OSIRIS-REx 101: Brush up on the basics before Bennu's sample touches down

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In just a few days, the OSIRIS-REx spacecraft will drop a sample from the asteroid Bennu onto the Utah desert. The monumental achievement is the result of decades of work and will launch decades more in research opportunities in areas as significant as the origin of life.

This special edition of Lo Que Pasa will take you through the OSIRIS-REx story and culmination, including ideas for marking the event, including:

- Take the kids to OSIRIS-REx Day at the Children's Museum Tucson [1].
- Host a watch party at home [2].
- Pick up the new mission-themed Forever stamp [3].
- Make a paper model of the spacecraft [4].
- Learn about the spacecraft’s next mission: OSIRIS-APEX [5].

But first, we set the stage by giving an overview of the "what" and the "why" of OSIRIS-REx.

What is OSIRIS-REx?

NASA’s OSIRIS-REx – the first U.S. mission to collect a sample from an asteroid and return it to Earth for study – is being led by researchers in the University of Arizona Lunar and Planetary Laboratory. The spacecraft was launched on Sept. 8, 2016, and the sample delivery is set for Sept. 24, 2023.

The name is an acronym made up of the mission's major concepts and goals:

- **O** – Origins: Return an asteroid sample and study its organic material.
- **SI** – Spectral Interpretation: Define the global properties of a carbon-rich asteroid.
- **RI** – Resource Identification: Map the global properties, chemistry and mineralogy of the asteroid.
- **S** – Security: Measure and learn about the forces that can change an asteroid’s orbit.
- **REx** – Regolith Explorer: Document the texture, geochemistry and other properties of the surface material at the sampling site.

Dante Lauretta [6], Regents Professor of planetary sciences, is principal investigator for the billion-dollar-mission. Lauretta developed the idea for the mission with the late Michael Drake [7], Regents Professor and former director of LPL. Dani DellaGiustina [8], assistant professor of planetary sciences, is the mission's deputy principal investigator.

The OSIRIS-REx spacecraft is about the size of a 15-passenger van. It weighs about 1,940 pounds without fuel and about 4,650 pounds with fuel. It measures more than 20 feet long with its solar panels deployed and about 8 feet wide. Instruments on the spacecraft include a suite of cameras developed by researchers at the University; spectrometers that provide light, mineral and temperature information; the Touch-And-Go Sample Acquisition Mechanism; and the Sample Return Capsule, outfitted with a heat shield and parachutes to deliver the sample safely to Earth.

What is Bennu?

Bennu is the asteroid scientists chose as the target of the OSIRIS-REx mission. The asteroid’s composition, size and proximity to Earth made it ideal for the mission. Bennu is a B-type asteroid, meaning it is carbon-rich and expected to have organic compounds and water-bearing minerals.

Bennu got its name through a "Name That Asteroid" contest won by a 9-year-old named Mike Puzio, who said the arm and solar panels on the OSIRIS-REx spacecraft looked like the neck and wings of Bennu [9], an Egyptian deity that symbolizes the sun, creation and rebirth and is depicted as a grey heron. The asteroid has a diameter of about 1,673 feet, or 510 meters, which means the Empire State Building could fit inside it.

What’s happening on Sept. 24?

The OSIRIS-REx spacecraft will deliver the sample from Bennu to a designated landing "ellipse" in a desert in western Utah. The sample recovery team held its final test [10] on Aug. 29-30. Photos from the two-day "dress rehearsal" [11] can be seen in a gallery on the University's news website.

The capsule is set to enter Earth's atmosphere at 7:42 a.m. MST, traveling at about 27,650 miles per hour. Once located and packaged for travel, the capsule will be transported to a clean room where it will undergo initial processing and disassembly before heading to NASA's Johnson Space Center in Houston. There, scientists will open the sample canister
and document the contents before providing portions of the sample to researchers worldwide for analysis. A small amount will be displayed at the University’s **Alfie Norville Gem & Mineral Museum** in the Pima County Historic Courthouse at 115 N. Church Ave. in Tucson.

The city of Tucson and Pima County have both proclaimed Sept. 24 “OSIRIS-REx Sample Return Mission Day,” recognizing the University’s achievement with the OSIRIS-REx mission, its tradition of space exploration, and the important role that the University and its faculty, staff and students play in making Tucson and Pima County special places to live. Both made their proclamations at meetings on Sept. 19.

**What do we hope to learn?**

Bennu is made up of material left over from when the planets formed more than 4.5 billion years ago. Scientists hope, with a sample of this ancient material, they can get closer to answering questions like:

- How did life arise on Earth?
- How did our oceans get their water?
- How do we prevent an asteroid from colliding with Earth?

**The mission so far**

For an overview of the mission, from the trip to Bennu to the spacecraft beginning its journey home, read these University News articles.

- Sept. 8, 2016: Launch | **Bound for Bennu! OSIRIS-REx Launch Was ‘Perfect’** [13]
- Sept. 22, 2017: Earth flyby | **Hands Gather on Deck as UA’s Asteroid Explorer Buzzes Earth** [14]
- Dec. 3, 2018: Asteroid Bennu arrival | **OSIRIS-REx Arrives at Asteroid Bennu** [15]
- Oct. 20, 2020: Sample collected | **OSIRIS-REx Successfully Touches Bennu in Sample Grab** [16]
- April 7, 2021: Final Bennu flyover | **NASA’s OSIRIS-REx Completes Final Tour of Asteroid Bennu** [17]
- May 10, 2021: OSIRIS-REx begins journey back to Earth | **OSIRIS-REx Spacecraft is Headed Home with Asteroid Sample** [18]

**Things to know**

- More than 150 University graduate and undergraduate students have worked on the mission.
- Scientists say Bennu is one of the more potentially hazardous asteroids that has been discovered, estimating that it has a 1-in-1,750 chance of hitting Earth late in the 22nd century.
- The mission has an unofficial mascot named **Pen-REx** [19], a stuffed penguin wearing a Tyrannosaurus rex costume and an OSIRIS-REx T-shirt.

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