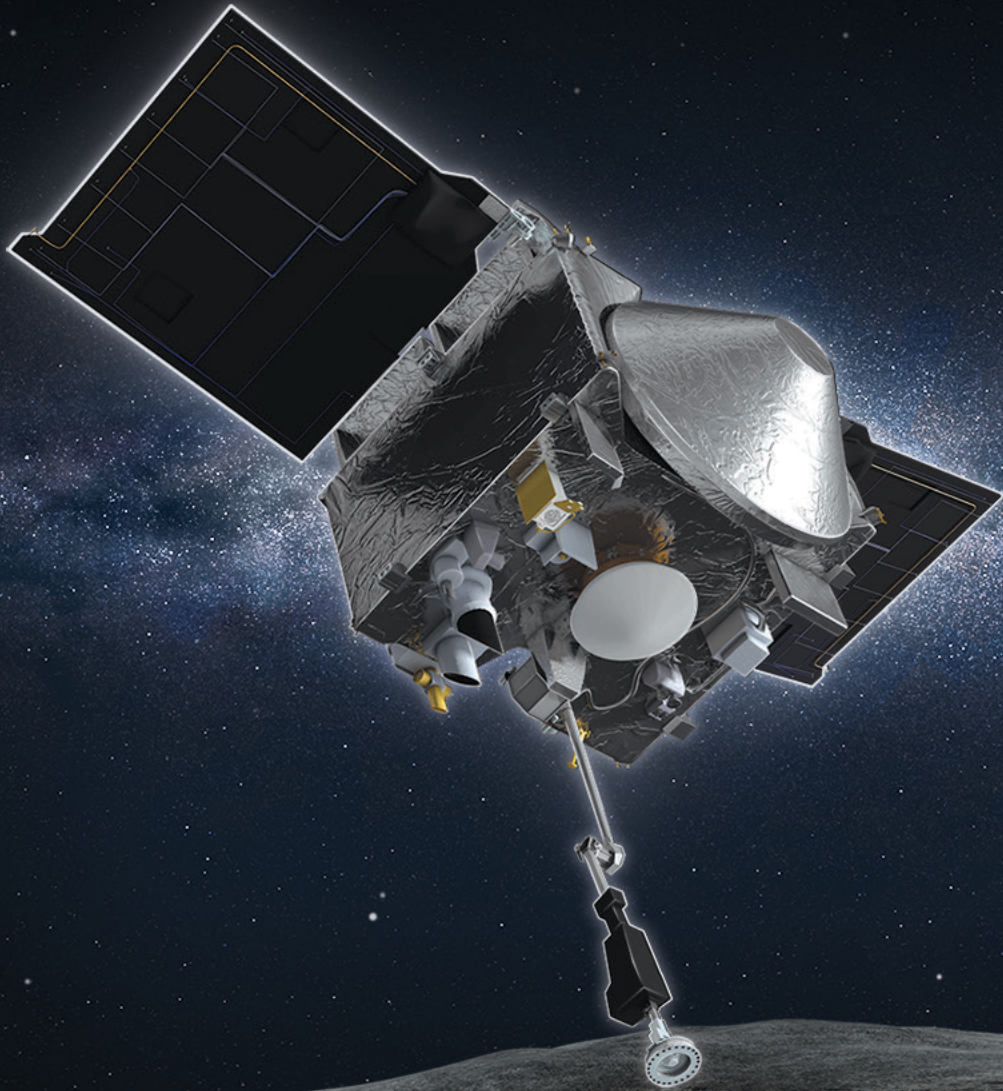




**OSIRIS-REx**  
ASTEROID SAMPLE RETURN MISSION



# Overview and Highlights of the OSIRIS-REx Mission

A.A. Simon  
(NASA Goddard Space Flight Center)

& all of the OREx team!



