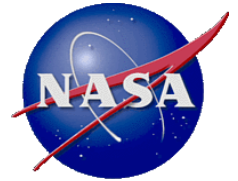


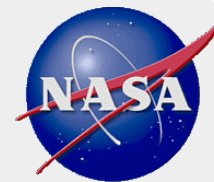
National Aeronautics and Space Administration



# **NASA Measurement Summary**

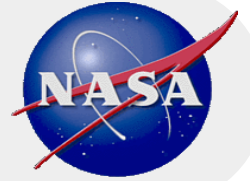
**WG1  
33<sup>rd</sup> IADC Meeting**

**Gene Stansbery  
Orbital Debris Program Office**



## Major Initiatives

- **Meter Class Autonomous Telescope (MCAT)**
- **Debris Resistive Acoustic Grid Orbital NASA-Navy Sensor (DRAGONS) on ISS**
- **DebrisSat**



# Meter-Class Autonomous Telescope (MCAT)

- **NASA is currently working with the Air Force and AFRL to deploy a new 1.3-m telescope on Ascension Island.**
- **The low latitude of the site will permit observations of low inclination debris at all altitudes.**
  - **Debris as small as 10 cm in GEO should be detectable.**
- **The telescope will ultimately operate autonomously.**
- **Operations will start in 2015.**



**The MCAT telescope and mount will be non-traditional.**



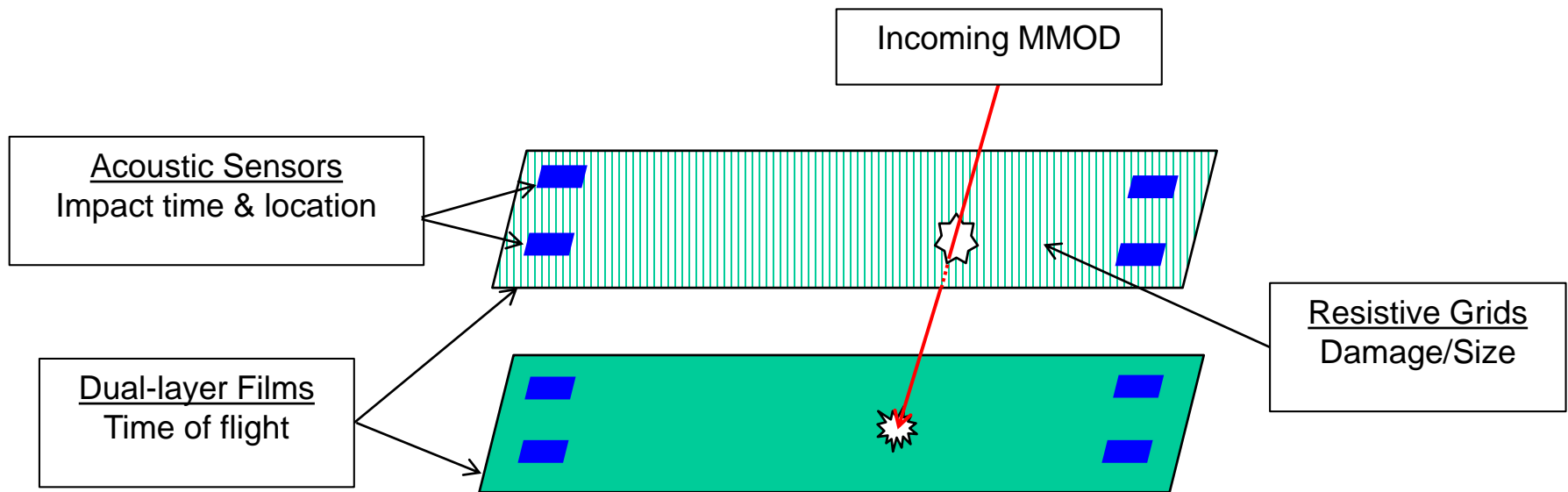
# Meter-Class Autonomous Telescope (MCAT)

