OSIRIS-REx Update

New Frontiers 3, Phase C

OSIRIS-REx™
Asteroid Sample Return Mission

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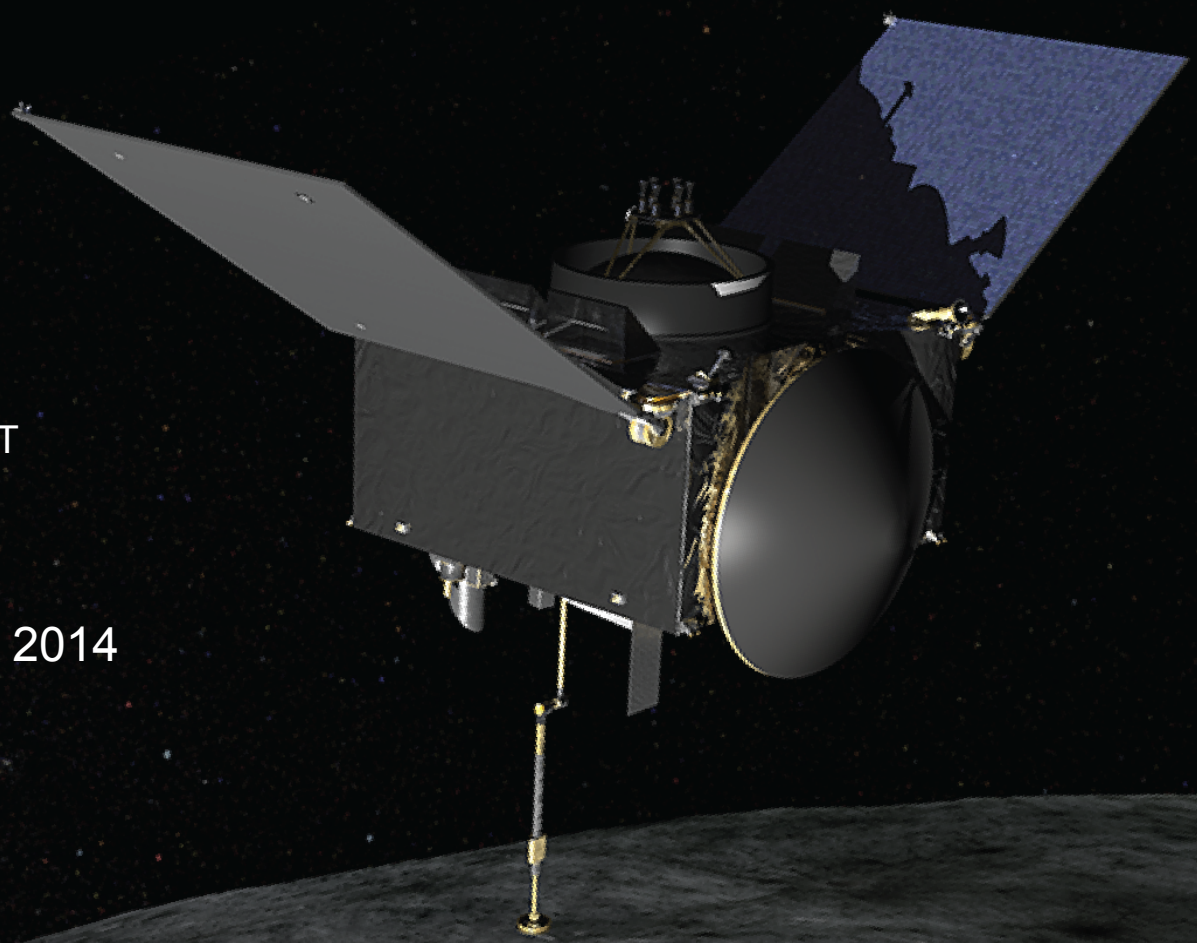
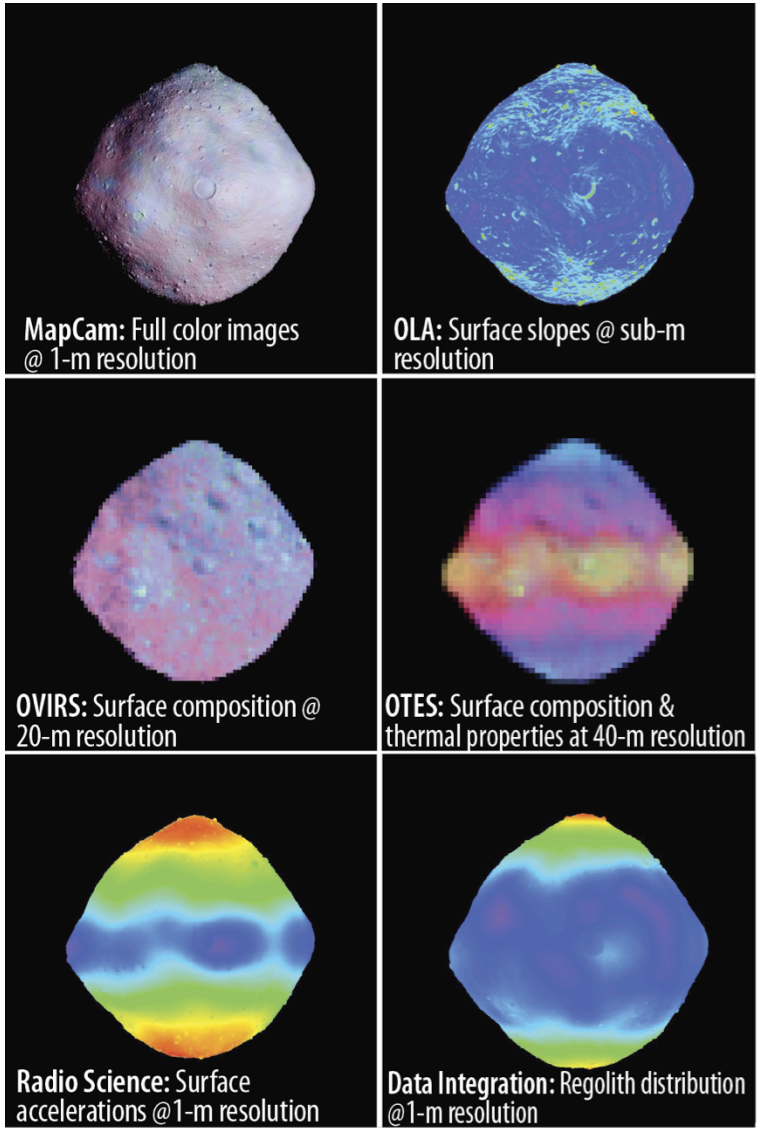
Project Scientist
GSFC