# Mission Overview

## Origins

Return and analyze a sample of pristine carbonaceous asteroid regolith

## Spectral Interpretation

Provide ground truth for telescopic data of the entire asteroid population

## Resource Identification

Map the chemistry and mineralogy of a primitive carbonaceous asteroid

## Security

Measure the Yarkovsky effect on a potentially hazardous asteroid

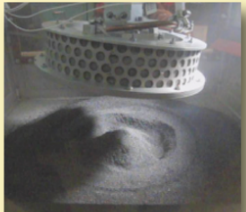
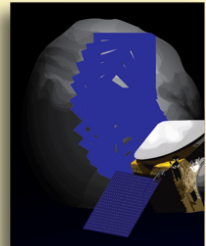
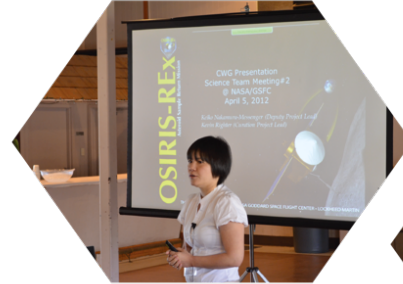
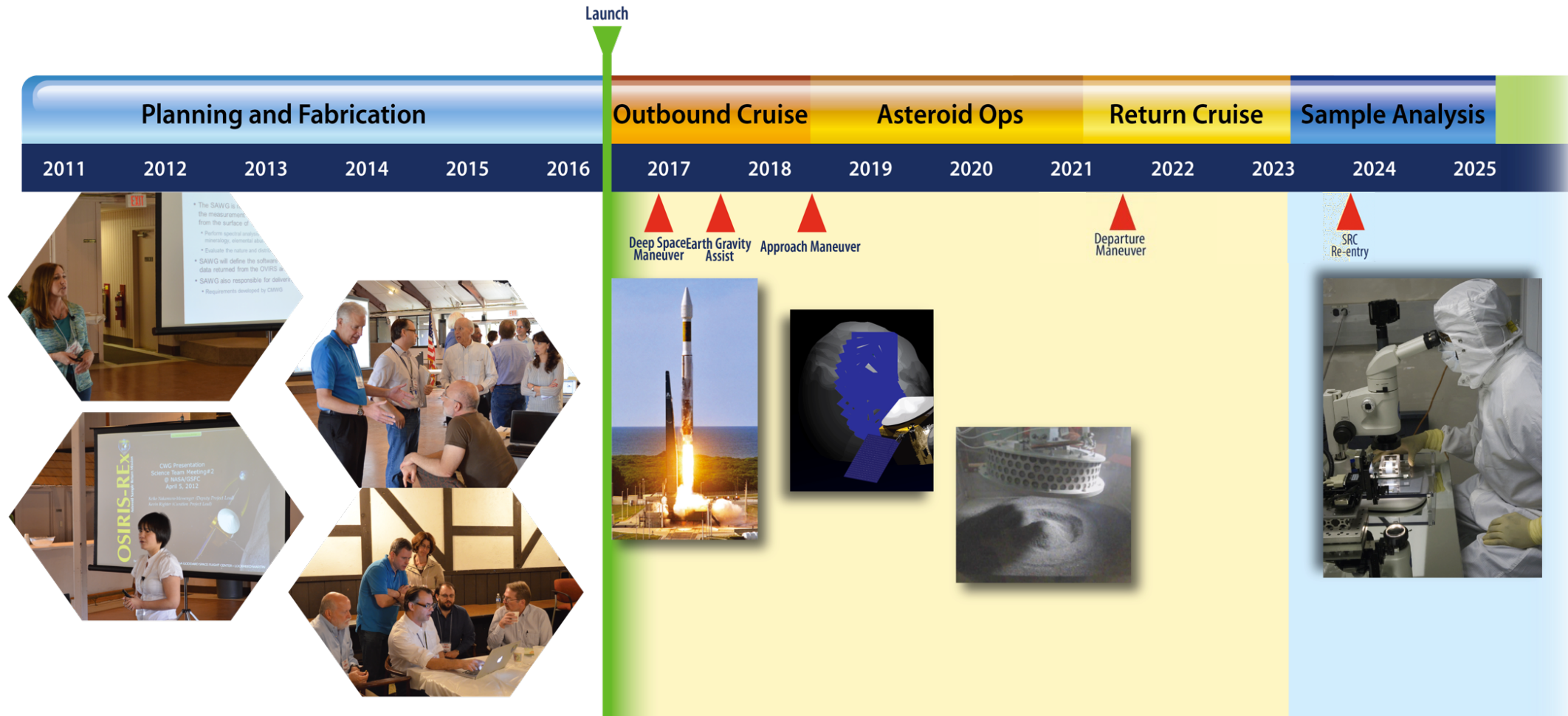
## Regolith Explorer

