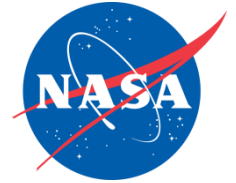


National Aeronautics and Space Administration



# Observing strategies for focused, faint orbital debris surveys using the Magellan telescope

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<sup>1</sup>*Univ. Texas El Paso*

<sup>2</sup>*University of Michigan*

<sup>3</sup>*JETS/Jacobs*

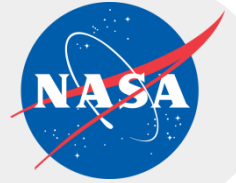
<sup>4</sup>*NASA Johnson Space Center*



UNIVERSITY OF  
MICHIGAN



**JACOBS**<sup>TM</sup>



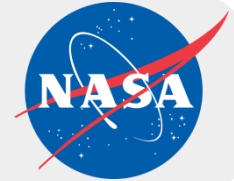
# Magellan Baade Telescope



- 6.5 Meter Telescope located at Las Campanas Observatory

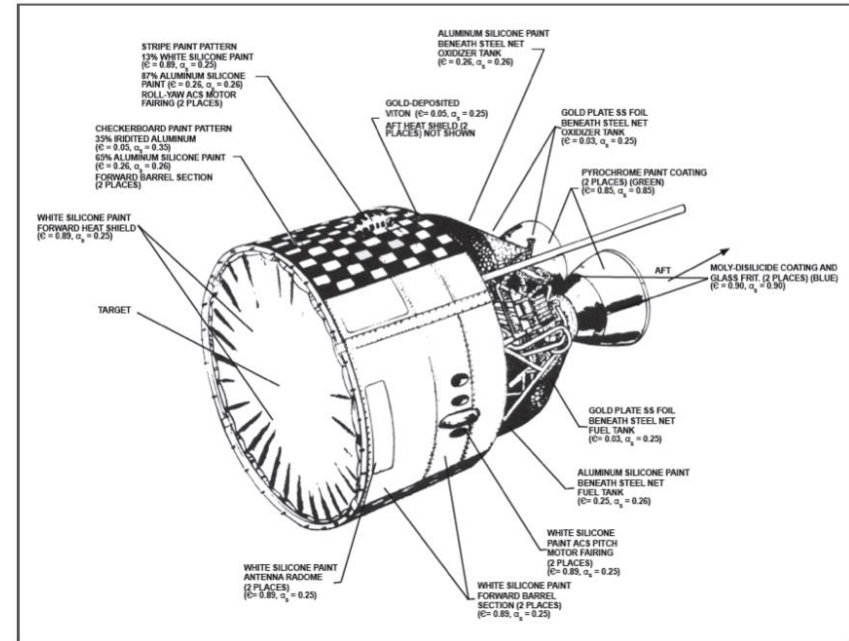
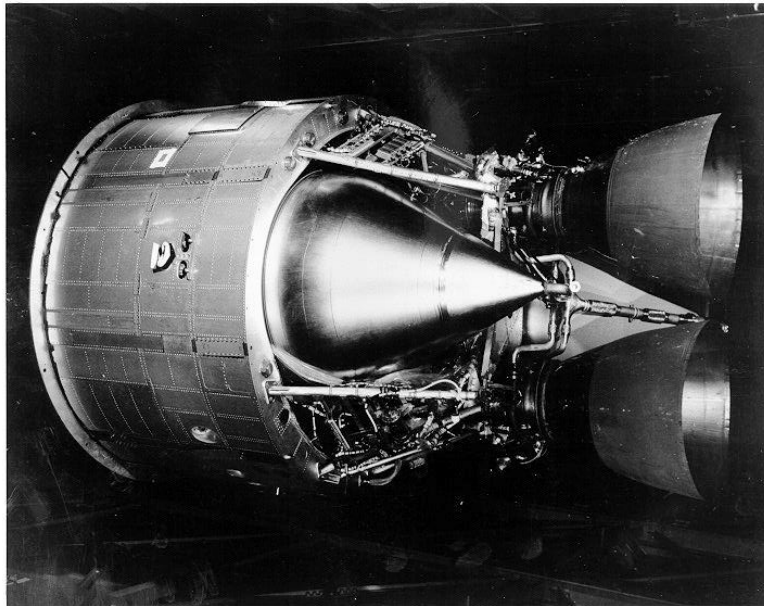
- 2 half nights granted for orbital debris studies
- Attempted a more focus debris search than previously