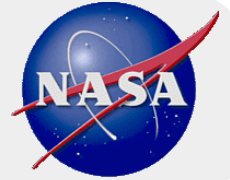




# Debris Resistive Acoustic Grid Orbital Navy- NASA Sensor (DRAGONS)

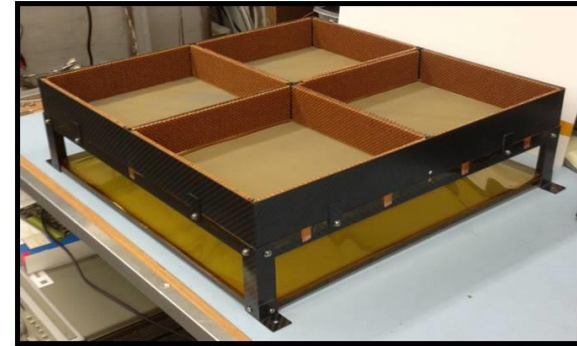
- Purpose is to provide data on debris smaller than 1 mm
- DRAGONS combines dual-layer thin films and an acoustic sensor system with the resistive grid sensor system to create a COTS-based instrument that provides excellent semi-real-time impact detection and recording capability
  - Impact data includes: **Impact time, impact flux, particle size, impact speed, impact direction, and impact energy**