Document the regolith at the sampling site at cm scale



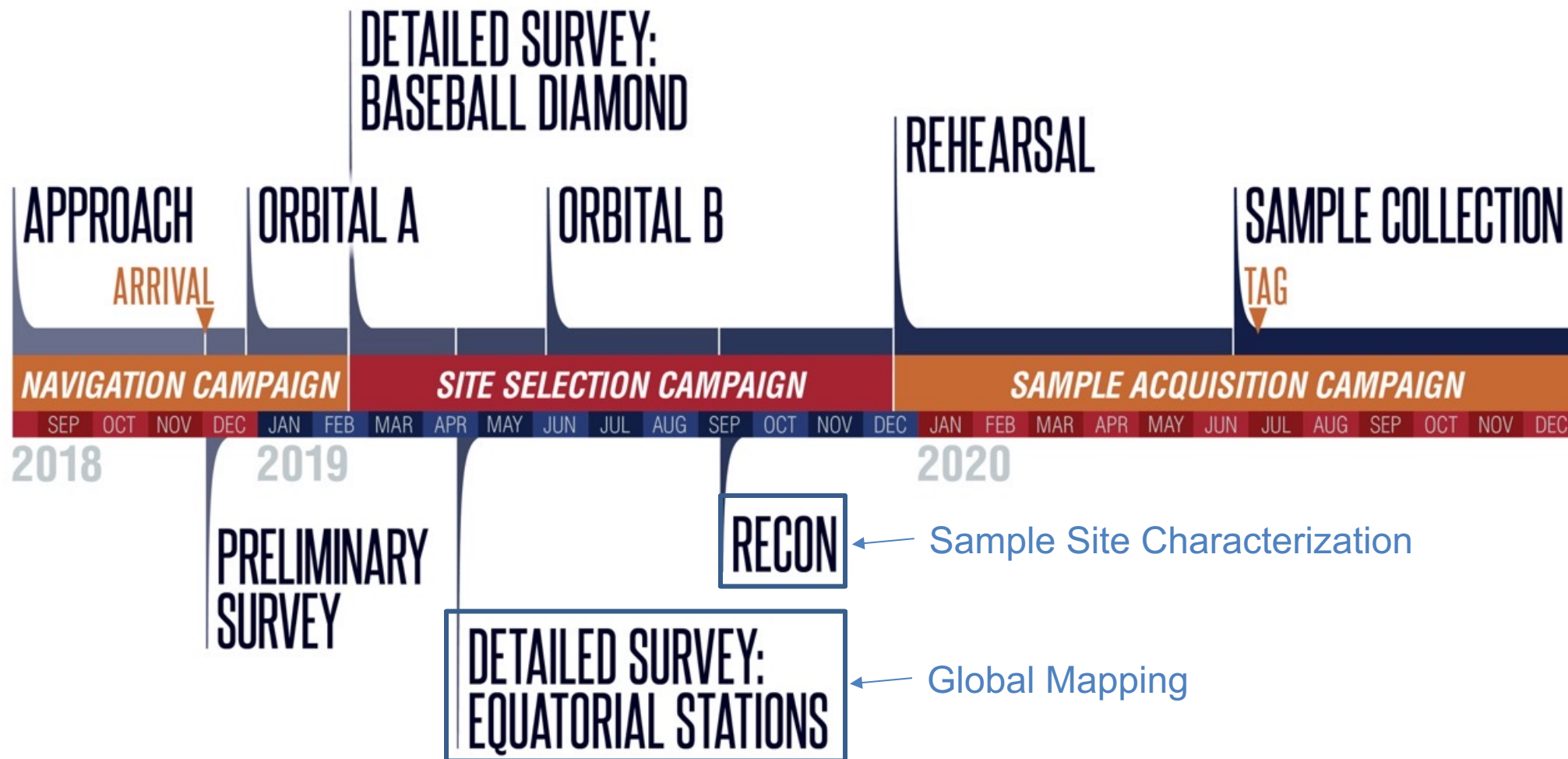


# Mission Timeline





# Asteroid Operations Plan

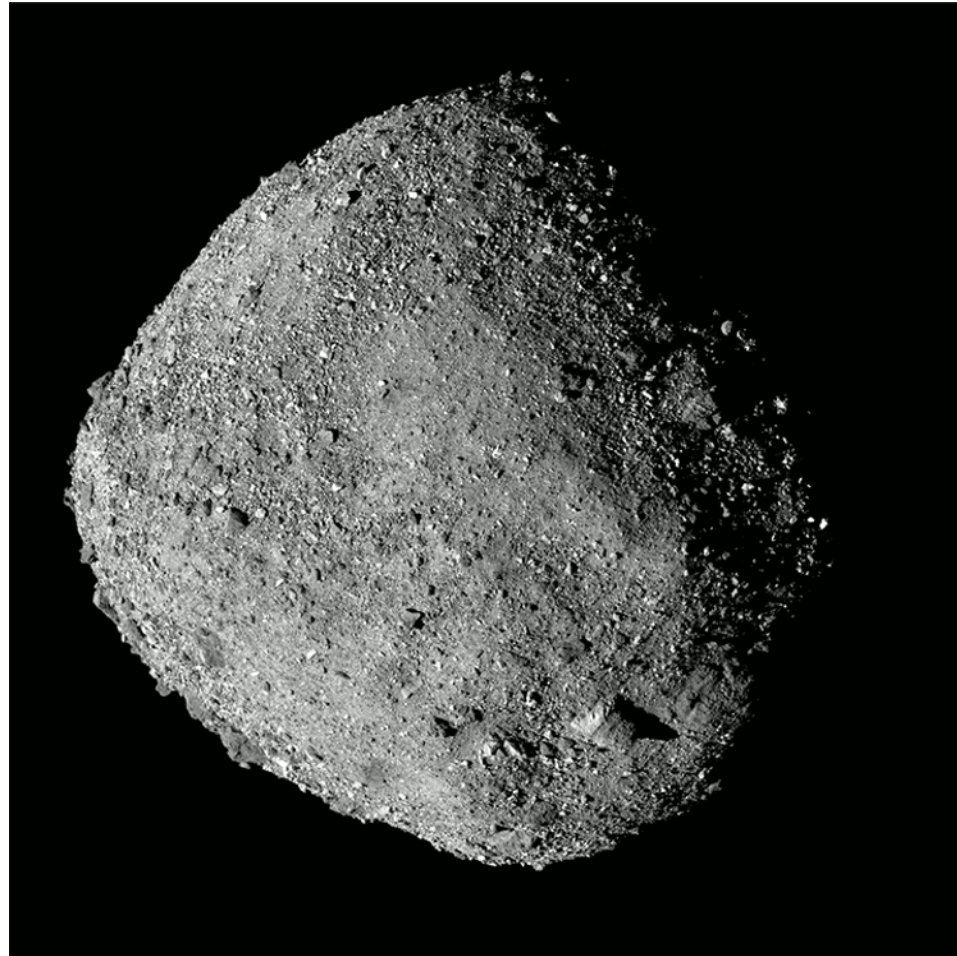