SBAG-January 9, 2014

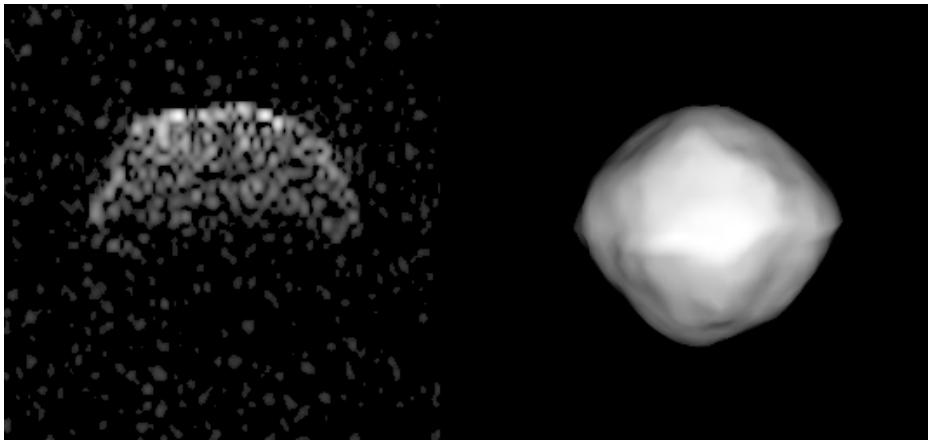


WHAT IS OSIRIS-REX?

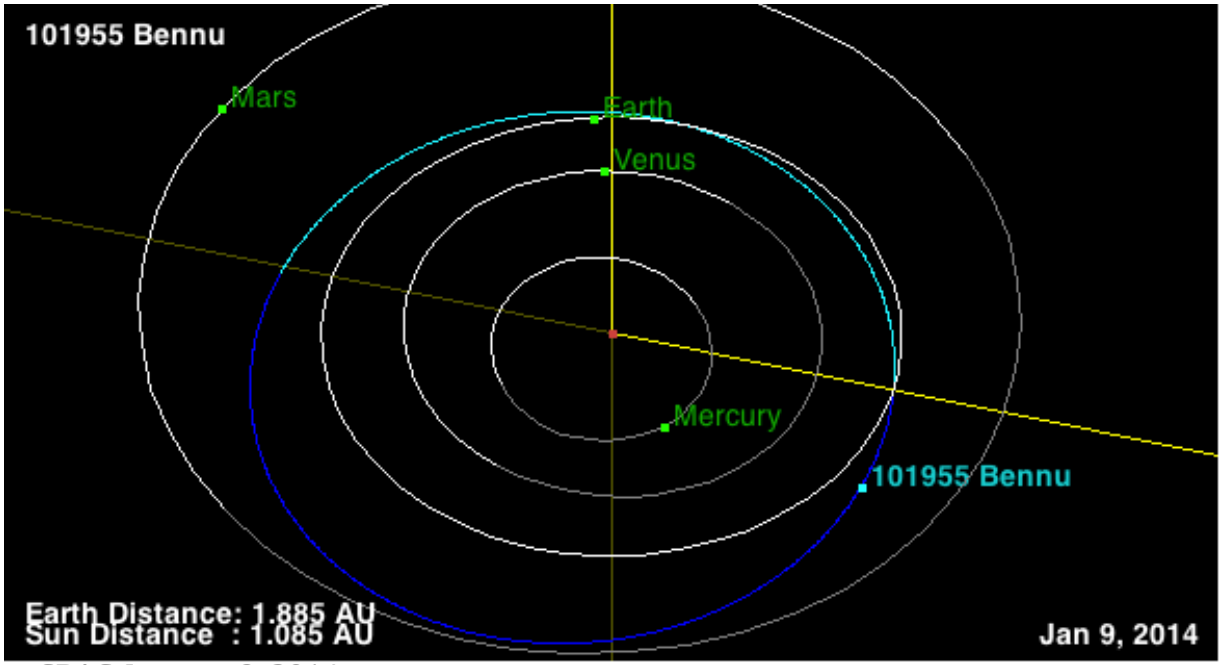


- **O**rigins
  - Return and analyze a sample of pristine carbonaceous asteroid regolith
- **S**pectral **I**nterpretation
  - Provide ground truth for telescopic data of the entire asteroid population
- **R**esource **I**dentification
  - Map the chemistry and mineralogy of a primitive carbonaceous asteroid
- **S**ecurity
  - Measure the Yarkovsky effect on a potentially hazardous asteroid
- **R**egolith **Ex**plorer
  - Document the regolith at the sampling site at scales down to the sub-cm

TARGET: BENNU



- It is a primitive asteroid, with a spectral signature suggesting a **carbon- and volatile-rich surface**
- Its **size (500-m), shape (spheroidal "spinning top"),** and **rotation state (4.3 hr period, 180° obliquity)** are known

