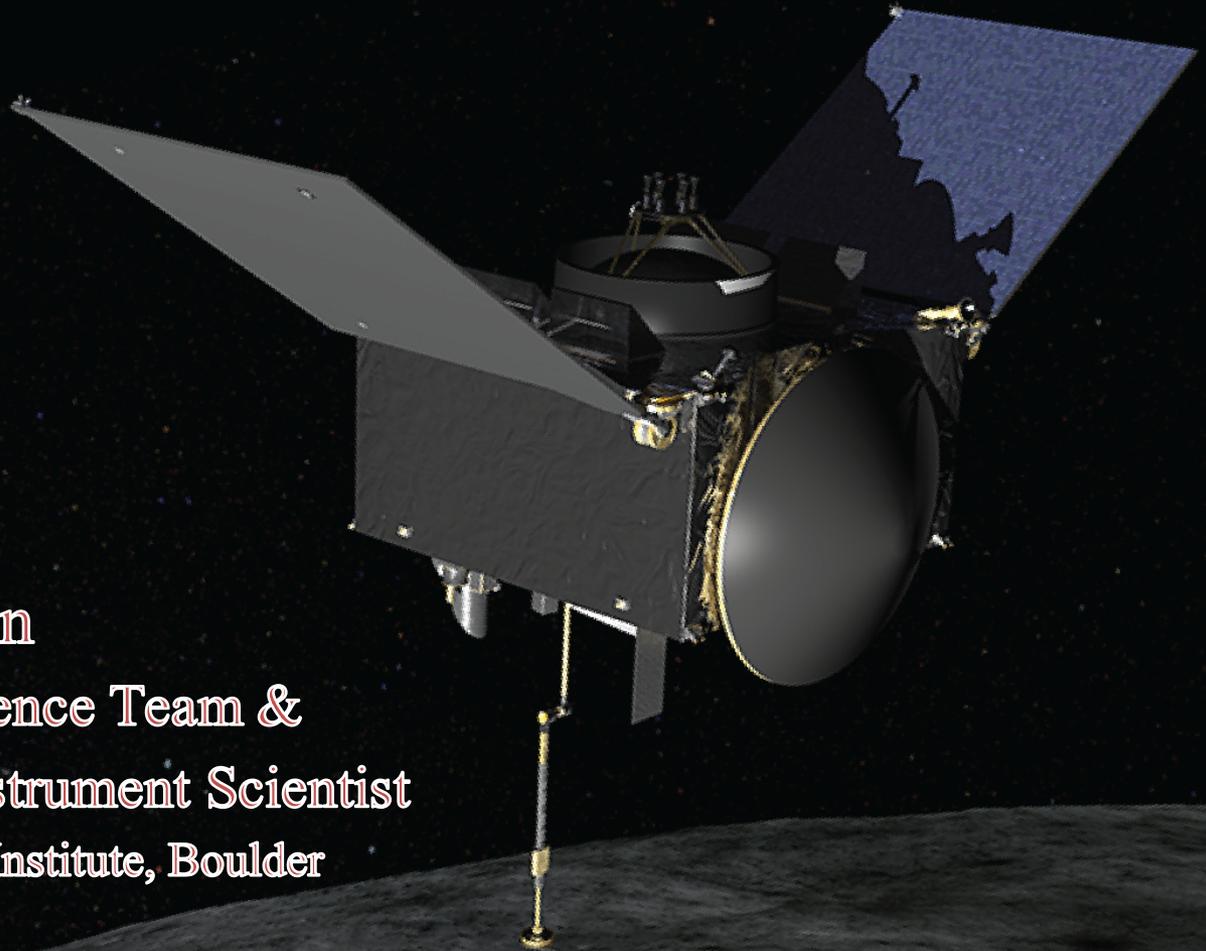




# OSIRIS-REx Mission Overview

**OSIRIS-REx™**  
ASTEROID SAMPLE RETURN MISSION

Vicky Hamilton  
OSIRIS-REx Science Team &  
OTES Deputy Instrument Scientist  
Southwest Research Institute, Boulder





