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# PRIVATE FRONTIER: SPACE

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**Segment Length: 6:11 minutes**

## **Lesson Description:**

Space, the final frontier. Are voyages to explore strange new worlds – to seek new life and new civilizations, to boldly go where no one has gone before – best left to government to fund with our tax dollars or should these efforts be conducted by the private sector at their own expense? This segment looks at government and private space exploration.

## **Vocabulary:**

*Bipartisan* – (adj.) Agreement or cooperation between two parties, usually used to refer to cooperation between Democrats and Republicans.

*Bureaucracy* – (adj.) Non-elected government officials administering agencies, often characterized by specialization of functions, adherence to fixed rules, and hierarchical authority.

*Infrastructure* – (n.) Basic physical facilities or systems that are necessary for the performance of tasks or operations.

## **Objectives:**

Students will be able to:

- discuss differences between government and private space exploration.
- explain the benefits of private space exploration.
- evaluate the importance of competition in space exploration, especially regarding efficiency and effectiveness of outcomes.

## **Preview Activity and Questions:**

Distribute the K-W-L chart (page 21) and have students complete the K and W sections.

**OR**

Have students answer the following questions in their notebooks:

Would you be interested in traveling in space? If so, how might you be able to do that?

Use Think, Pair, Share to have students answer the preview question. After a few minutes, poll the students. Ask the students to discuss their answers.

## **Viewing Guide:**

It is recommended that teachers show the video segment twice: once to allow students to view the video and focus on the issues presented, and once to allow them time to complete the viewing guide. After they complete the viewing guide, allow students a few minutes to work in pairs sharing and verifying answers.

## **Answers to Viewing Guide:**

1. government
2. privatizing
3. cutting edge
4. commercialized
5. private sector

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## Private Frontier: Space Viewing Guide

**Directions: As you watch the video, fill in the blanks with the correct words.**

1. The private company found a way to bring that same rocket safely back to Earth. That's what they're applauding there. The private company did what \_\_\_\_\_ couldn't do and did it with much less money. That happens all the time.
2. In fact, President Obama proposed \_\_\_\_\_ much of this, and the bipartisan congressional response was extremely negative.
3. Everybody loves the space program. And NASA has this wonderful history, and people just assume it's going to be on the \_\_\_\_\_ \_\_\_\_\_ and doing the right thing. They don't know that our journey to Mars is built on 1970s technology.
4. Most of space has been \_\_\_\_\_.
5. Well, I mean, I just can't understand that. Now, I work for the airline pilots union, and we all fly in airplanes safely, 700 million people a year. That's the technology that is... completely run by the \_\_\_\_\_ \_\_\_\_\_ and goes very well.

**Now, take a few moments to reflect on the video and answer the questions below:**

What is the point that John Stossel makes in this video? \_\_\_\_\_

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What do you think about private space exploration? \_\_\_\_\_

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## Discussion and Analysis:

1. What is NASA?
2. Should the government be the ones exploring space? Explain.
3. Which is better, allowing people to voluntarily spend their own money on space exploration or forcing taxpayers to pay for it? Why?
4. Why might NASA not support private space exploration?
5. Why might some congressional representatives not support private space exploration? Why might some representatives support it?
6. Do you think space exploration should be privatized? Why / Why not?
7. Why would Elon Musk and Jeff Bezos want to lead the way on space exploration?
8. Would it be wrong if their goals include making money? Explain.
9. Lori Garver used the word “bureaucracy” as a pejorative, a negative term. Why? What’s wrong with bureaucracy?
10. According to Lori Garver, NASA is using old technology. What are some reasons NASA might have – or might have had – for not improving or updating its technology and infrastructure?
11. What do the satellites in orbit around the earth do? Are those for private, commercial interests or for government? Who should pay for them?
12. From where will the biggest gains in space exploration come, government programs or the competition among businesses all trying to explore? Explain.
13. What is the point Lori Garver is making when she refers to airplane travel?
14. The news reporter on MSNBC said she worried about private industry exploring space because of the lack of an equitable outcome. What does that mean? Is she implying that when government does something, the outcome is equitable? Is she right? Explain.
15. What are the limits to space exploration? Do we really know? Explain.