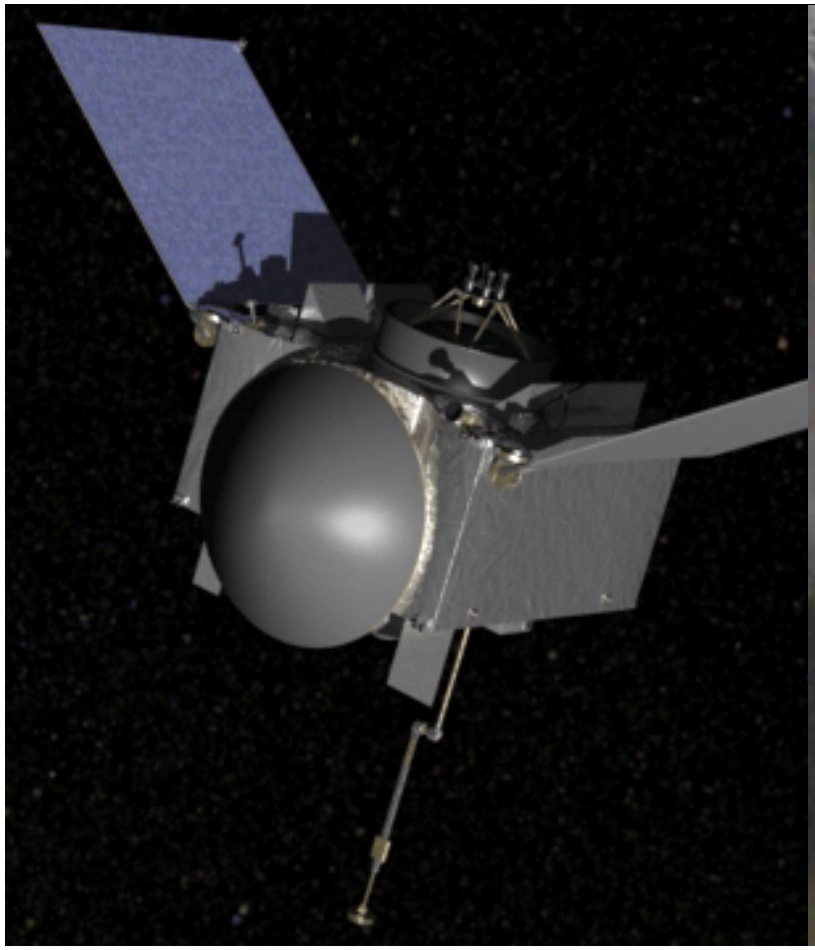


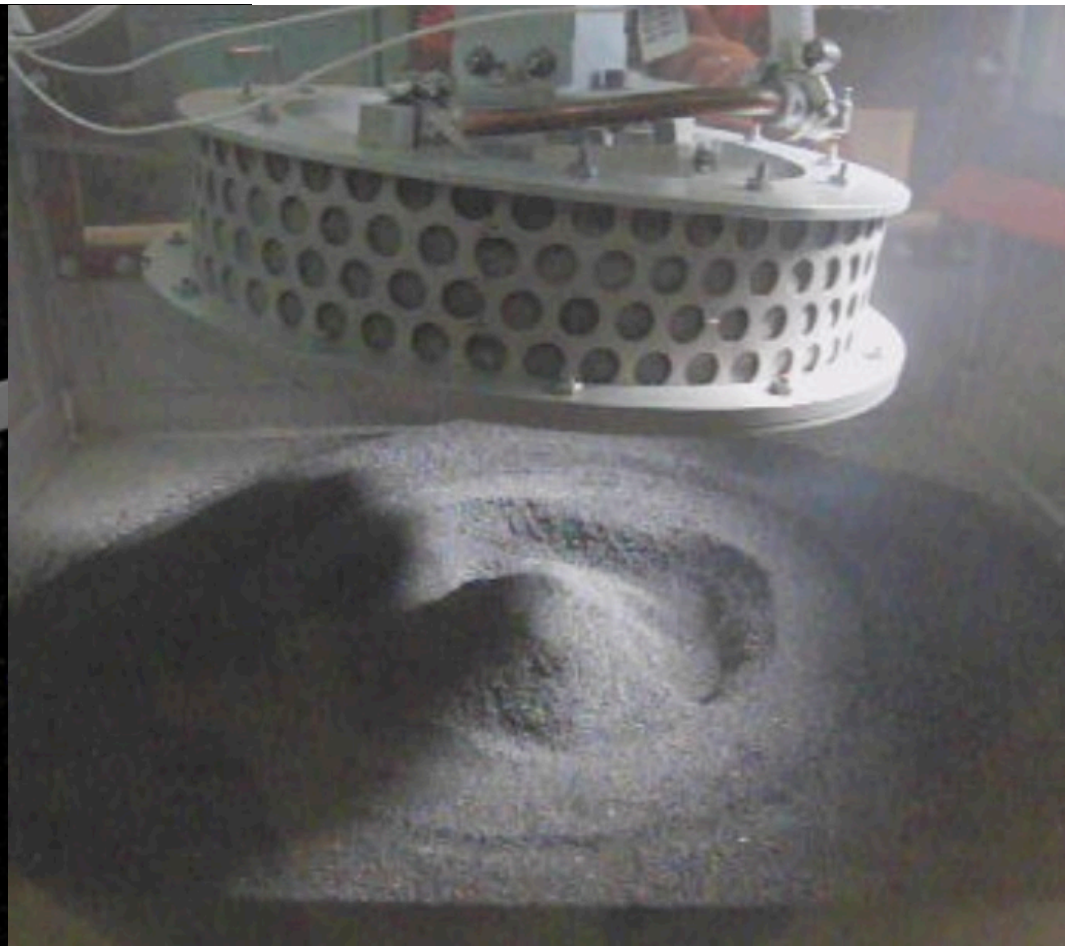
- All available data suggest **abundant regolith** on the surface available for sampling
- Study of this **Potentially Hazardous Asteroid** is strategically important to NASA and Congress