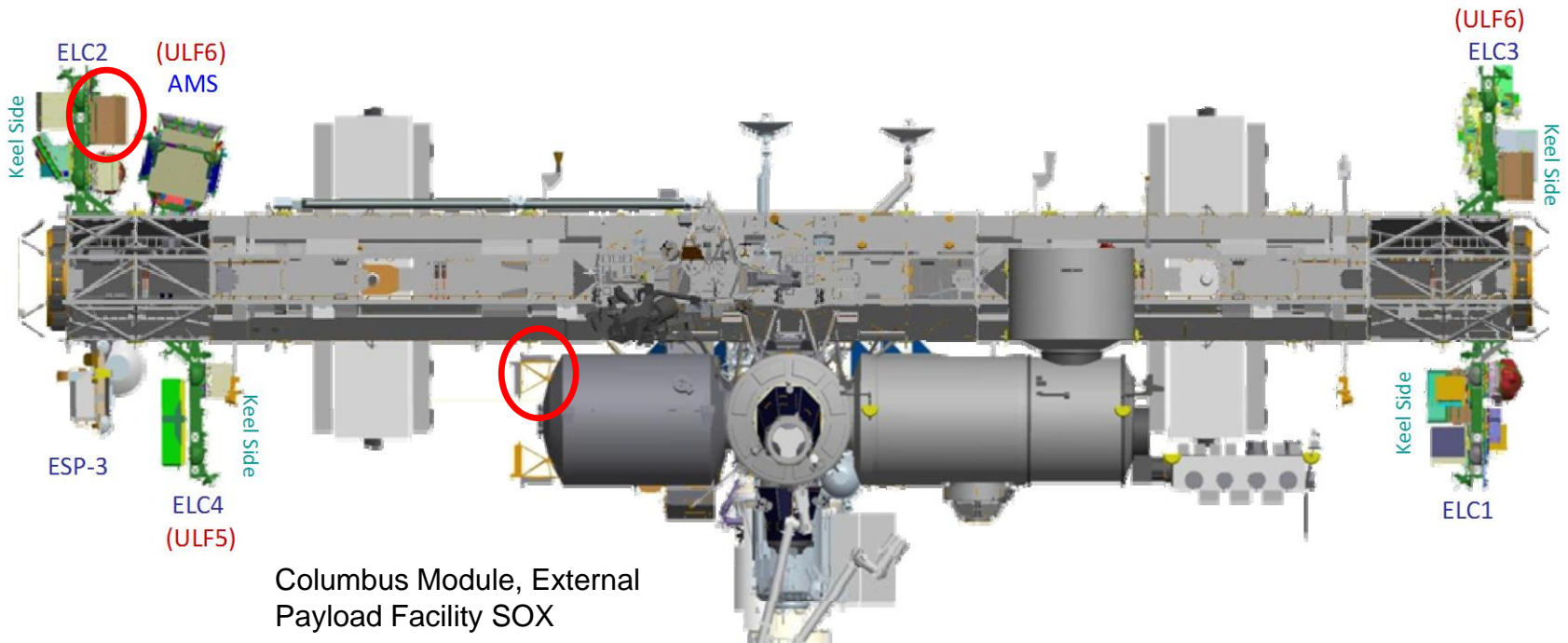


# DRAGONS

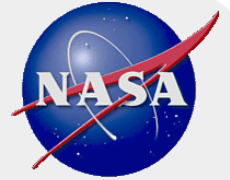
- **Two potential flight opportunities**
  - ISS Technology Demonstration Office
  - DoD Space Test Program – higher altitude



**DRAGONS Prototype**







# DebrisSat

- **NASA Standard Breakup Model**

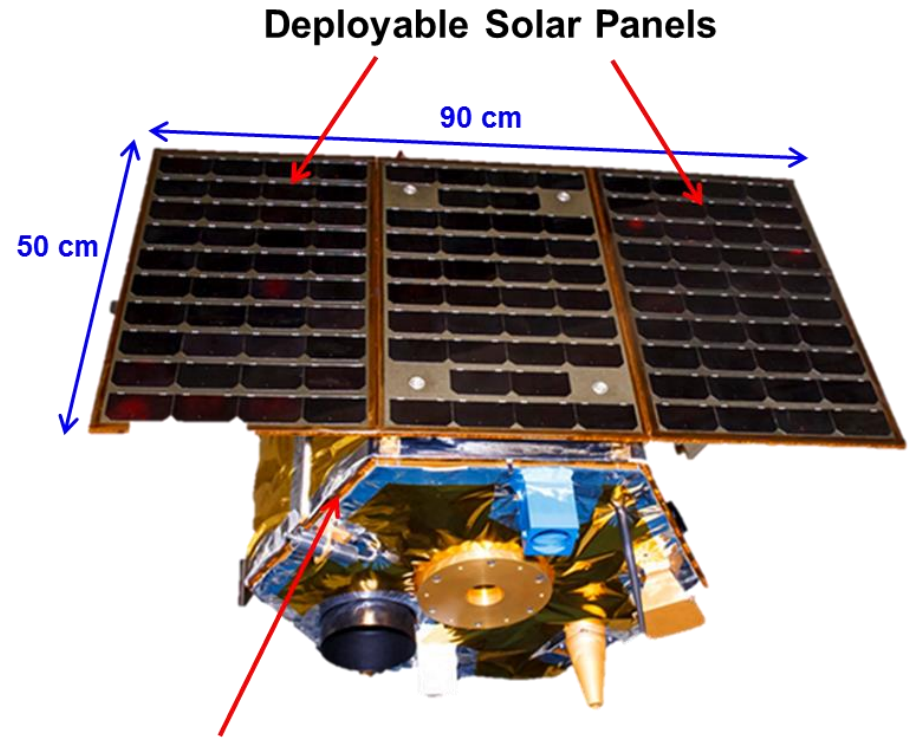
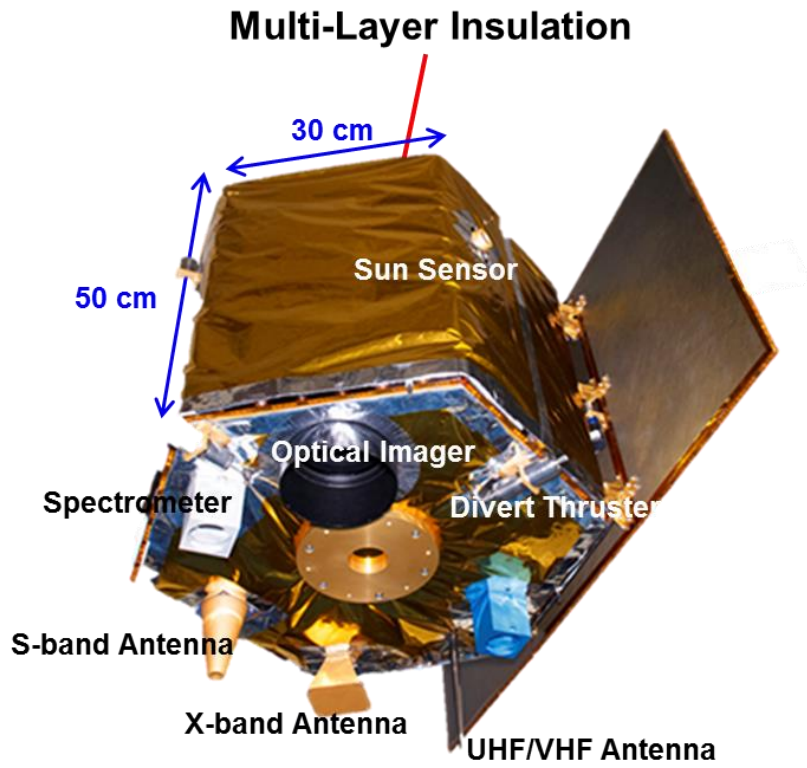
- Based on ground based hypervelocity impact tests and on-orbit fragmentations, explosion and collision
- Ground based tests were on performed on 1960's Transit satellite and simulated spacecraft & rocket bodies
  - No multilayer insulation (MLI) or solar panels
- Iridium/Cosmos collision in 2009 showed differences between “new” and “old” construction