# OSIRIS-REx DEFINED

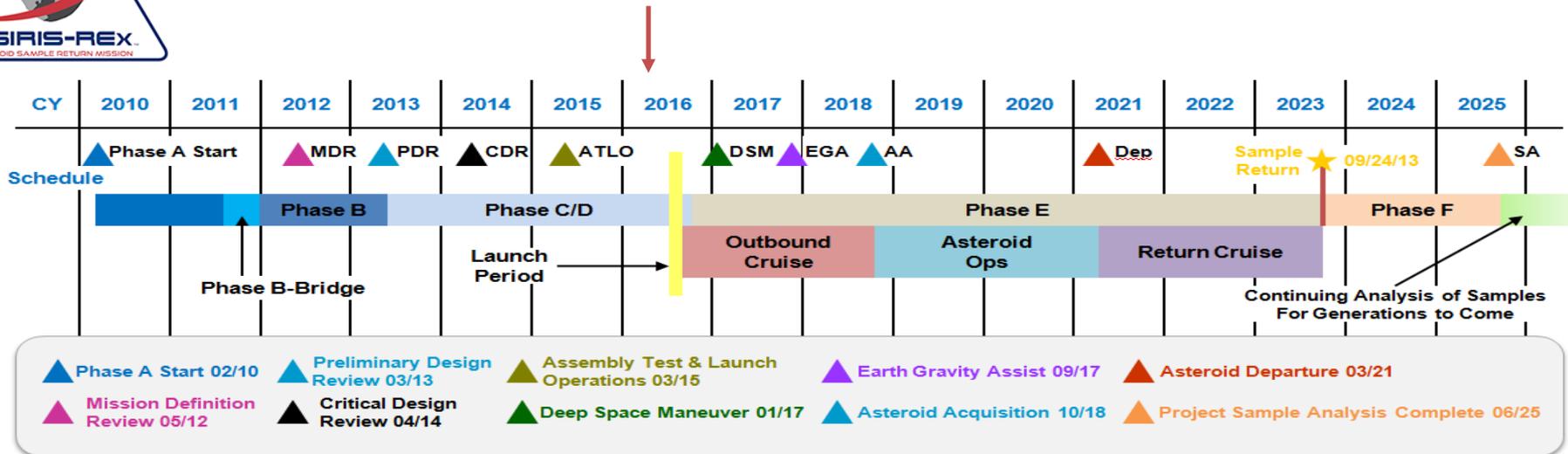
---



- **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 **E**xplorer
  - Document the regolith at the sampling site at scales down to the sub-cm