## Discuss These Lines from the Video:

1. When government, NASA, sent their rockets up, the rockets would eventually burn and fall apart so they just tax you and build new ones for every mission.
2. If we threw away our airplanes or our ships after each time we flew them, they would be so expensive. But if you’re all about the jobs, you just like building new ones.
3. If you’re competing, you can’t say who’s going to win and what district it’s going to be in, so it’s a lot harder to do that if you’re using the public’s money.
4. Everybody loves the space program. And NASA has this wonderful history, and people just assume it’s going to be on the cutting edge and doing the right thing. They don’t know that our journey to Mars is built on 1970s technology.
5. So most of the satellites being launched, the rockets going up now, are private companies’.

6. Elon [Musk] announced that he's going to Mars in 2018, not with people, but should he do that anywhere near the range and with his new heavy lift vehicle, it hopefully will start to be obvious we don't need to spend the taxpayers' money on this.
7. I know people believe that somehow safety is more with the government, but of course, we don't have a perfect record at NASA either.

## Quotes for Discussion:

*We are on the eve of innovations whose scope cannot be foreseen.* — **Ludwig von Mises**

*NASA is an engine of innovation and inspiration as well as the world's premier space exploration agency, and we are well served by politicians working to keep it that way, instead of turning it into a mere jobs program, or worse, cutting its budget.* — **Bill Nye**

*In the coming era of manned space exploration by the private sector, market forces will spur development and yield new, low-cost space technologies. If the history of private aviation is any guide, private development efforts will be safer, too.* — **Burt Rutan**

*NASA is increasingly not the future of space exploration. I love the fact that we have private sector folks devoting a lot of money to stimulate innovation in space technology.* — **Ian Bremmer**

*Everyone, red state, blue state, everyone supports space exploration.* — **Bill Nye**

*People make their own fates, and if enough of us make our fate to be space explorers, perhaps we can actually get some space exploration done.* — **Robert Zubrin**

*I think we are at the dawn of a new era in commercial space exploration.* — **Elon Musk**

*As a cornerstone of my policy, we will substantially expand public-private partnerships to maximize the amount of investment and funding that is available for space exploration and development.* — **Donald Trump**

*But does Man have any "right" to spread through the universe? Man is what he is, a wild animal with the will to survive, and (so far) the ability, against all competition. Unless one accepts that, anything one says about morals, war, politics, you name it, is nonsense. Correct morals arise from knowing what man is, not what do-gooders and well-meaning old Aunt Nellies would like him to be. The Universe will let us know – later – whether or not Man has any "right" to expand through it.* — **Robert A. Heinlein**

*We don't know which will be the companies that are going to make money in space. It's like 1976, and we don't know who is going to be Apple computer and who is going to be one of the five companies that dies within a few years.* — **James Muncy**

*I think in your lifetime, space travel could be nearly as commonplace as, say, traveling to another continent is.* — **Richard Branson**

*I believe we can do more in making the President's vision for space exploration a reality by awarding cash prizes to encourage greater participation of the private sector in the national space program.* — **Dana Rohrabacher**

*It's a fixer-upper of a planet but we could make it work.* — **Elon Musk,**  
**speaking about humans settling on Mars**

*Most people on Earth would love the chance to become astronauts if they could afford it, so it's up to us to try to make sure it's affordable.* — **Sir Richard Branson**

*There is just one thing I can promise you about the outer-space program – your tax-dollar will go further.*  
– **Wernher von Braun**

*We are really evolved to be pioneers. And for good reason. New worlds have a way of saving old worlds. And that's how it should be. We need the frontier. I want to see millions of people living and working in space.*  
– **Jeff Bezos**

*We're making space more American. We're making space more democratic. We're making space more available, approachable, and real to the average American.*  
– **James Muncy**