# Discoveries on Approach

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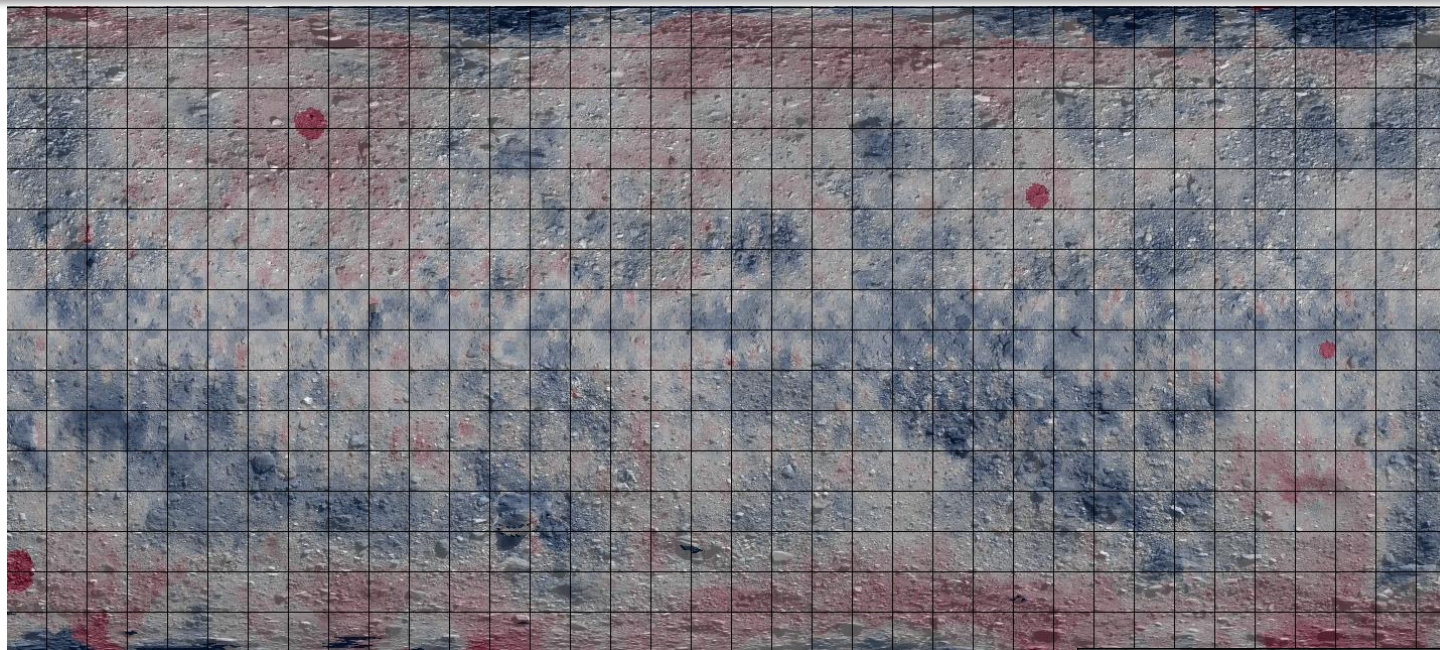
Boulders, boulders, more boulders





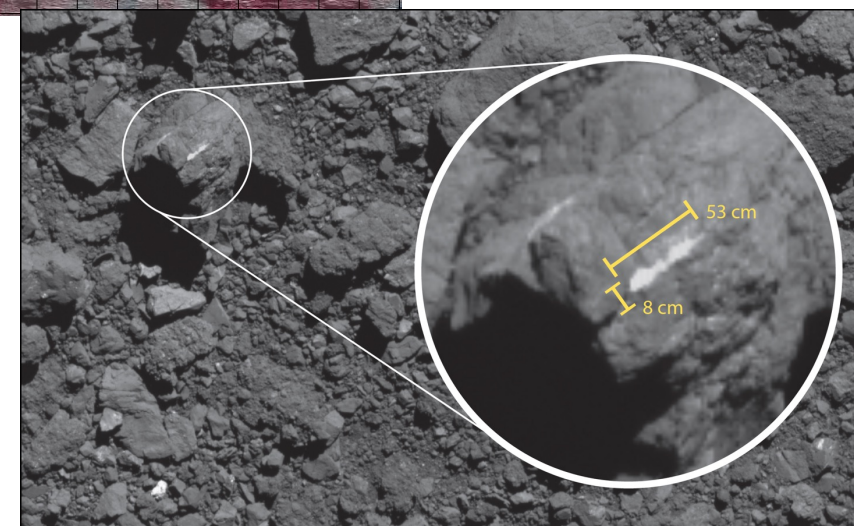
# Mission Highlights: Composition

- Global maps:
  - Blue spectral slope
  - Carbon-bearing materials and hydrated phyllosilicates everywhere
  - Iron oxides present
- Small amounts of exogenous material
  - pyroxene