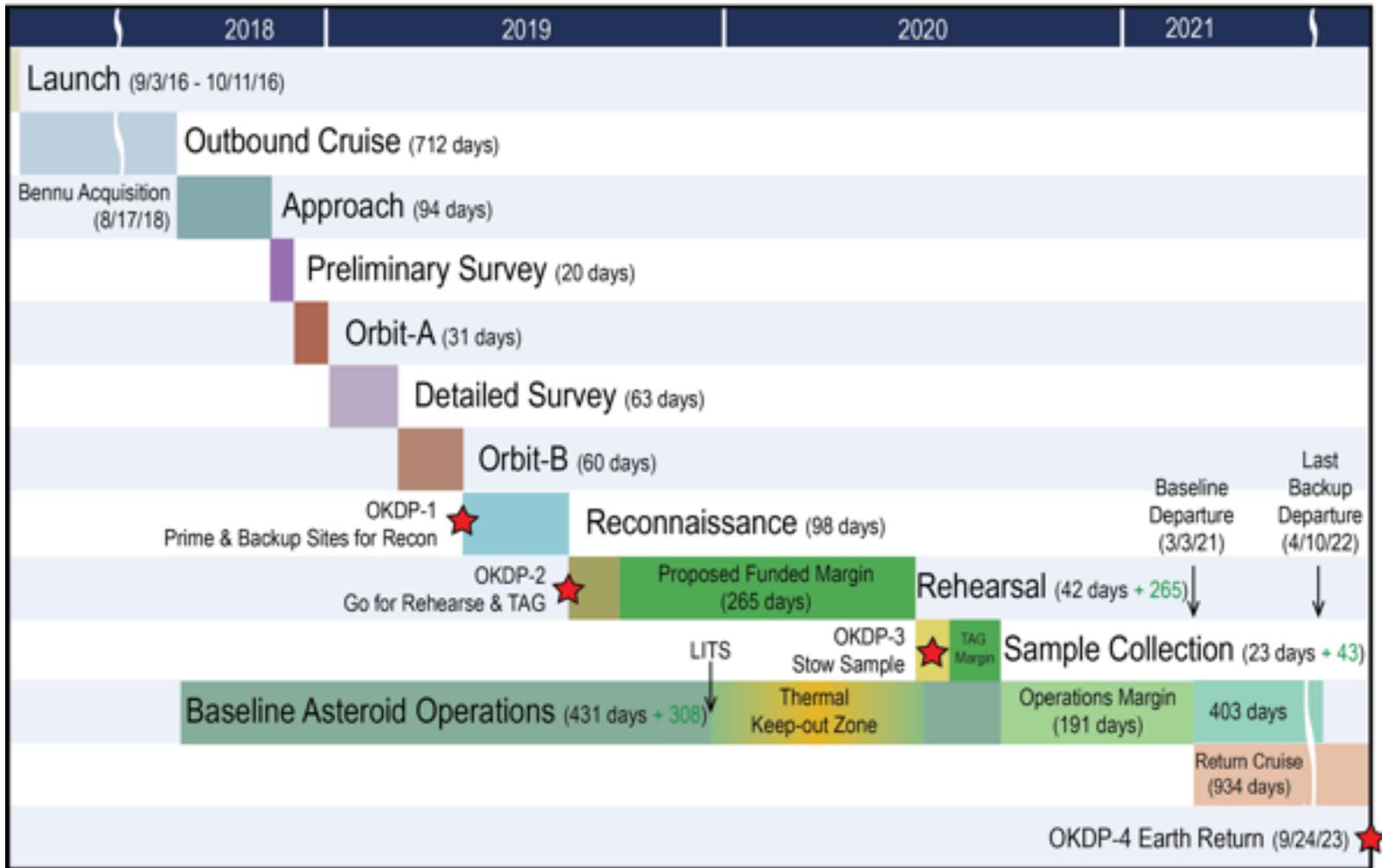
# MISSION TIMELINE



- **NASA Selects OSIRIS-REx for flight: May 25, 2011**
- Preliminary Design Review (PDR): March 2013
- Critical Design Review (CDR): April 2014
- System Integration Review (ATLO): February 2015
- **Launch: 8 September 2016**
- Earth Gravity Assist (EGA): September 2017
- **Asteroid Arrival (AA): August 2018**
- **Asteroid Departure (Dep): March 2021**
- **Sample Return: September 2023**
- **End of Mission (Sample Analysis – SA): September 2025**



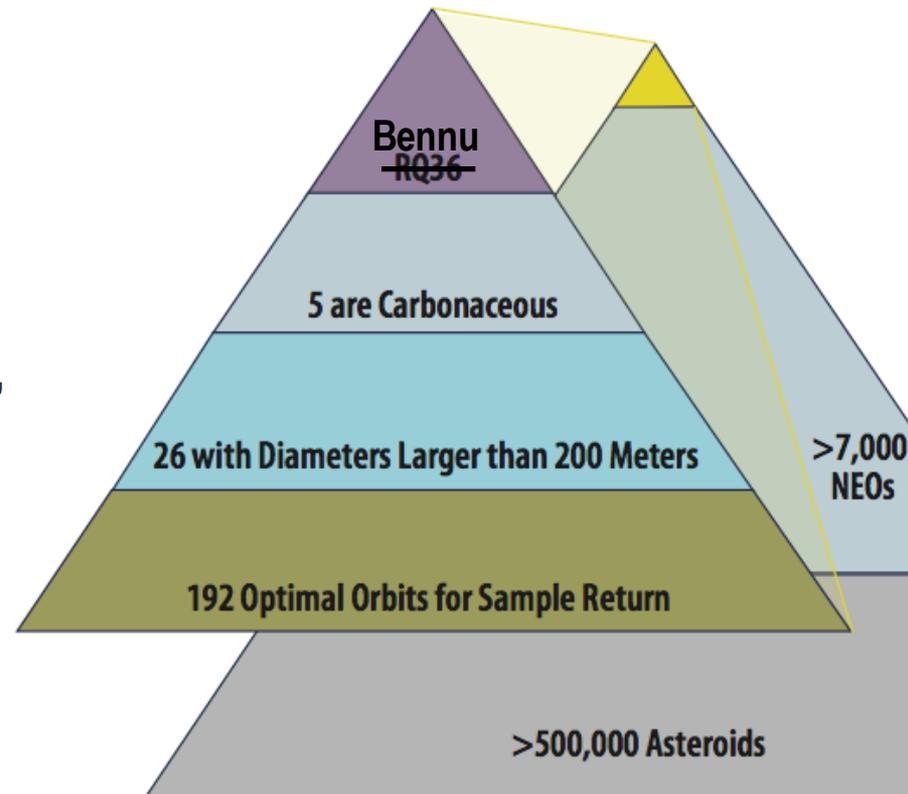
# MISSION OPERATIONS TIMELINE AT ASTEROID