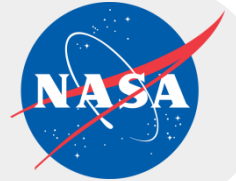
→ Searching specifically for small debris (<10cm) that may have come about from recent Titan Transtage breakup



# Titan Transtage Breakup

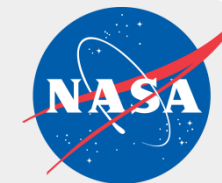
- 4 June at approximately 02:38 UT, a provisional breakup of a Titan 3C Transtage rocket body (SSN# 3692, International Designator 1969-013B) occurred
- >45 years after its launch
- The breakup has reportedly five observed fragments.
- This is the fourth breakup of this class





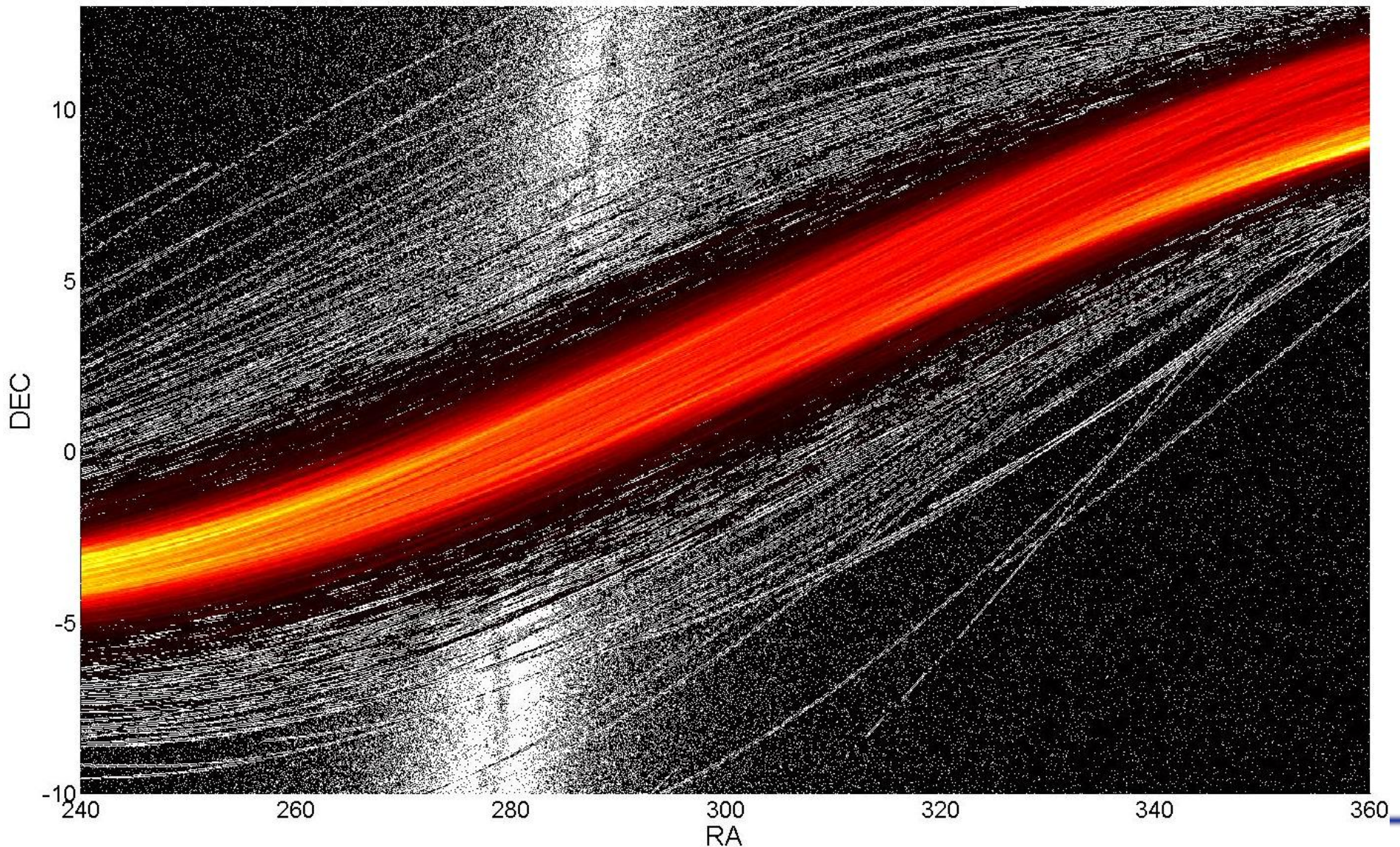
## Focused Search Strategy

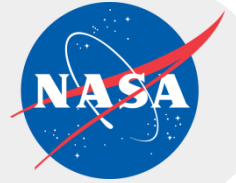
- **Debris cloud produced using models**
- **Fragment orbits were propagated forward in time**
- **Expected debris cloud density was calculated for sky above Magellan over observing window**



