


**ASTR 4800 - Space Science: Practice & Policy**  
 Today: **NASA's Commercial Space Economy**

- Next Class: *Science at NASA* – guest lecture by NASA Associate Administrator Dr. Thomas Zurbuchen.
- Reading: links on class website for Nov. 4.




Astronomy 4800 - Space Science: Practice & Policy

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**New Photos of merging galaxies from JWST**

Bryan Derr

Are there any other Hubble photographs you hope to see redone by the JWST?



Optical: Hubble ACS & WFC3  
 Near-Infrared: NIRCam  
 Mid-Infrared: MIRI

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**NASA's Commercial Space Economy**

Kobi Fouts and Ana Kizhnerman

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**International Space Law**

- Outer Space Treaty 1967**
  - Set the initial rules of non-ownership and weapons in outer space.
- Commercial Space Launch Act 2015**
  - Designed to encourage commercial space flight
  - Postponed oversight of private companies till 2023 which extends funding given for third party damages
  - Grants companies the right to own materials collected from space
- Moon Agreement 1979**
  - Forbids the establishment of military colonization and weaponry testing of any kind
- Land Remote-Sensing Commercialization Act**
  - Indemnifies companies for large third-party damages and it informs regulations for commercial human spaceflight

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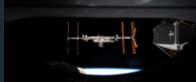



**Differences in policy and execution**

- Risk Assessment?
- Scale?
- Deadlines, and Delays?
- Bureaucracy and Funding?
- Differing Goals by Firm?
- Liability and Insurance?



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**Key Players**

- NASA**

- SpaceX**

- Blue Origin**

- Lockheed Martin**


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### The ISS & Low earth Orbit Economy

- Public Communication Satellite Infrastructure
- ISS Resupply
- CubeSats (nano satellites)
- Military or Defense Satellites (Nav. & comms.)

**Discussion:** What area of space or technology, do you believe firms will expand into as more competition enters LEO?

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### Partnerships, Contracts, and Competitions

Share of space-related R&D expenditures, by source, %

**The Space Economy Report**

989	\$2.6 billion	\$3.9 billion
Commercial launch services	Commercial launch services	LEO GEO launch services
\$2.4 billion	\$10.2 billion	1,819
Commercial launch services	Space weather services	Launches completed

**The 2019 Global Space Economy at a Glance**

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### Missions of Cooperation

- Commercial Crew Program
  - Servicing the ISS and future manned missions
- Human Landing System
  - Ensures continued human missions in conjunction with Artemis

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### Issues with Private Operations

- Less oversight of methods
- Profit motivation can cause negative externalities
- Lack of accountability
  - No requirement to make public appearances
- Environmental damage
  - Overcrowding

Number of objects in Earth's orbit

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## Class Exercise

**As the government has a historical precedent for insuring private firms against risk to promote growth, should the government protect firms against mission failures utilizing astronauts to prevent a public outlash and a permanent loss of progress to the industry?**

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### What happens if missions fail?

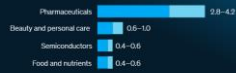
- Private companies must ensure all damages & costs that go beyond contractual budgets
- NASA is mainly responsible
  - Possibility of another shut down of the program?
  - Media coverage and public interest will make the launch center stage

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## What happens if missions succeed?

- Ensured Government funding and confidence.
- Successful record leads to higher private investment.

Forecasted annual revenue at maturity of selected industries if they collaborate with space companies, billion \$



- Long term reduction in the cost of space flight.
- Expansion of industry and R&D

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## National loyalty of firms?

- Currently private companies that work with NASA are on fixed price contracts instead of variable cost plus contracts (increases chance of high profit margin)
  - Sets maximum payout instead of open ended budget
- Overall goal: provide lower-cost space travel
- The more private companies develop, the greater the competition becomes both nationally and internationally

**Discussion:** What happens when firms take contracts from other competitors, or go against US interests?

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