

ASTR 4800 - Space Science: Practice & Policy

### Today: The Space Shuttle

- **Next Class:** NASA's Budget. Read over material linked on class website for Oct. 3.
- Space Scientist Interview info due to me by Oct. 19.



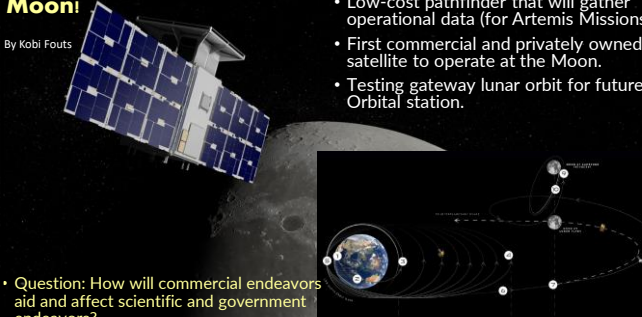
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### Capstone tumbling to the Moon!

By Kobi Fouts

- Launched June 28th at 3:55a.m.
- Low-cost pathfinder that will gather operational data (for Artemis Missions)
- First commercial and privately owned satellite to operate at the Moon.
- Testing gateway lunar orbit for future Orbital station.




• Question: How will commercial endeavors aid and affect scientific and government endeavors?

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### Overview of Space Shuttle Program

- Partially re-useable Earth orbital spacecraft officially known as *Space Transportation System*.
- Operated from 1981-2011.
- Highlights include:
  - Launching & servicing Hubble Space Telescope, numerous satellites.
  - Conducted 2-week duration experiments in space (including 15 CU Bioserve Life Science experiments).
  - Built & serviced International Space Station (ISS).




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### History of the Shuttle Program

- In 1969-72 time frame, President Nixon approved Space Shuttle & terminated Apollo.
- By being partially re-useable, Shuttle was **supposed to** reduce costs of payloads to orbit.
- 5 operational Shuttles were built (Columbia, Challenger, Discovery, Atlantis & Endeavour).
  - Challenger & Columbia were lost in separate accidents.



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### Space Shuttle Mission Profile



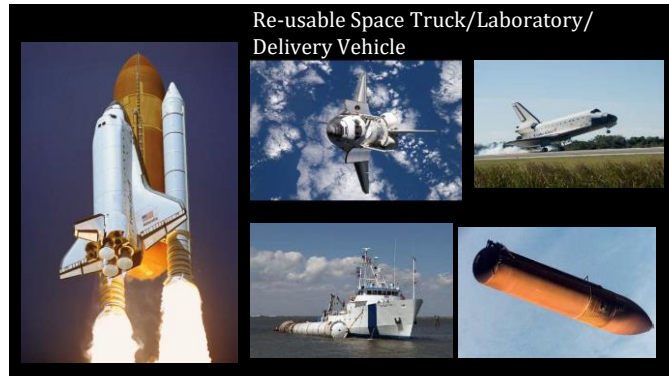
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### Going to Work in Space: Scientists and Engineers: The Space Shuttle Era

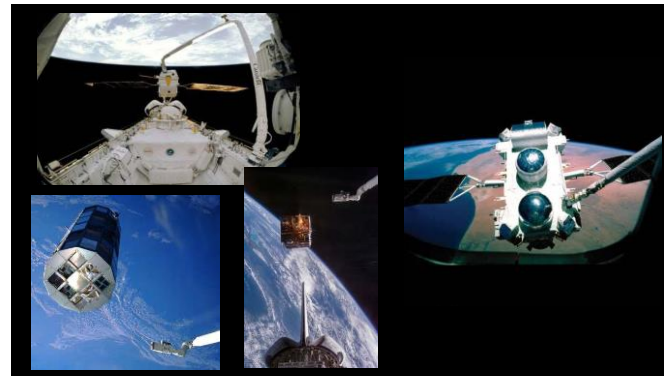


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Re-usable Space Truck/Laboratory/  
Delivery Vehicle

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## Space Shuttle Accidents

- **Challenger**
  - Broke apart 73 seconds into launch on Jan. 28, 1986.
  - O-ring seal in right solid rocket booster failed at liftoff.
  - Found that NASA's organizational culture & decision-making processes were contributing factors.
- **Columbia**
  - Disintegrated upon re-entry in 2003.
  - Foam insulation broke off of external tank at launch damaging heat shield.
  - G.W. Bush terminated Shuttle Program in 2004.
- Tragic loss of 14 astronauts.

[Reagan's speech](#)

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## Costs

- NASA spent \$192 billion on Shuttle from 1971 to 2011, launching 131 flights.
- The Shuttle never achieved the promise of reducing cost per pound to LEO.

**A COSTLY ENTERPRISE**

The average cost per launch was about \$1.5 billion over the life of the US space-shuttle programme.

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## Class Exercise

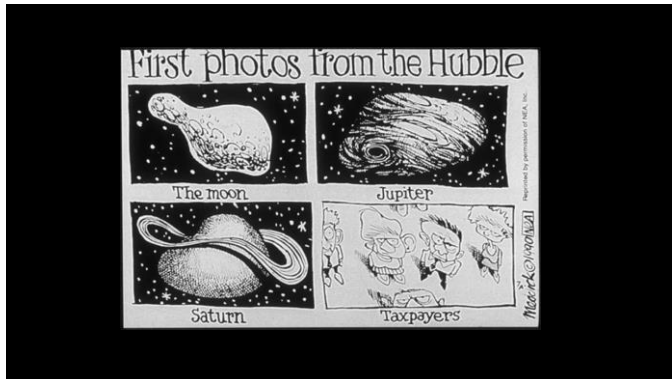
Did President G.W. Bush make the right decision to cancel the Space Shuttle? Why or why not?

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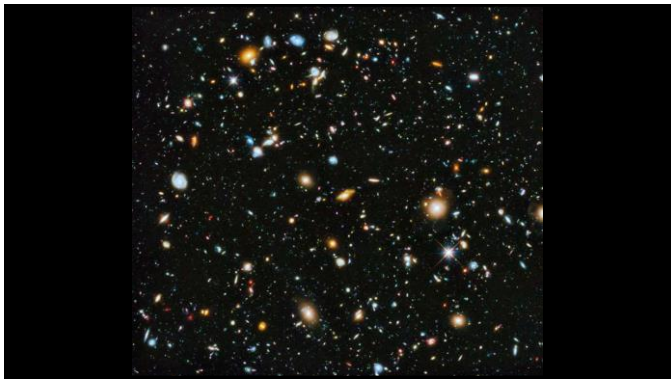
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## 2011 Nobel Prize in Physics

The 2011 Nobel Prize in Physics was awarded to **Saul Perlmutter**, **Brian P. Schmidt** and **Adam G. Riess** "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae." These observations were made, in part, by NASA's Hubble Space Telescope.