OVERVIEW OF THE OSIRIS-REX MISSION

- ✓ 2011 – May 25: Mission Selection
- ✓ 2013 – June 1: Mission Confirmation
- 2016 – September 3: Launch window opens
- 2018 – 2021: Bennu encounter
  - 2018 – August: Approach Phase – Astronomical properties and environment
  - 2018 – November: Survey Phase – Bulk properties, shape and spectroscopy
  - 2019 – January: Orbital Phase – Topography, gravity, and preliminary site characterization
  - 2019 – March: Recon Phase – Detailed sample-site characterization
  - 2019 – May: Rehearsal Phase – Rehearse sampling maneuvers
  - 2019 – July: **Collect at least 60 grams** of asteroid regolith (schedule and s/c allows for 2 additional attempts)
  - 2021 – March: Leave vicinity of asteroid
- 2023 – September 24: **Return Sample to Earth**
- 2025 – September 30: End of Sample Analysis and End of Mission

SAMPLE COLLECTION SYSTEM: TAGSAM





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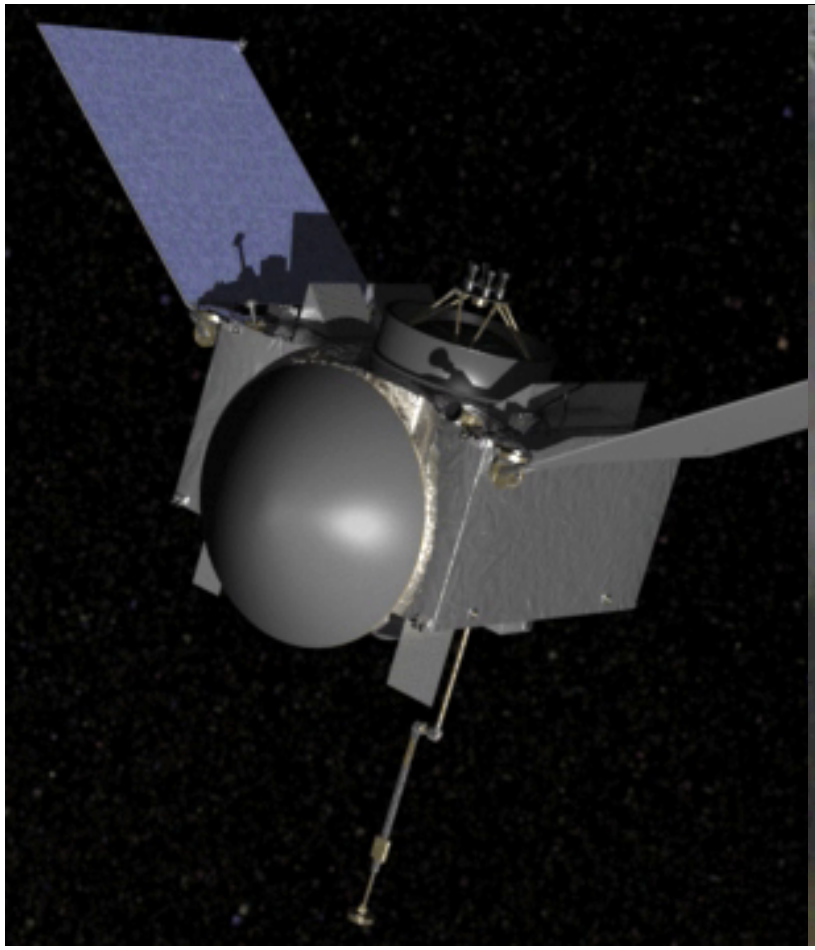
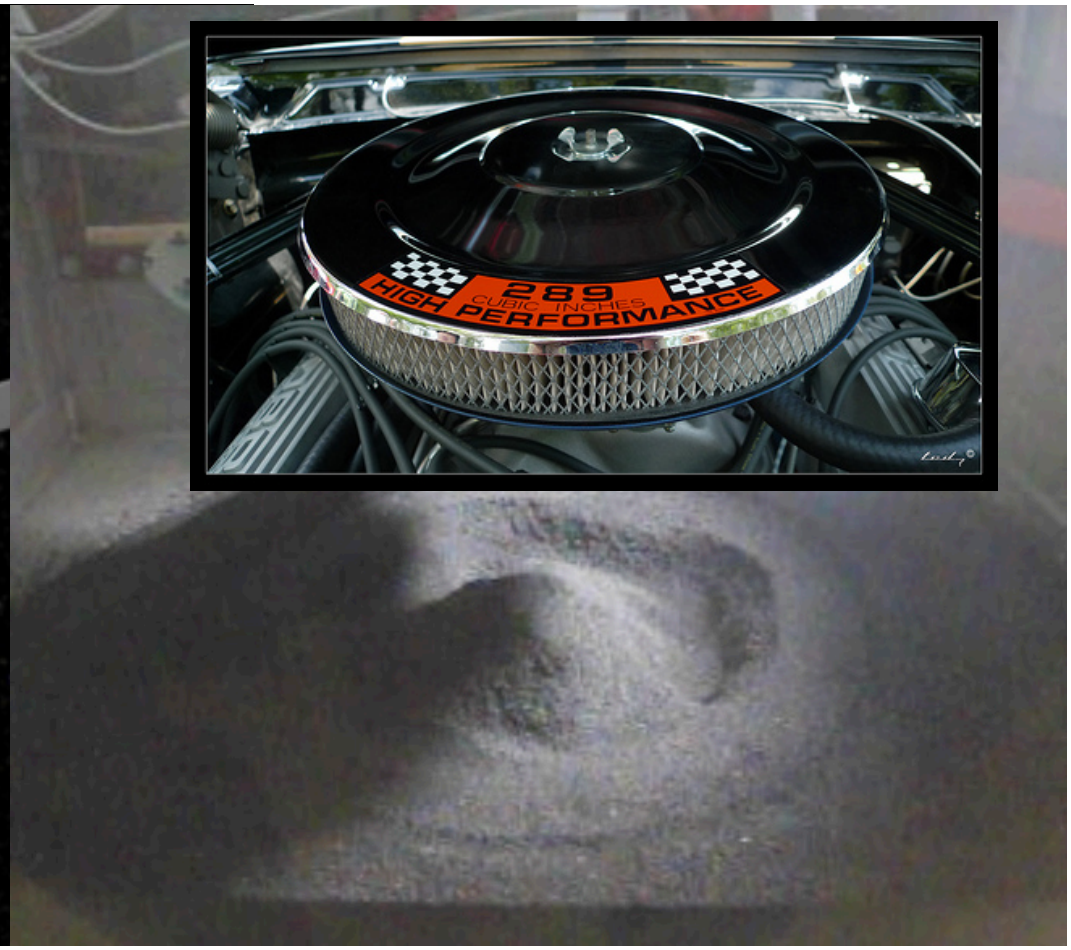