- **DebrisSat**

- Design and fabricate a 60-cm/50-kg class satellite, including MLI and solar panels, to be representative of modern payloads in LEO
- Carry out a hypervelocity impact test with sufficient kinetic energy to completely breakup DebrisSat



# DebrisSat



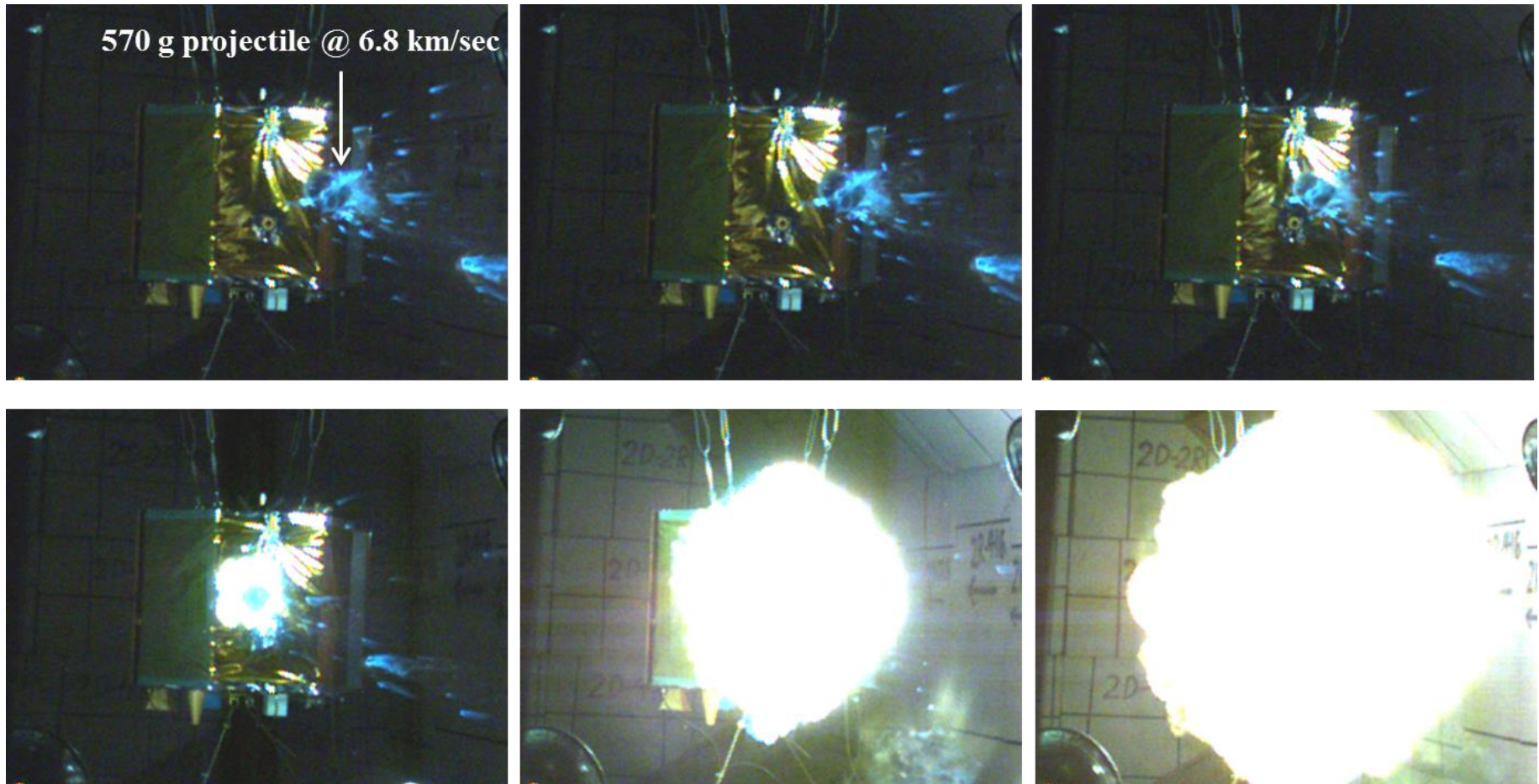
8.6 cm × 9 cm, 570 g  
6.8 km/sec





# DebriSat

- **DebriSat shot was successfully conducted on April 15th at Arnold Engineering Development Center (AEDC)**
  - Projectile impacted DebriSat at 6.8 km/sec and completely fragmented the target



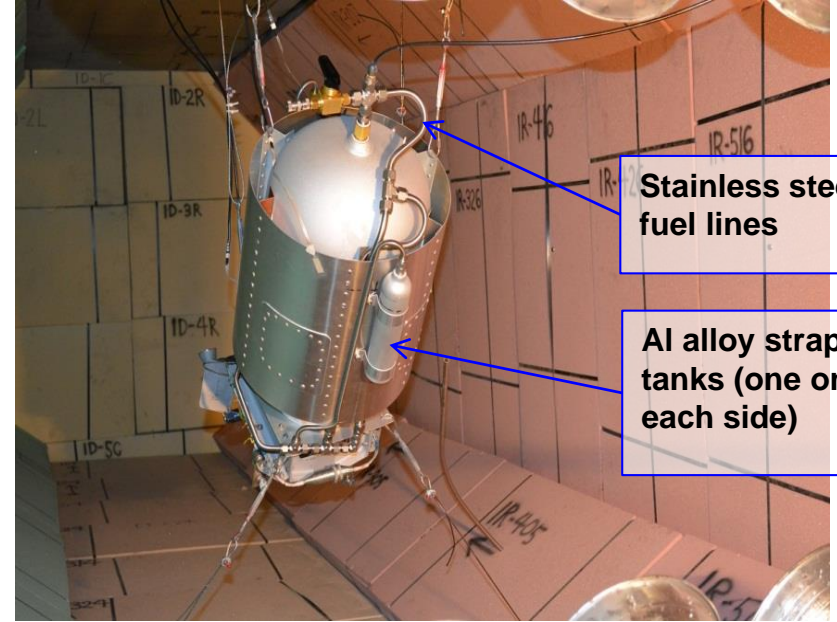
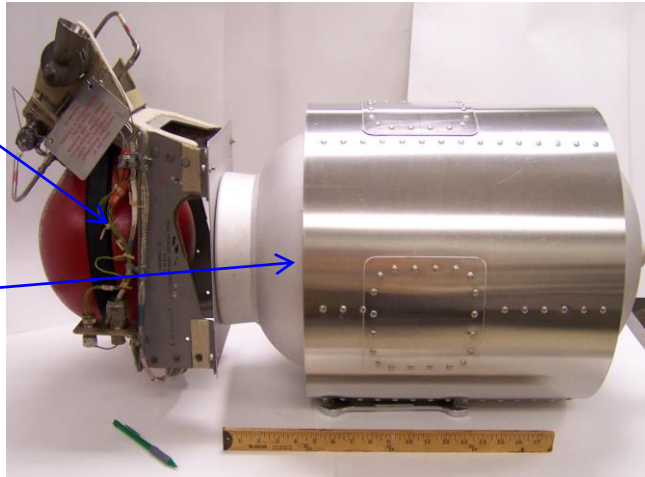