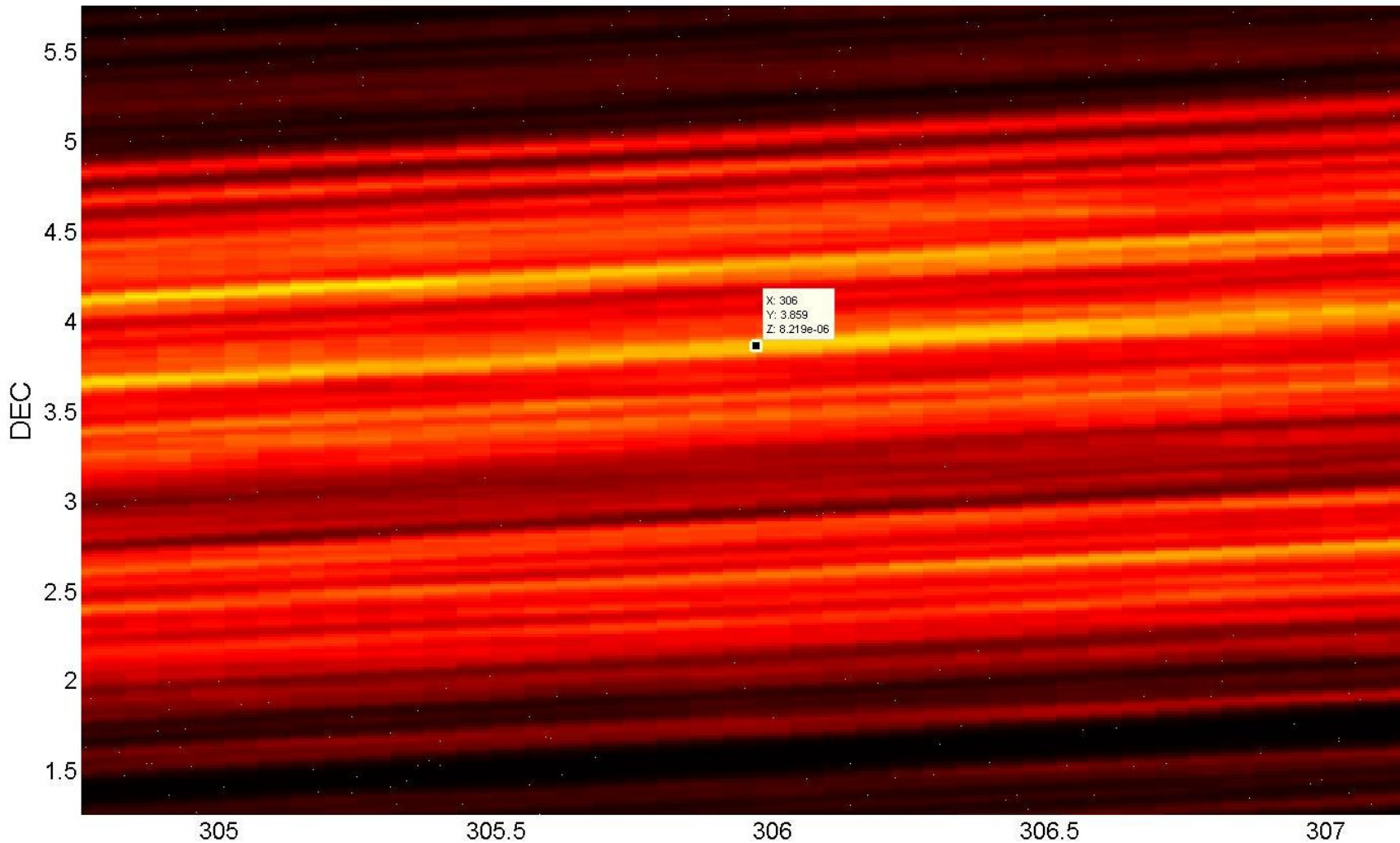
# Magellan Tasking Strategy

3692 Predicted Debris Cloud Density Over Magellan for Night of UT July 27th - 28th and Background Stars