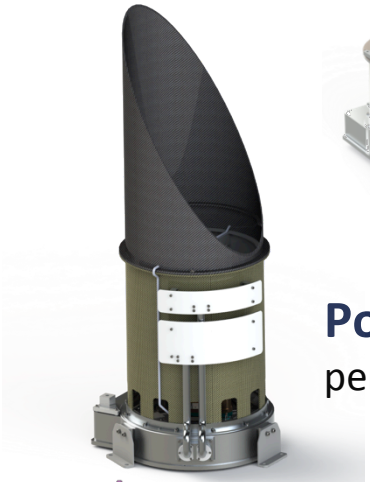


INSTRUMENT PAYLOAD

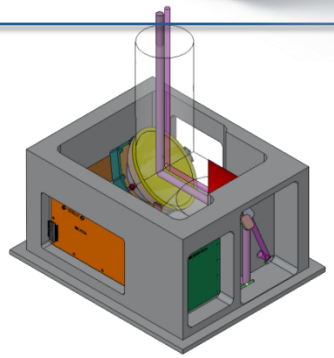
OCAMS (UA)

SamCam images the sample site, documents sample acquisition, and images TAGSAM to evaluate sampling success

MapCam provides landmark-tracking OpNav, performs filter photometry, maps the surface, and images the sample site

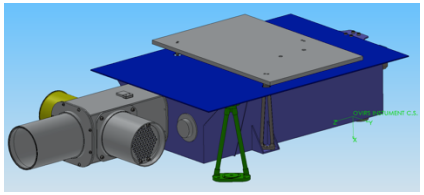


PolyCam acquires Bennu from >500K-km range, performs star-field OpNav, and performs high-resolution imaging of the surface



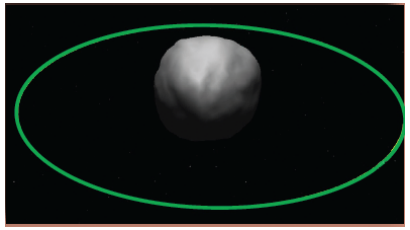
OLA (CSA) provides ranging data out to 7 km and maps the asteroid shape and surface topography

INSTRUMENT PAYLOAD

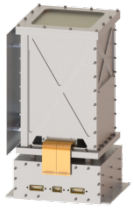


OVIRS (GSFC) maps the reflectance albedo and spectral properties from 0.4 – 4.3 µm

OTES (ASU) maps the thermal flux and spectral properties from 4 – 50 µm



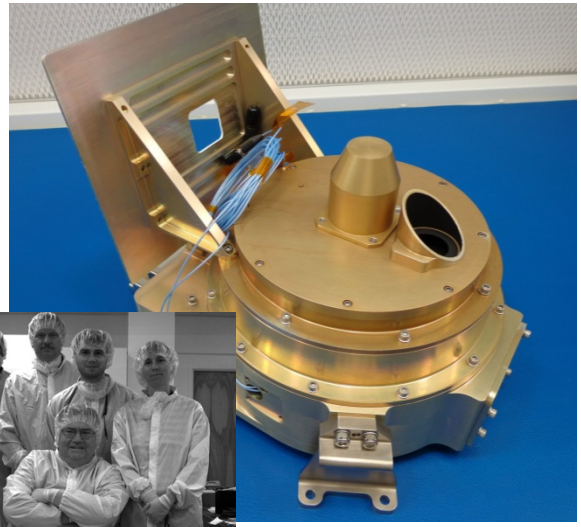
Radio Science (CU) reveals the mass, gravity field, internal structure, and surface acceleration distribution

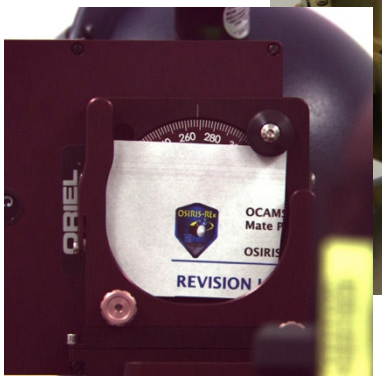


REXIS (MIT) is a Student Collaboration Experiment that trains the next generation of scientists and engineers and maps the elemental abundances of the asteroid surface