## **Activities:**

1. Have students complete the K-W-L chart graphic organizer (page 21).
2. Have students, alone or in small groups, complete the Stakeholder Chart (page 22).
3. Distribute individual quotes from the Quotes for Discussion section to pairs of students. Have the students discuss the meaning of the quote and write the meaning on the back of the quote. Have the students present the quotes and their explanations or collect them as an exit ticket.
4. Research and create a slideshow about Jeff Bezos and Blue Origins or Elon Musk and SpaceX. Some topics you might want to include are their goals, timetables, amount of money invested and by whom, and accomplishments so far. (See link in the Resources section for help in preparing a slideshow.)
5. Lori Garver was a top administrator at NASA for nine years, a member of President Obama's transition team, and an advisor to Hillary Clinton's presidential campaign. Research and write a biography of Lori Garver. (See links in the Resources section for a guide to writing biographies.)
6. Read one of the articles in the Resources section. Then write a summary using Cornell (two-column) notes. (See link in the Resources section for help in taking Cornell notes.)
7. President Obama and President Trump hold different views on NASA and space exploration. Research their positions, decide which position you support, and then write a persuasive essay arguing your position. (See links in the Resources section for help in writing persuasive essays.) As an alternative, write and deliver a speech to the class in which you try to persuade the other students to agree with your position. (See links in the Resources section for help in speaking to a class.)
8. In groups, research arguments for and against private space exploration. Then, conduct a classroom debate. Students should be given time to research their position prior to debating. See link in the Resources section for a guide to conducting classroom debates.)
9. Research the X-Prize Foundation. What is the Google Lunar XPrize? What other competitions have been or will be held? Why have they conducted these competitions? Why have people competed? What have been the results? Who has funded these competitions? Why? What conclusions can you draw about the ability of individuals and commercial enterprises to solve problems? Prepare a slideshow to show the class what you have learned. (See link in the Resources section for help in preparing a slideshow.)
10. What is NASA? What has it done? Research the history of NASA and create a video or slideshow to show the class what you have learned. (See link in the Resources section for help in preparing a slideshow.)

11. Lori Garver said that when President Obama proposed privatizing much of the space program, the bipartisan congressional response was extremely negative. What is the role of Congress in space exploration? Why does it have a role? What type of rocket did Congress force NASA to build for \$50 million? Research and write a report about the details of President Obama's proposal and the congressional response.
12. Create a tri-fold brochure advertising commercial space travel with Virgin Galactic. You should research Virgin Galactic's plans to help you develop your brochure.
13. Lori Garver said that NASA doesn't have a perfect safety record. What did she mean? Research NASA's safety record and report your findings to the class in a slideshow. (See link in the Resources section for help in preparing a slideshow.)
14. Write an essay about Virgin Galactic and private space exploration. Would you take a trip to outer space? Why / Why not?
15. Are there any federal regulations regarding the development and testing of commercial space craft? If so, what are they? Write a research paper that answers these questions.
16. Research and write an essay about the European Space Agency. What is the agency's mission? How is it funded? What has it achieved?
17. Watch one of the videos listed in the Resources section. Then, write an essay about the video.
18. Read one of the books in the Resources section and write a book report. (See link in the Resources section for help in writing a book report.)
19. Airlines are owned and operated safely by the private sector, said Lori Garver. She said that 700 million people a year fly safely. Research and produce a slideshow about airplane safety and the dangers of other forms of travel. (See link in the Resources section for help in preparing a slideshow.)
20. Produce a "man-on-the-street" video in which you ask people if they would like to travel to space. Be sure to ask them to explain their answers. (See links in the Resources section for help in producing man-on-the-street videos.)