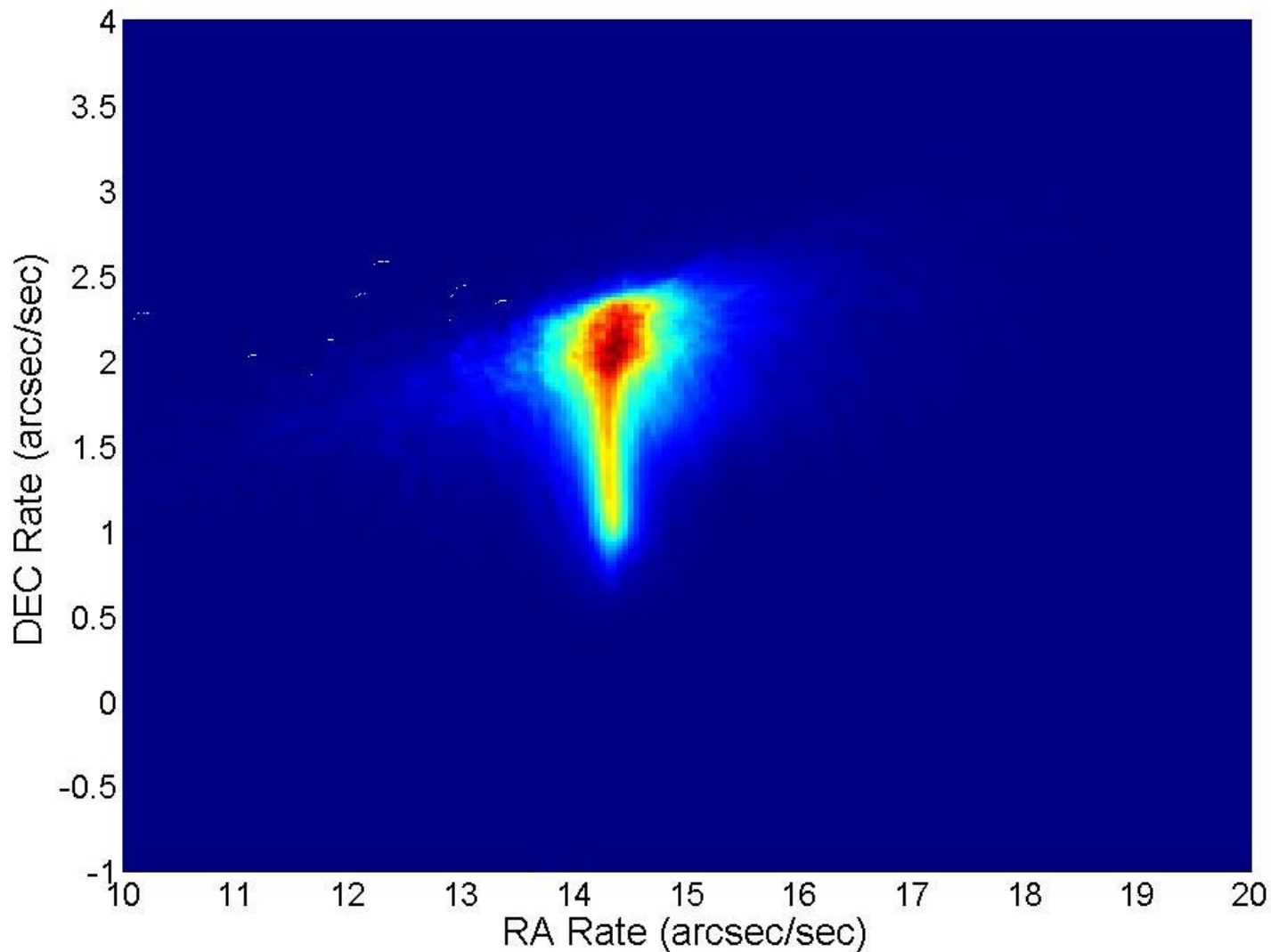
3692 Predicted Debris Cloud Density > 5cm Over Magellan for Night of UT July 26th - 27th and Background Stars