1.05-micron band depth map

Veined boulders

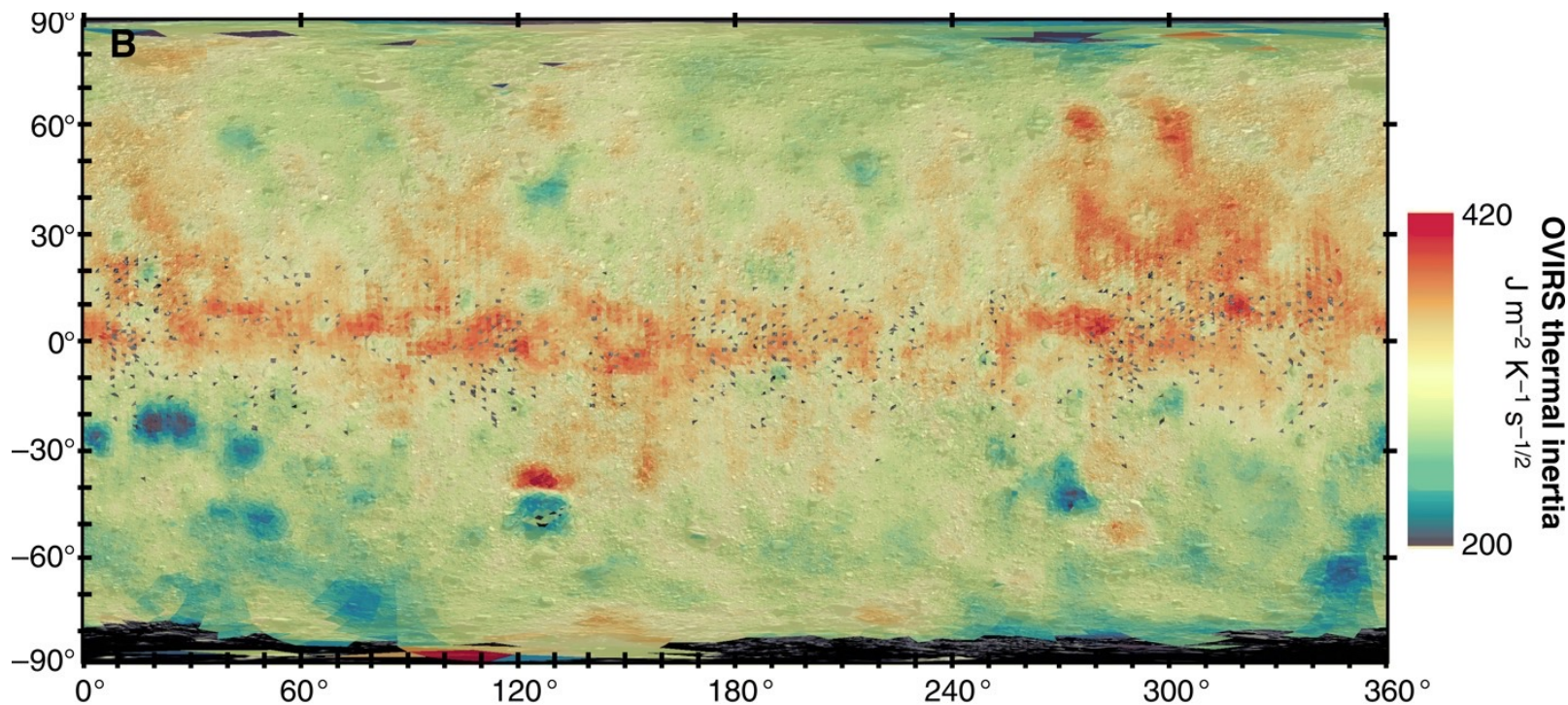


DellaGiustina et al. *Nat. Astro.* 2020,  
Kaplan et al. *Science* 2020,  
Simon et al. *Science* 2020



# Mission Highlights: Thermal Inertia

We expected large boulders with high thermal inertia and dusty areas with low thermal inertia, but found the opposite: could be due to compacted material and/or porous boulders





