



CURRENT AFFAIRS



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OSIRIS-REX MISSION

This article covers "Daily Current Affairs" and the Topic details "OSIRIS-REx mission". This Topic has relevance in the Science and Technology section of the UPSC CSE exam.

For Prelims:

About the OSIRIS-REx mission?

About Bennu?

For Mains:

GS 3: Science and Technology

Scientific Significance of the mission?

Why in the news:

After covering a vast distance of over 4 billion miles (6.2 billion kilometers) to reach Bennu and subsequently making the return journey, the OSIRIS-REx probe recently released its sample return capsule approximately 63,000 miles (101,000 km) above Earth.

About OSIRIS-REx mission

NASA's OSIRIS-REx mission, launched in September 2016, marked a significant undertaking in space exploration. Its primary objectives included:

- **Survey and Characterize Bennu:** The mission aimed to comprehensively study Bennu, examining aspects such as its composition, shape, topography, and rotation. This data was vital for identifying a safe and scientifically valuable site for sample collection.
- **Collect a Sample:** OSIRIS-REx was designed to gather a minimum of 60 grams (2.1 ounces) of surface material from Bennu. This sample was expected to provide valuable insights into the composition of the early solar system and potentially shed light on the origins of life on Earth.
- **Return the Sample:** Following the successful collection of the sample, OSIRIS-REx was tasked with safely transporting it back to Earth. This crucial step would allow scientists to analyze the pristine asteroid material in terrestrial laboratories, advancing our understanding of celestial bodies and their role in the solar system's history.

Instruments of OSIRIS-REx:

The OSIRIS-REx spacecraft was equipped with an array of scientific instruments and systems designed to accomplish its mission objectives:

- **OCAMS (OSIRIS-REx Camera Suite):** This suite included three cameras – MapCam, PolyCam, and SamCam. MapCam was used to create surface maps of Bennu, PolyCam captured high-resolution images for navigation and sample site selection, and SamCam documented the sample collection process.

- **OTES (OSIRIS-REx Thermal Emission Spectrometer):** OTES was responsible for measuring the temperature of Bennu's surface. This data was crucial in determining the composition of the asteroid.
- **OVIRS (OSIRIS-REx Visible and Infrared Spectrometer):** OVIRS played a key role in analyzing the spectral properties of Bennu's surface. It helped identify minerals and organic compounds present on the asteroid.
- **OLA (OSIRIS-REx Laser Altimeter):** OLA was used to gather topographical information by emitting laser pulses and measuring the time it took for the light to bounce back. This data was used to create detailed 3D maps of Bennu's surface.
- **TAGSAM (Touch-And-Go Sample Acquisition Mechanism):** TAGSAM was the crucial component responsible for collecting the sample. It used a nitrogen gas burst to stir up surface material, which was then captured in a sample collector for subsequent return to Earth.

Key Mission Milestones:

- **Launch:** OSIRIS-REx embarked on its journey on September 8, 2016, when it was launched aboard an Atlas V rocket from Cape Canaveral Air Force Station.
- **Asteroid Arrival and Survey:** After arriving at Bennu in December 2018, the spacecraft conducted thorough surveys of the asteroid, identifying potential sites for sample collection.
- **Sample Collection:** On October 20, 2020, OSIRIS-REx achieved a significant milestone by successfully touching down on Bennu's surface, collecting a sample, and securely stowing it in the Sample Return Capsule (SRC).
- **Departure from Bennu:** In May 2021, OSIRIS-REx bid farewell to Bennu after spending more than two years studying the asteroid up close.
- **Sample Return to Earth:** The spacecraft made its way back to Earth and released the SRC, which re-entered Earth's atmosphere and safely landed in the Utah desert on September 24, 2023.

Scientific Significance:

- **Understanding the Early Solar System:** The collected sample holds pristine material from the early solar system, providing crucial insights into the conditions and processes that contributed to the formation of planets and the potential emergence of life.
- **Asteroid Impact Hazard Assessment:** OSIRIS-REx's study of Bennu's properties and trajectory has advanced our understanding of asteroid dynamics, helping us assess and mitigate potential impact hazards.
- **Resource Utilization:** Bennu's composition includes valuable resources like water and organic molecules, which could be of interest for future space exploration and resource utilization efforts, potentially supporting sustained human presence beyond Earth.
- **Origins of Life:** The mission's findings may contribute to our understanding of the delivery of organic molecules and water to Earth, offering insights into the origins of life on our planet and potentially elsewhere in the universe.

About Bennu:

Physical Characteristics:

- **Size and Shape:** Bennu is a relatively modest asteroid, measuring about 492 meters (approximately 1,614 feet) in diameter. It displays a nearly spherical shape.
- **Rotation:** Bennu exhibits a relatively swift rotation, completing one full rotation approximately every 4.3 hours, which is relatively rapid for an object of its size.

Orbit and Origin:

- **Orbit:** Bennu follows an elliptical orbit around the Sun, bringing it close to Earth's orbit. It is categorized as a near-Earth asteroid (NEA), which means it has the potential for close encounters with our planet.
- **Origin:** Bennu is considered a primitive asteroid, tracing its origins back to the early stages of the solar system, approximately 4.5 billion years ago. It is specifically classified as a carbonaceous asteroid, indicating its likely abundance of carbon-rich and potentially organic materials.

Scientific Significance:

- **Time Capsule:** Bennu serves as a remarkable time capsule, preserving materials from the nascent solar system. Through the study of Bennu, scientists can gain valuable insights into the environmental conditions, composition, and processes that characterized the formation of our solar system.
- **Water and Organic Compounds:** Bennu is believed to house water-bearing minerals and organic compounds, holding significant implications for future space exploration. These resources could potentially be tapped for missions further into space, and the study of Bennu may also contribute to our understanding of the origins of life on Earth and the possibility of life elsewhere in the universe.