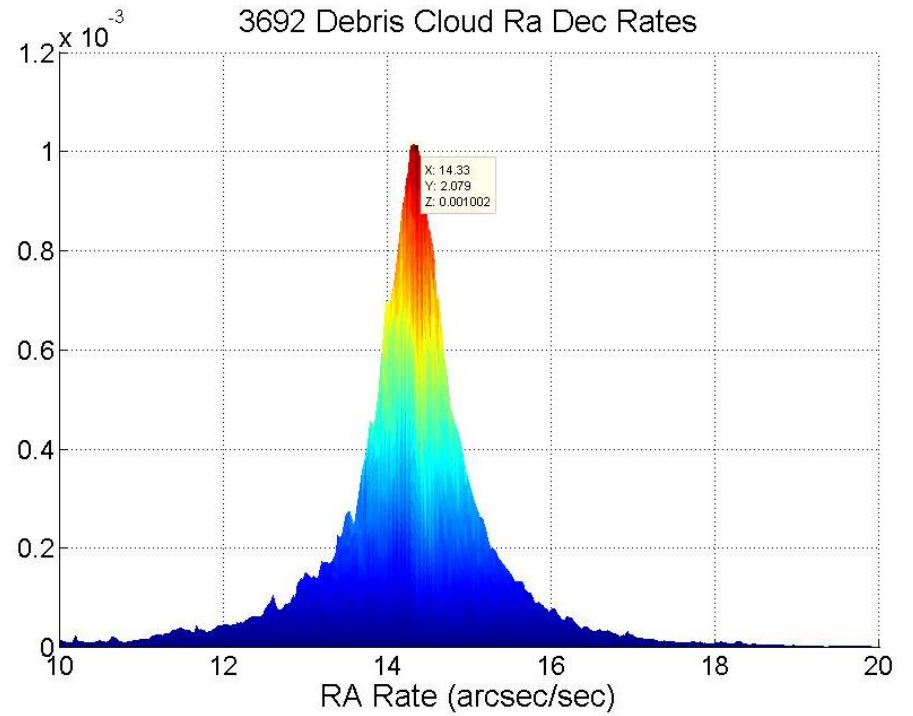
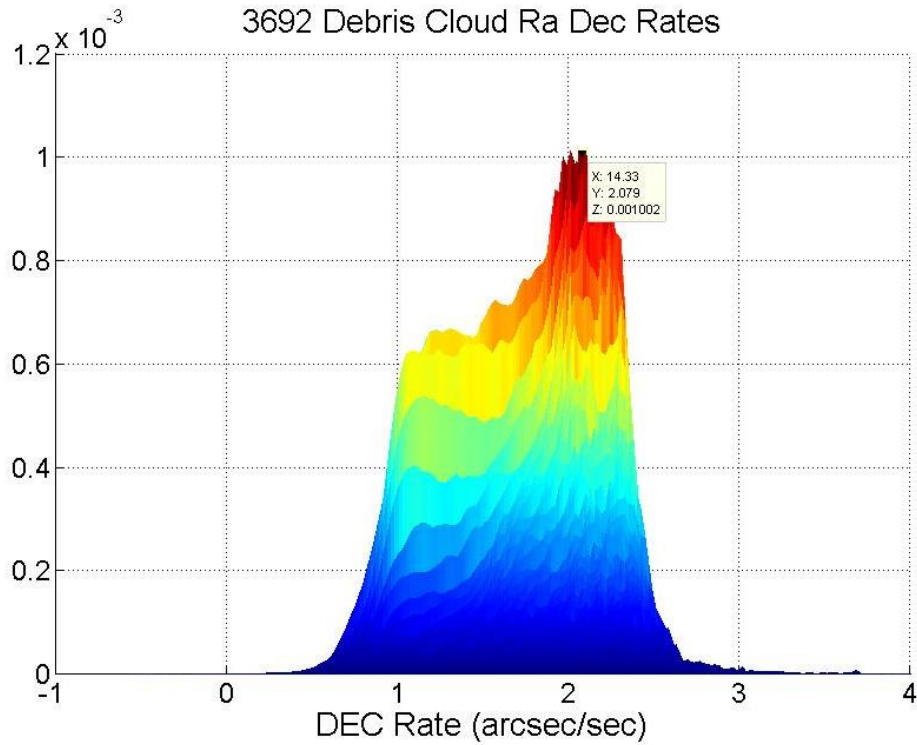
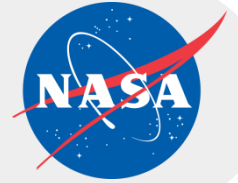