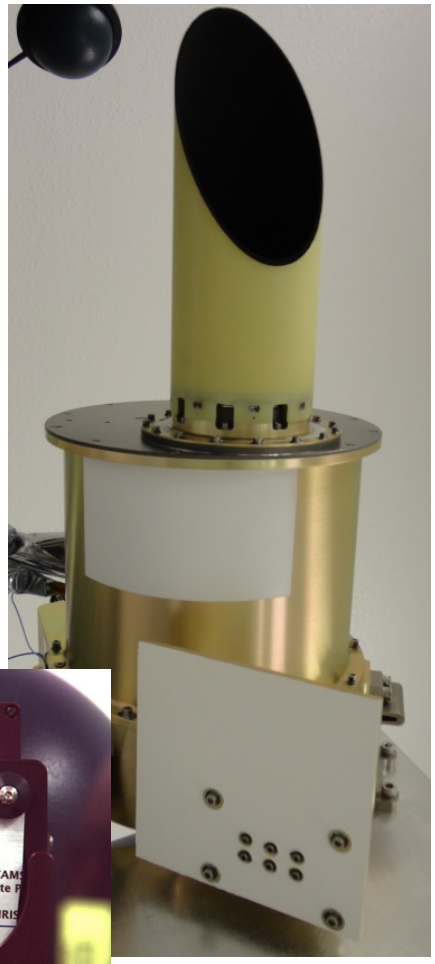
INSTRUMENT ENGINEERING UNITS!

