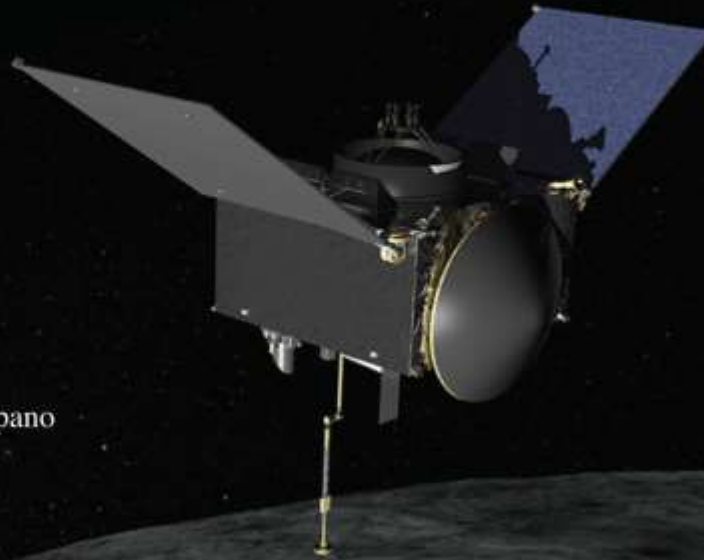


Question 2  
Boulder Summit  
June 16, 2015

OSIRIS-REX  
ASTEROID SAMPLE RETURN MISSION

Ellyne Kinney Spano



## Question 2

---

- What counting techniques will adequately support SFD measurements for Sampleability assessments that do not pose a schedule and operational risk?
- Team of experts (Keiko volunteered herself and Harold, Bill Bottke, Beau Bierhaus, Scott Bellamy, Danny Gravin, Scott Messenger, Tim McCoy, RDWG postdoc?,
  - Train together, calibrated together
  - Can mentor other counters (students, volunteers,
  - Can act as validators for other methods
  - Can pre-count calibration images from Itokawa, Eros, Earth
- Crowd sourced team
  - Select cadre of CosmoQuest volunteers? Or go completely public?
  - Proprietary data (lack context, lack geolocation information, intermix calibration images from other planetary bodies )
  - On-line forums monitored by experts/scientists; create a community with discussion forums, levels, badges, prizes, graduated levels of images: start



## Question 2

---

- Automation: Can also be checked with expert counters
  - Should have 5-6 different algorithms optimized for different image illuminations, quality, surface types. Chose the optimal one once we have a chance to evaluate the surface of Bennu
  - Good for triage; top 3 sites for experts; citizen scientist for others
- Can triage be handled by qualitative analysis?
- Final sites needs scrutiny by experts.
  
- Actions:
  - Need details of Hannah's timing analysis (counts per unit time)
  - An assessment of the overhead related to a 20 person expert team
  - An assessment of the overhead related to a 100 person novice team
  - An assessment of the overhead related to a open crowd sourcing campaign
  - What do we need to produce to prove or calibrate the accuracy of an automated approach: Need calibrated data sets, Freespace, Eros, Itokawa, Vesta, Ceres, Surface Analog images, need several techniques,

Boulder Counting Summit (June 16, 2015)

(#)



---

## Backup



## Draft Charter

---

The goal of the RDWG/IPWG rock counting meetings are for all stakeholders to arrive at an agreed set of requirements for the SFD data products used in sample site selection. These requirements will allow the IPWG to proceed with the development of software and workflows that are consistent with the time constraints of asteroid proximity operations and the accuracy and confidence requirements for the safety and sampleability maps.



## IPWG Relevant MRDs

---

- MRD-121 - Image  $\geq 80\%$  of the surface of Bennu with  $\leq 21$ -cm spatial resolution (4-pixel criterion), once at 10am local time and once at 2pm local time, to produce a **global mosaic**, stereo images, **mosaics of hazards** and regions of interest, and image sequences of the asteroid surface.
- MRD-116 - For  $\geq 80\%$  of a 2-sigma TAG delivery error ellipse around at least 2 **candidate sampling sites map** the areal distribution and determine the **particle size-frequency distribution of regolith grains**  $\geq 2$ -cm in longest dimension.