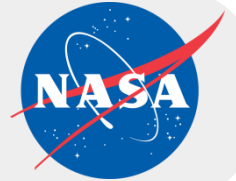
# Magellan Tasking Strategy

3692 Debris Cloud Ra Dec Rates



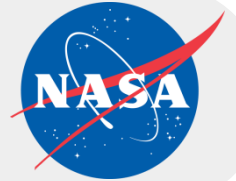






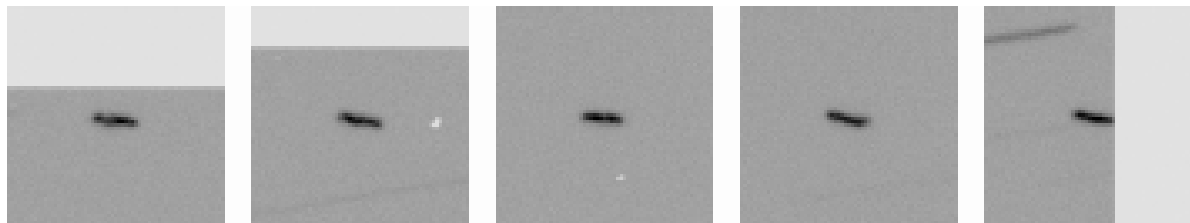
# Observations

- **26-28 July**
  - Magellan run very successful. 0.5 night of 3 night run shared with another project
  - Observations - 5 seconds through r filter until moonset then broad 4800-7800 filter using the IMACS f/2 instrument (0.5 degree diameter field)
  - Conditions clear and probably photometric, seeing < 0.8 arcsec FWHM.
  - 20 sequences of 16 images each rate tracked at expected positions and rates of maximum of debris population. Take 2 images while sidereal tracked to establish focus, then 16 at rate track.
  - 15 sequences at first initial RA,DEC; 5 sequences at second initial RA, DEC.
- **30 Oct – 1 Nov**
  - Next observing run using Baade



## Eyeball results

- Object ~16-17th mag
- Moving 1 arc-sec/sec in EW direction with respect to predicted debris motion
- Object at upper edge of frame in first two images, at extreme right of frame in last image.
- Visually detected object at telescope in between in-between attempting to set personal paddle ball record.



Rest of processing in progress...