SamCam

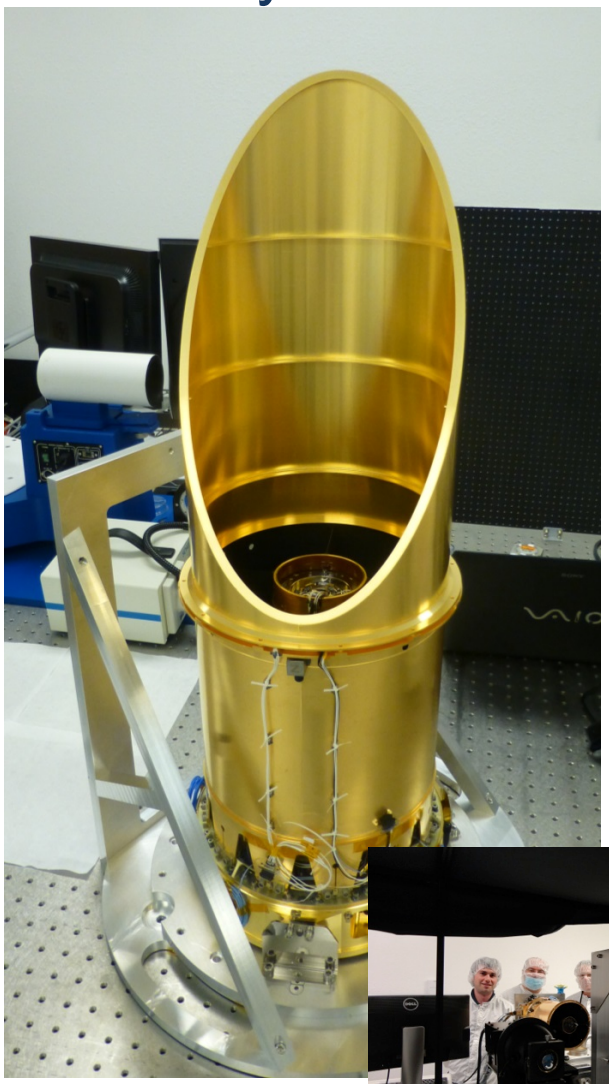


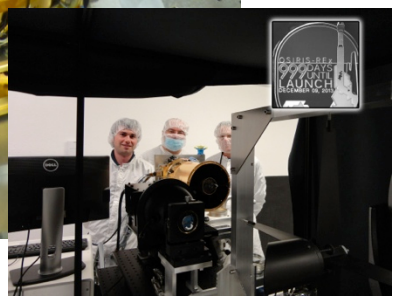


MapCam



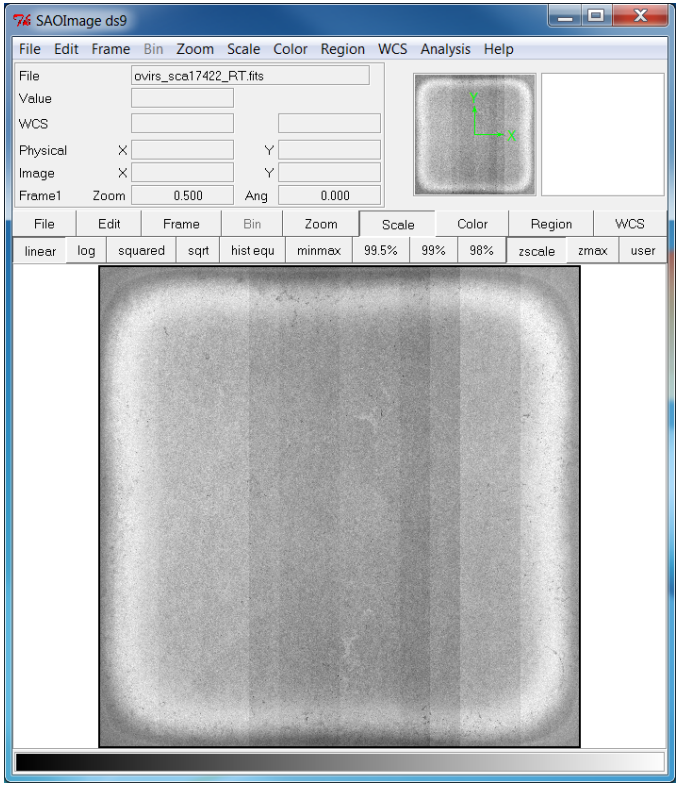
PolyCam



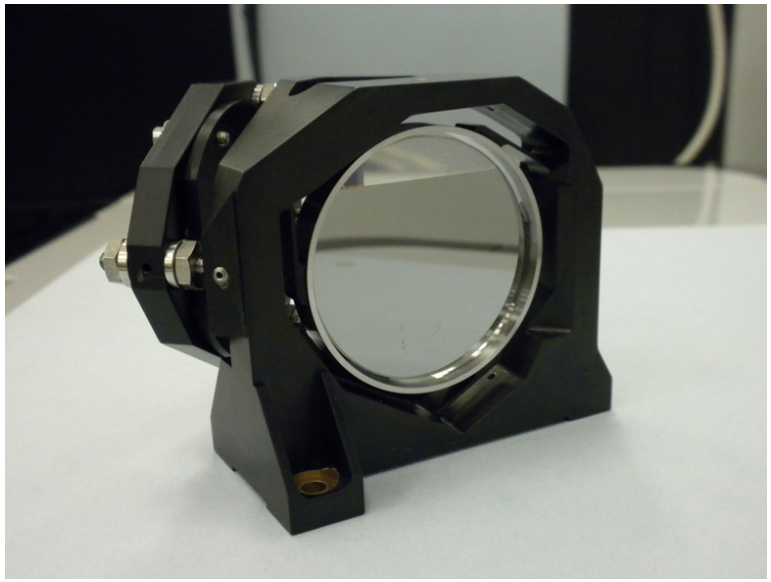


INSTRUMENT ENGINEERING UNITS!

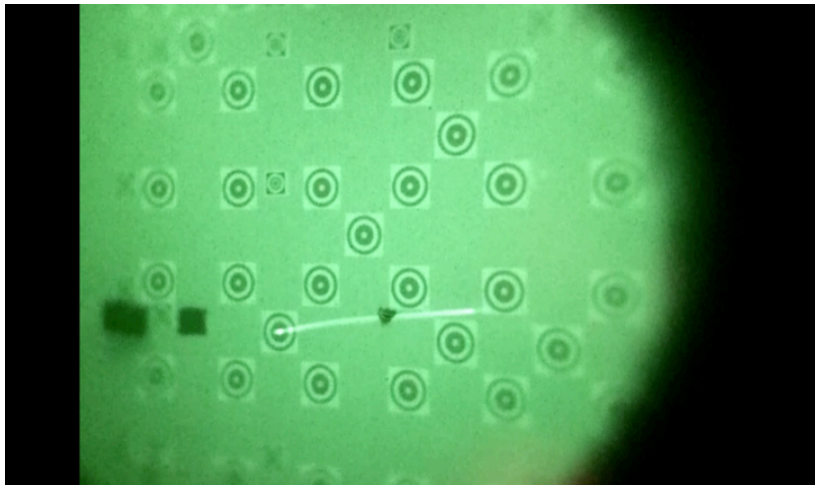
OVIRS Warm Detector Test



OTES diamond beamsplitter



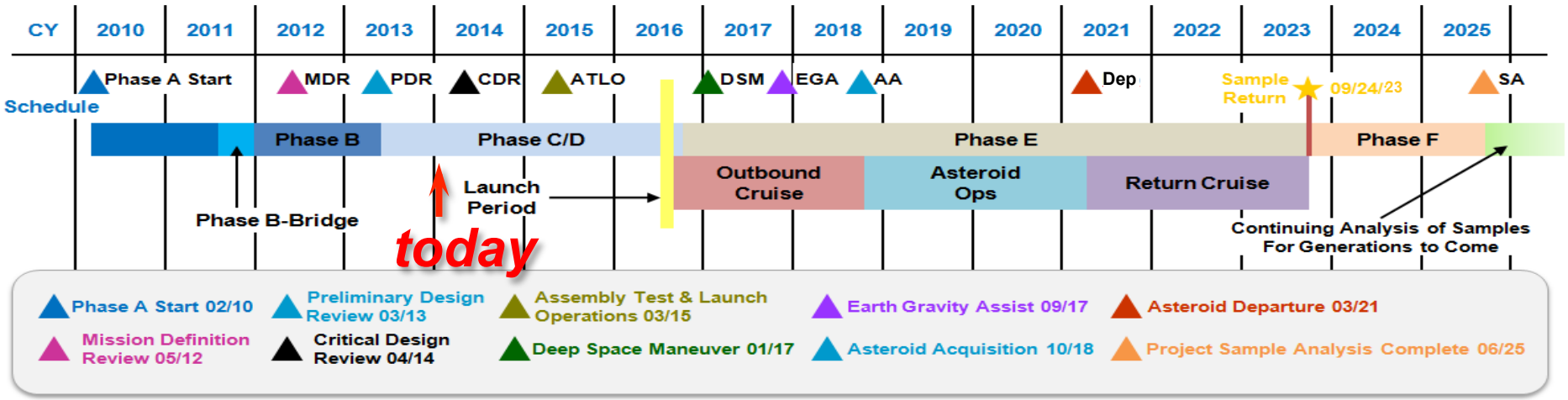
OLA First Scan



PROJECT IS HEALTHY

As of 12/31/13

Cost	Unliened/Unencumbered Reserves / Cost-to-Complete (w/o reserves)	=	28.4%
Schedule	(Unscheduled Months) / Years until launch	=	2.2 Mo/Yr
Dry Mass	(Maximum – Estimated)% / Estimated	=	15%
Power	(Allocated – Estimated)% / Estimated	=	22%



OTHER RECENT ACCOMPLISHMENTS

- Selection of ULA Atlas V 411 launch vehicle (8/5/13)

OTHER RECENT ACCOMPLISHMENTS

- Mission CDR (still) scheduled for April 1, 2014
  - OTES already passed CDR 12/6/13
  - OVIRS recovered lost schedule due to Federal shutdown and will have CDR 1/28-30/14 as planned!
  - Other subsystem CDRs and EPRs are on track