# DebrisSat Test Shot

- **To further increase the benefits of the project, Aerospace built a target resembling a launch vehicle upper stage (“DebrisLV”) for the pre-test shot**
  - DebrisLV: 17.1 kg, body dimensions ~ 88 cm (length) × 35 cm (diameter)
  - Pre-test shot was successfully conducted on April 1st
  - Projectile impacted DebrisLV at 6.9 km/sec and completed fragmented DebrisLV

Delta-II Ti roll control thruster assembly

Al alloy tank (xenon 15 psia) and Al alloy skin



Stainless steel fuel lines

Al alloy strap-on tanks (one on each side)





## DebrisSat Test Shot

- **AEDC always conducts a test shot prior to the main event**
  - Opportunity to test emulated upper stage





## On-Going Measurements

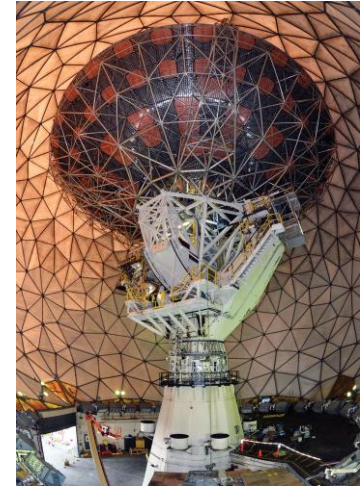
- **Radar**
  - HUSIR/HAX
  - Goldstone
- **UK InfraRed Telescope (UKIRT)**
- **Michigan Orbital DEbris Survey Telescope (MODEST)**
- **Magellan/Blanco/Bi-static**



## On-Going Radar Measurements

- **Haystack Ultrawideband Satellite Imaging Radar (HUSIR) – X band**

- Was down for several years for upgrade and bearing issues.
- Resumed limited operations in Jan. 2014
- 336 hours collected in FY 2014
- Expect ~600 hrs in FY 2015



- **HAX**

- 645 Hours collected since last IADC



- **Goldstone**

- 87 hours collected since last IADC







## On-Going Optical Measurements

- **MODEST (0.6 m)**
  - 1 week of survey observations late June 2014
- **Magellan (6.5 m)**
  - 2 nights May 27 and May 28 direct imaging for faint GEO object survey. 0.5 deg field of view. Both nights clear.
- **Blanco (4.0 m)**
  - 1 night June 24 with Dark Energy Camera (2 deg diameter field of view) for faint GEO object survey.
- **MODEST/Blanco/SST/USNO Multi-Static**
  - Coordinated survey observations with 3.5-m Space Surveillance Telescope (New Mexico, USA), 1.3-m telescope at USNO Flagstaff (Arizona, USA), and 0.6-m MODEST (Chile). Clear all sites.





## On-Going IR Measurements

- **United Kingdom InfraRed Telescope (UKIRT)**
  - 3.8 m telescope
  - Mauna Kea, Hawaii (4200 m elevation)
  - Significant time dedicated to NASA Orbital Debris Observation
- **WFCAM (Wide Field CAMera) JHK**
  - 25 nights of data – April, May, June, 2014
  - 16 objects observed
- **WFCAM ZYJHK**
  - 26 Nights – Oct, Nov, Dec 2014
  - 24 objects observed
- **UIST (UKIRT Imaging Spectrometer) 1-2.5um spectra**
  - 6 nights of data – Aug, Sept 2014
  - 10 objects observed

