011-2012

**30th IADC Meeting
Montreal, Canada
2012**



NASA Measurement Activities

- **Haystack/HAX/Goldstone Radars**
- **Returned surfaces**
- **MODEST/Magellan**
- **Tumbling objects**
- **Optical Measurement Center**
- **MCAT**
- **SST**



Haystack/HAX/Goldstone

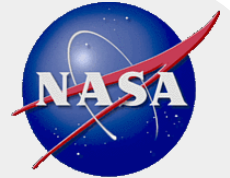


- **Haystack** – Recently upgraded by adding W-band capability. However, during testing to return to service, the azimuth bearing failed. Estimated return to service is now April 2013.
 - 0.058° FOV, capable of detecting 5-6 mm debris
- **HAX**
 - 0.1° FOV, capable of detecting 1-2 cm debris
 - ~1000 hours collected since last IADC
- **Goldstone**
 - 0.02° FOV, bi-static, capable of detecting 2-3 mm debris
 - ~9 hours collected since last IADC



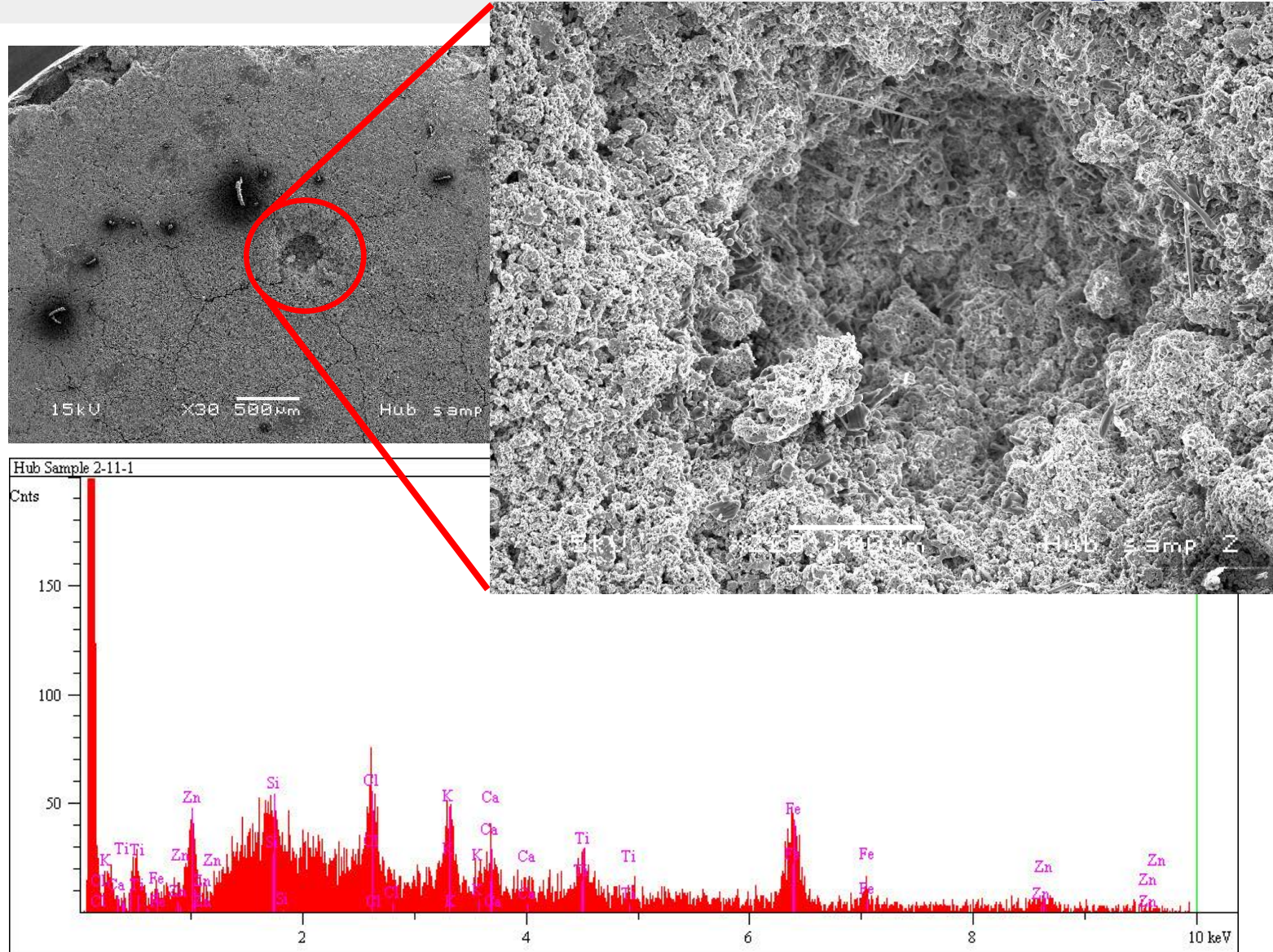
Returned Surfaces

- **HST Wide Field Planetary Camera-2 (WFPC-2) radiator**
 - WFPC-2 radiator examined optically in 2009 at Goddard Space Flight Center
 - Over 700 features recorded
 - Limiting feature size on the order of 300 μm
 - An international effort is underway to determine the origin of impactors
 - NASA: JSC & GSFC
 - ESA, in conjunction with UK Natural History Museum (NHM) and the Ion Beam Center
 - Feature cores provide projectile's elemental distribution: MM, OD, or UNK
 - 200 cores will be taken for JSC and the NHM each
 - Each institution will permanently archive cores for further research
- **Other Returned HST Surfaces**
 - Bay 8 MLI samples (20x20 cm samples)
 - Both inspected at JSC down to a limiting feature size of 100 μm
 - Bay 5 and Bay 10 MLI samples to be archived at JSC
 - Will receive Bay 10 upper half (9.8 yr), Bay 5 and 8 (19 yr) MLI sheets
 - Bay 10 is outer layer & 3 mil underlayer; 5 & 8 are 17 layer stack
 - MLI serves as capture cell for projectile residues, can be dissected



Returned Surfaces: elemental analysis

- Sample No.2 examined at JSC
- This feature does not extend to Al surface of radiator
- Preliminary SEM/EDS analysis indicates presence of Fe, in addition to paint/binder constituents

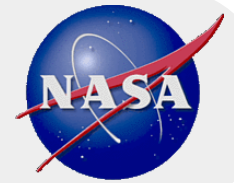


Cerro Tololo Inter-American Observatory (CTIO)



**The telescopes at CTIO, from left to right:
1.0 m, 0.6 m MODEST, 4.0 m, 1.5 m, and 0.9 m (SMARTS)**

- **0.6 m MODEST (Michigan Orbital DEbris Survey Telescope) used for survey and colors**