# TAG







# Contact!

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# Gas firing





# TAG Sequence

IMU velocity 10 cm/s

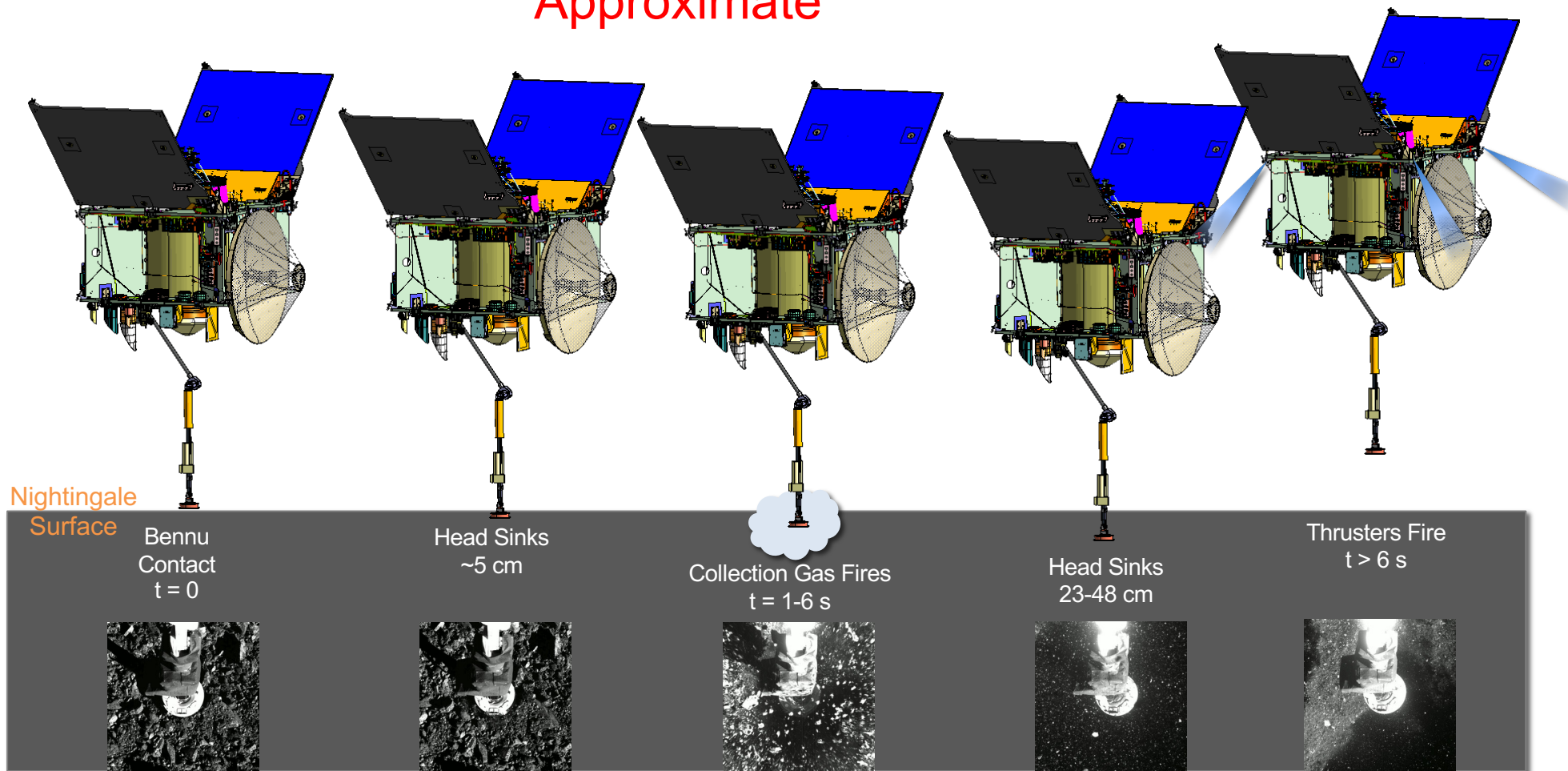


Preliminary and Approximate

4 cm/s



40 cm/s





# Summary

- Asteroid Bennu held surprises for us!
  - Lots of loose rubble, no obvious regolith “ponds”
  - Composition and spectral slope are fairly uniform across the surface
    - ~90% of the surface is blue (a few redder boulders and craters)
    - Small variation in absorption band depths or band identification
  - Some exogenous material
    - Discrete bright boulders of pyroxene
  - Ample evidence of past aqueous alteration
    - Hydrated phyllosilicates present
    - Evidence of “veins”, possibly carbonates
    - Iron oxides
- What’s Next?
  - Finished final Bennu farewell views in April
  - Depart the asteroid in May
  - Earth return in September 2023