Status Date: December 13, 2013

Item No.	OSIRIS-REx - CDR's	Owner/Location	2013 Nov	2013 Dec	2014 Jan	2014 Feb	2014 Mar	2014 Apr	2014 May
			3 10 17 24	1 8 15 22 29	5 12 19 26	2 9 16 23	2 9 16 23 30	6 13 20 27	4 11 18 25
1	EPR - Gnd Ops/Prelim Mission Phase Review	GSFC/LM	Tues Afternoon 11/12 - Wed 11/13						
2	EPR - TAG Peer Review #1 (CDR)	GSFC/LM	Thurs 11/14						
3	OTES	ASU/ASU		Wed 12/4 - Fri 12/6					
4	EPR - SPOC/Science	UA/UA			Tues 1/7 - Thurs 1/9				
5	EPR - Flight Dynamics	GSFC/KinetX			Tues 1/14 - Wed 1/15				
6	C&DH	LM/LM			Mon 1/20				
7	Structures and Mechanisms	LM/LM			Mon 1/20 - Tues 1/21				
8	EPS	LM/LM			Tues 1/21 - Wed 1/22				
9	Thermal	LM/LM			Wed 1/22				
10	SRC Avionics Unit (AU)	LM/LM			Thurs Morning 1/23				
11	Propulsion	LM/LM			Thurs 1/23 - Fri 1/24 (1/2 day)				
12	Harness	LM/LM			Thur Afternoon 1/23				
13	Telecom	LM/LM			Thurs Afternoon 1/23 - Fri 1/24				
14	OVIRS	GSFC/GSFC			Tues 1/28 - Thurs 1/30 (TBC)				
15	Software (Flt, Sim, SoftSim, SELTS)	LM/LM				Mon 2/3 - Wed 2/5			
16	SARA/SRC/TAGSAM	LM/LM				Mon 2/3 - Fri 2/7			
17	GN&C	LM/LM				Thurs 2/6 - Fri 2/7			
18	Ground System	GSFC/UA				Tues 2/11 - Thurs 2/13			
19	REXIS	MIT/MIT				Tues 2/18 - Thurs 2/20			
20	Fault Protection	LM/LM				Wed 2/19			
21	EDL/Recovery and Curation	LM/LM				Thurs 2/20 - Fri 2/21 (1/2 day)			
22	OCAMS	UA/UA				Mon 2/24 - Fri 2/28			
23	Systems Engineering Peer Review	GSFC/GSFC					Tues 3/4		
24	**Combined Flt Sys/Mission CDR @ LM**	**GSFC/LM**						**Tues 4/1 - Wed 4/9**	
25	OLA CDR	CSA/MDA			Tues 4/29 - Thurs 5/1 (1/2 day)				

OTHER RECENT ACCOMPLISHMENTS

- New publications from science team work
  - Walsh et al., *Icarus* **225** (2013) 283–297

    Introducing the Eulalia and new Polana asteroid families: Re-assessing primitive asteroid families in the inner Main Belt
  - Nolan et al., *Icarus* **226** (2013) 629–640

    Shape model and surface properties of the OSIRIS-REx target Asteroid (101955) Bennu from radar and lightcurve observations
  - Hergenrother et al., *Icarus* **226** (2013) 663–670

    Lightcurve, Color and Phase Function Photometry of the OSIRIS-REx Target Asteroid (101955) Bennu
  - More submitted/in press describing Bennu properties
- Continue to improve our scientific understanding of Bennu and are passing the information to the engineers

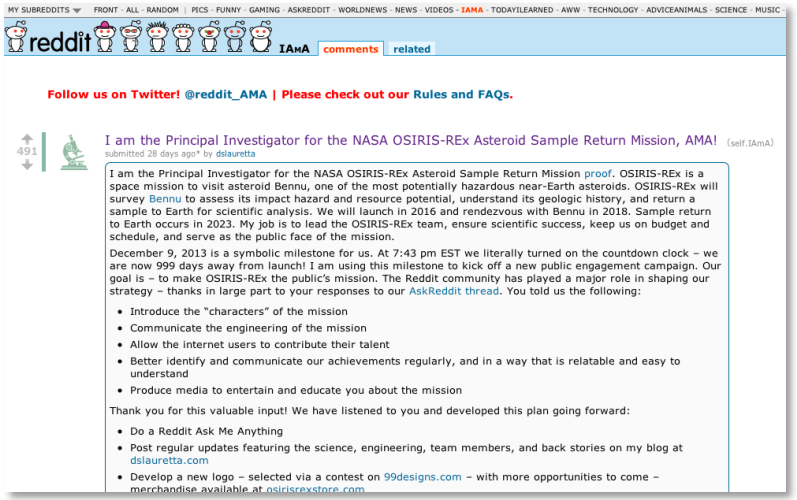
OTHER RECENT ACCOMPLISHMENTS

- 999 Days to launch event (12/9/13)
  - New logo, website, videos, Facebook, Reddit AMA…

PUBLIC ENGAGEMENT

Videos

Social Media



THANK YOU

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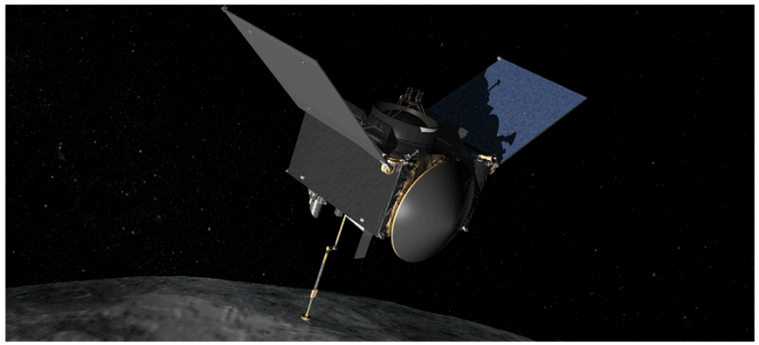
dslauretta.com



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