## Sampleability Maps MRDs

---

### Site-Specific Maps

- SMR – 01: Site-specific sampleability assessment shall be based on the following data products:
  - Site-specific PSFD graphs and maps (5-cm and 2-cm resolution) (MRD-116)
  - Stereo Data Products of sample sites (MRD-116)
- SMR – 03: For each data product listed in SMR-01, the following four variables shall be independently constrained and used to assess the site-specific sampleability:
  - Slope of the Particle Size-Frequency Distribution (PSFD)
  - Maximum grain size
  - Minimum grain size



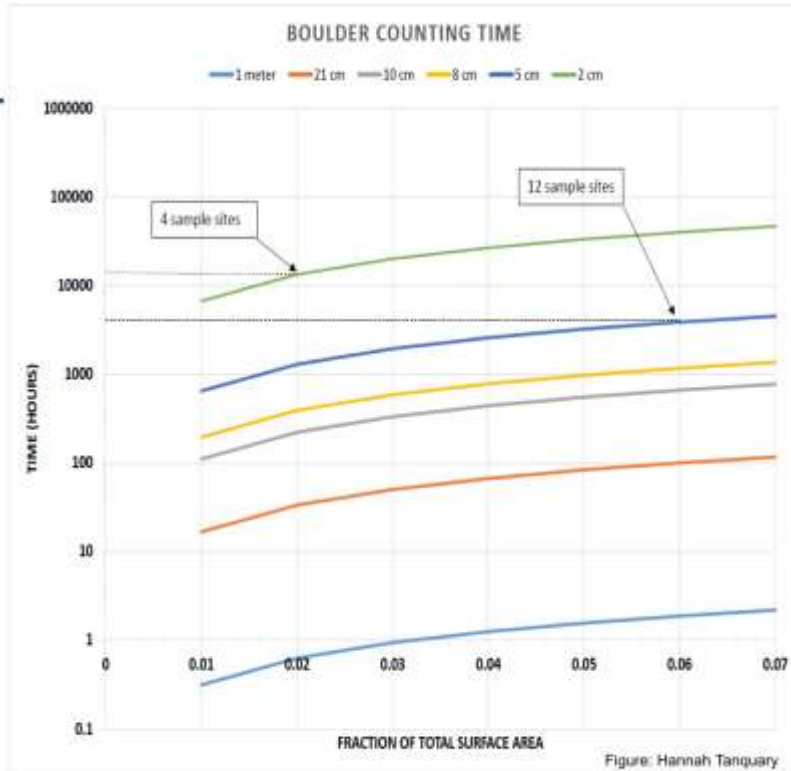
## Sampleability Maps MRDs

---

### Global Sampleability Maps

- SMR – 23: Global Sampleability assessment shall be based on the following data products:
  - Global Mosaic @ 21-cm resolution (MRD-121)
  - Global PSFD graphs (50-m x 50-m grid) and Global PSFD map (1-m and 21-cm resolution) (MRD-121)
  - Global Stereo images of Asteroid Surface (MRD-121)
- SMR – 25: For each data product listed in SMR-23, the following three variables shall be independently constrained and used to assess the global sampleability:
  - Slope of the Particle Size-Frequency Distribution (PSFD)
  - Maximum grain size





Boulder Counting Summit (June 16, 2015)



## SFD Product Timing Estimates

### Assumptions

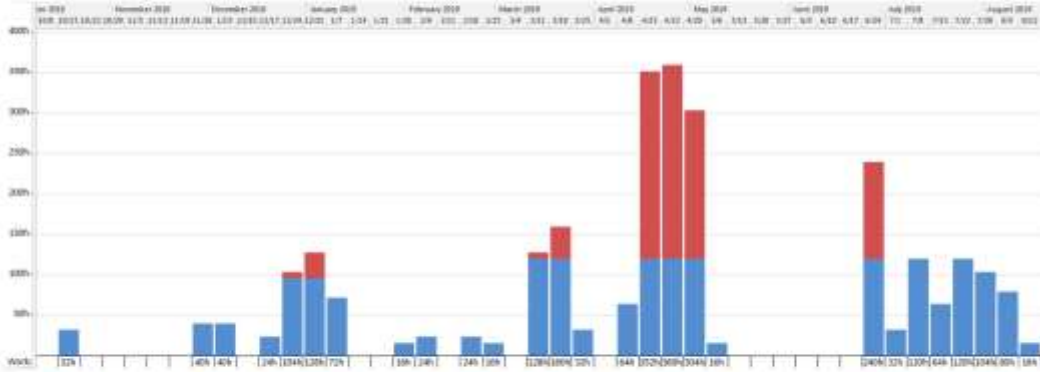
- 8 hours/day
- 5 days/week
- Each image is counted **once** by **one** person

Map	coverage	person-hours	time frame	# of people
Global 1-m	100%	80	2 weeks	1
Global 21-cm	30%	600	5 weeks	3
12 sample sites 5-cm	6%	4000	6 weeks	15
4 sample sites 5-cm	2%	1300	6 weeks	5
2 sample sites 2-cm	1%	8000	6 weeks	30

Boulder Counting Summit (June 16, 2015)



# IPWG Phase E Resources



Assumes 3 people & a success oriented schedule

Boulder Counting Summit (June 16, 2015)

df)