- **0.9 m operated by SMARTS Small- and Medium-Aperture Research Telescope System Consortium used for follow up metrics and simultaneous colors**



Las Campanas Observatory 6.5 m Magellan telescopes

Baade – imaging & spectroscopy

Clay - spectroscopy

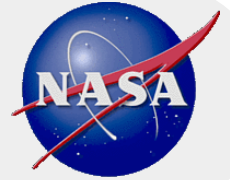


- Used for dim object survey & spectroscopy studies



Optical Measurement Campaigns

- **July 2011 - MODEST (survey) and Magellan (Clay - spectroscopy)**
- **Nov 2011 - MODEST (IDCSP observations)**
- **February 2012 - MODEST - new shutter installation**
- **March 2012 - Magellan (Baade - spectroscopy)**
- **April 2012 - 0.9-m (photometry) and MODEST (photometry and tracking tests)**
- **May 2012 - Magellan (Clay- spectroscopy)**



Measurements of Tumbling R/Bs

- **Source 1: United States Air Force Academy (USAFA)**
 - Obtained 15 nights of data from 9 Nov 2011 and 17 Jan 2012
 - Recorded 273 separate light curves on 126 unique objects
 - Pre-processed by USAFA to generate light curves
- **Source 2: New Mexico Skies Observatory Complex (NMS)**
 - Remotely operated from Johnson Space Center
 - 25 nights data acquired since February 2012
 - Recorded 224 separate light curves



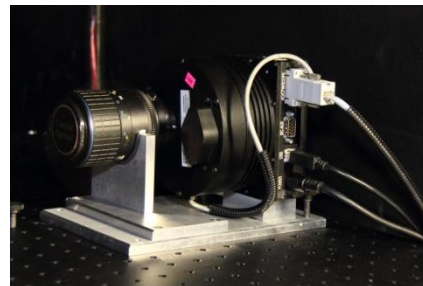
NASA Optical Measurement Center (OMC)

- The OMC simulates space-based illumination conditions using equipment and techniques that recreate telescopic observations and source-target-sensor orientations.
- Able to generate:
 - Optical signatures
 - BRDF measurements
 - Spectroscopic measurements

Lamp located on rotary arm (green)



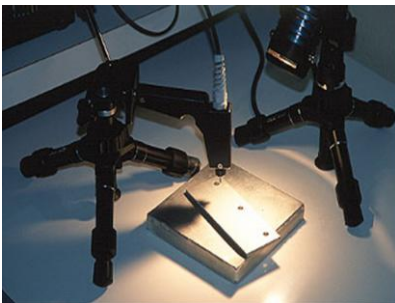
Camera



Robot



Spectrometer





- **Telescope assembled and mechanically tested**
- **Disassembled and painted**
- **Currently being reassembled**
- **Facility continues to be delayed**
 - Moved from Legan to Roi Namur
 - Manpower reduction has delayed groundbreaking to October 2012 and extended the period of construction to 12 months.
 - Looking at Ascension Island as an alternative site





Space Surveillance Telescope (SST)

- **DARPA developed**
 - **Synoptic survey**
 - **Located near Socorro, NM**
 - **Will be turned over to the Air Force at completion of test period**
- **3.5 m aperture; f/1; ~3 deg FOV**
- **Curved focal plane, mosaic CCD**