# DESTINATION: BENNU

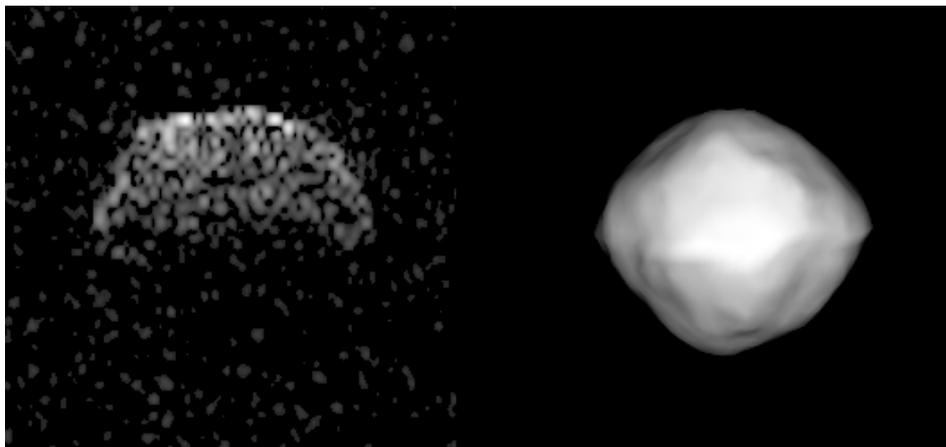
- Among all asteroids in our Solar System, why Bennu?
- Earth-crossing orbit that's easy to get to
- Distance to sun is “just right”
- Big enough to rotate slowly (~4.3 hr day) and not eject all surface particles
- Organics and water in minerals





# RADAR IS A UNIQUELY POWERFUL SOURCE OF INFORMATION ABOUT ASTEROID PHYSICAL PROPERTIES

---



- Radar measurements provided two-dimensional images with spatial resolution of 7.5 m
- Detailed three-dimensional model
  - **Size** = 550-m ( $\pm 20$  m, mean diameter)
  - **Shape** = spheroidal “spinning top”
  - **Rotation state** = 4.3 hr period,  $180^\circ$  obliquity
- Radar also probed the near-surface bulk density ( $1.3 \text{ g cm}^{-3}$ ) and structural scales larger than a few centimeters

# OUR PAYLOAD PERFORMS EXTENSIVE CHARACTERIZATION AT GLOBAL AND SAMPLE-SITE-SPECIFIC SCALES

**OCAMS  
(UA)**



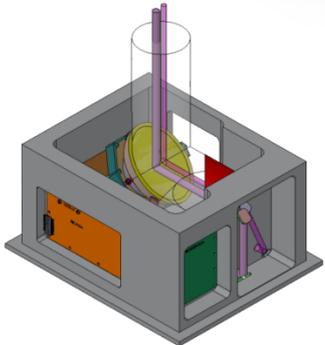
**SamCam** images the sample site, documents sample acquisition, and images TAGSAM to evaluate sampling success



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



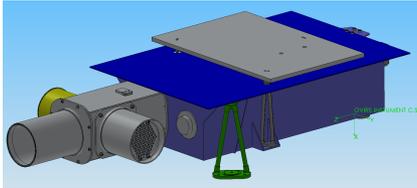
**PolyCam** acquires Bennu from >500K-km range, performs star-field OpNav, and performs high-resolution imaging of the surface



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

# SPACECRAFT-BASED REMOTE SENSING PROVIDES GROUND TRUTH FOR OUR ASTRONOMICAL DATA

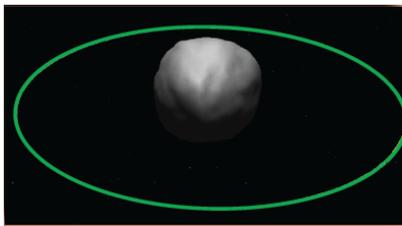
---



**OVIRS (GSFC)** maps the reflectance albedo and spectral properties from 0.4 – 4.3  $\mu\text{m}$



**OTES (ASU)** maps the thermal flux and spectral properties from 5.5 – 50  $\mu\text{m}$



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



**REXIS (MIT)** Student experiment - maps the elemental abundances of the asteroid surface



# OSIRIS-REx IS DEVELOPING CRITICAL TECHNOLOGIES FOR EXPLORING NEAR-EARTH ASTEROIDS

---

- Astronomical characterization in support of mission design
- Measurement of asteroid global characteristics
- Detailed characterization of an asteroid surface at sub-cm scales
- Mission-critical data processing and analysis on a tactical timeline
- Accurate navigation in microgravity
- Delivery to a specific location on the asteroid surface
- Successful contact and acquisition of material from an asteroid surface
- Safe return of the sample to Earth



# JOIN THE MISSION ON THE WEB!



**OSIRIS-REX™**  
ASTEROID SAMPLE RETURN MISSION

## Social Media Activities

- Website: [asteroidmission.org](http://asteroidmission.org)
- [Facebook](#) and [Twitter](#) feeds
- PI blog: [dslauretta.com](http://dslauretta.com)
- [321 Science](#) videos

Merchandise at:

[www.osirisrexstore.com](http://www.osirisrexstore.com)