Source:

<https://www.space.com/nasa-osiris-rex-success-recovery-asteroid-sample>

Q.1 Which spacecraft mission aimed to study and collect a sample from the asteroid Bennu?

- (a) Apollo 11
- (b) Voyager 2
- (c) OSIRIS-REx
- (d) Curiosity

ANSWER: C

Q.2 What is the primary scientific significance of the OSIRIS-REx mission?

- (a) Studying the formation of Earth's atmosphere
- (b) Investigating the composition of Mars' surface
- (c) Understanding the origins of life on Earth
- (d) Gaining insights into the early solar system and the formation of planets

ANSWER: D

Q.3 “Discuss the scientific and practical significance of NASA’s OSIRIS-REx mission. Explain how missions like OSIRIS-REx contribute to the broader field of space science and the advancement of human knowledge.”

GLOBAL DEBT

This article covers "Daily Current Affairs" and the topic details "Global Debt". This topic has relevance in the "Economy" section of the UPSC CSE exam.

For Prelims:

What is Global Debt?

For Mains:

GS3: Economy

What are the reasons and impact of Global Debt?

Why in the news?

According to the Institute of International Finance (IIF) report, global debt saw a significant increase, reaching an unprecedented tally of \$307 trillion by the end of June 2023.

Understanding Global Debt

- Global debt is the total outstanding financial obligations or liabilities owed by governments, businesses, and individuals worldwide.
- This debt can take various forms, including government bonds, corporate bonds, bank loans, mortgages, and consumer debt, such as credit card debt.
- Governments resort to borrowing to finance expenditures that exceed their tax revenues and other sources of income. They may also borrow to cover interest payments on previous loans used to fund past expenses.
- On the other hand, the private sector extensively borrows funds primarily for investment purposes.

Reasons for the increasing levels of global debt:

- **Rising interest rates:**
 - As interest rates increase, it becomes more expensive for governments, businesses, and individuals to borrow money, leading to a higher debt accumulation.
- **Increase in savings and investments:**
 - A rise in the overall savings within an economy can contribute to an increase in debt levels.
 - When individuals and businesses have more savings, they are more likely to invest or make purchases, often requiring borrowing.
- **Government expenditures and deficits:**
 - Governments often borrow to finance various expenditures, such as infrastructure projects, social welfare programs, and defence spending.
 - When governments spend more than they collect in taxes and revenues, they rely on borrowing to cover the deficit.
- **Economic downturns and recessions:**
 - During an economic slowdown or recession, governments and central banks may implement expansionary fiscal and monetary policies, such as increased government spending or lower interest rates, to stimulate economic growth.
- **Financial crises and bailouts:**

- Episodes like the 2008 global financial crisis and subsequent bailouts of financial institutions can significantly contribute to the increase in global debt.
- In times of crisis, governments often provide financial support to prevent systemic collapses, which adds to their debt burden.

- **Currency Depreciation:**

- The emerging market economies, such as China, India and Brazil, have also experienced currency depreciation against major currencies, such as the U.S. dollar.
- This has increased the cost of servicing their foreign currency-denominated debt.

Concerns regarding increasing Global Debt:

- **Debt Sustainability:**

- Excessive government debt, fueled by reckless borrowing for populist programs, can become unsustainable in the long run.
- When interest rates rise, debt servicing becomes more challenging, especially for heavily indebted governments.

- **Risks of Rising Interest Rates:**

- While low interest rates have made debt management easier, increasing rates can create pressure for governments to meet their debt obligations.
- This may result in defaults or inflationary measures to alleviate the debt burden.

- **Inflationary Pressures:**

- Governments may "inflate away" their debt by creating new currency to pay off outstanding government debt.
- However, this can lead to inflation, effectively imposing an indirect tax on the economy to address the debt.

- **Concerns about Private Sector Debt:**

- Rapidly rising private debt levels, unsupported by genuine savings, can lead to unsustainable booms that may culminate in economic crises.
- The 2008 global financial crisis serves as a reminder of the risks associated with excessive private debt.

- **Vulnerability to Financial Crises:**

- Higher debt levels increase the vulnerability of economies to financial crises. When debt becomes unsustainable, an economic shock or downturn can trigger a crisis, leading to recession, banking sector instability, and a contraction in economic activity.

As countries navigate the challenges of increasing debt burdens, effective debt management and long-term fiscal policies are essential for safeguarding economic stability and promoting sustainable prosperity.

Sources:

[What are the reasons for the rise in global debt?](#)

Q1. With reference Global Debt, consider the following statements:

1. Global debt is the total amount of money that governments around the world owe to others.
2. Rising interest rates can contribute to an increase in global debt as it becomes more expensive to borrow money.
3. An economic downturn or recession leads to decreased global debt as governments implement policies to reduce borrowing.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 only

- (c) 3 only
- (d) None

Answer: (b)

Q2. Consider the following statements:

1. Excessive government debt can become unsustainable when interest rates rise, and debt servicing becomes challenging.
2. Currency appreciation in emerging market economies reduces the cost of servicing their foreign currency-denominated debt.
3. Governments primarily borrow to invest in the private sector.

How many of the abovementioned statements are correct?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

Answer: (a)

Q3. Discuss the causes and consequences of the surge in global debt in recent years. Suggest measures to address the challenges posed by rising global debt and ensure sustainable economic growth.

Gaurav

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