## Resources:

### Guides

A good explanation of K-W-L, with a sample chart, and a chart for downloading:

<http://www.readingquest.org/strat/kwl.html>

Also helpful for K-W-L:

<https://www.teachingchannel.org/videos/structured-learning-teaching-tip>

Think, Pair, Share

A brief explanation of the Think, Pair, Share instructional strategy, with examples:

<http://www.readingquest.org/strat/tps.html>

A video explanation of Think, Pair, Share:

<https://www.teachingchannel.org/videos/think-pair-share-lesson-idea>

For a clear, simple explanation of the Cornell note-taking system:

<http://coe.jmu.edu/learningtoolbox/cornellnotes.html>

<http://www.bucks.edu/~specpop/Cornl-ex.htm>

Conducting classroom debates:

<http://712educators.about.com/cs/lessonsss/ht/htdebate.htm>

[http://www.edu.gov.mb.ca/k12/cur/socstud/frame\\_found\\_sr2/tns/tn-13.pdf](http://www.edu.gov.mb.ca/k12/cur/socstud/frame_found_sr2/tns/tn-13.pdf)

<http://busyteacher.org/7245-conducting-class-debate-essential-tips.html>

How to write a book report:

<http://www.infoplease.com/homework/wsbookreporths.html>

How to write a persuasive essay:

[https://www.scribendi.com/advice/how\\_to\\_write\\_a\\_persuasive\\_essay.en.html](https://www.scribendi.com/advice/how_to_write_a_persuasive_essay.en.html)

<http://www.infoplease.com/homework/writingskills7.html>

How to produce a man-on-the-street interview:

<http://onemarketmedia.com/2009/02/16/seven-ideas-to-help-get-the-most-out-of-a-man-on-the-street-interview/>

<http://www.wikihow.com/Make-a-Man-on-the-Street-Interview>

[http://www.ehow.com/how\\_2283844\\_do-man-street-interviews.html](http://www.ehow.com/how_2283844_do-man-street-interviews.html)

For help in speaking to a class:

<https://www.hamilton.edu/oralcommunication/tips-for-effective-delivery>

Preparing effective slideshow presentations:

[http://www.ehow.com/how\\_5032561\\_prepare-effective-powerpoint-presentation.html](http://www.ehow.com/how_5032561_prepare-effective-powerpoint-presentation.html)

<http://www.microsoft.com/en-us/showcase/details.aspx?uuid=22f09a63-cecb-4260-a44f-8223d07dd031>

<http://blog.synapsiscreative.com/the-info/7-big-powerpoint-mistakes-you-just-cant-afford-to-make>

## Articles

“Examining the latest advances in private spaceflight on the anniversary of the ‘Falcon 9’ mission” by Dan Gunderman

<http://www.nydailynews.com/news/national/examining-latest-advances-private-spaceflight-article-1.2900745>

“For these private space companies, the future is now, and the final frontier is in reach” by Michael Sheetz

<http://www.cNBC.com/2017/02/17/commercial-space-companies-pioneer-the-final-frontier.html>

“How Private Space Companies Make Money Exploring The Final Frontier”

by Elizabeth Howell

<https://www.universetoday.com/114965/how-private-space-companies-make-money-exploring-the-final-frontier/>

“The Implications of the Privatization of Space Exploration” by Lina Shi

<https://publicpolicy.wharton.upenn.edu/live/news/1619-the-implications-of-the-privatization-of-space>

“Jeff Bezos Expected to Unveil Further Plans for Private Space Exploration”

by Andy Pasztor

<https://www.wsj.com/articles/jeff-bezos-expected-to-unveil-further-plans-for-private-space-exploration-1488743790>

“Private Companies, Not Governments, Are Shaping the Future of Space Exploration”

by Kristin Houser

<https://futurism.com/private-companies-not-governments-are-shaping-the-future-of-space-exploration/>

“Private space exploration: the new final frontier” by Carlos Folgar and Jess McCuan

<https://quid.com/feed/private-space-exploration-the-new-final-frontier>

“The Pros And Cons Of Privatizing Space Exploration” by Robert Frost, on Quora

<https://www.forbes.com/sites/quora/2017/04/04/the-pros-and-cons-of-privatizing-space-exploration/#2bae071c3319>

“New Space Leadership Poised to Shake Up NASA, Promote Private Spaceflight”

by Jay Bennett

<http://www.popularmechanics.com/space/rockets/a26347/future-space-exploration-private-industry/>

“SpaceX to Fly Passengers On Private Trip Around the Moon in 2018” by Calla Cofield

<https://www.space.com/35844-elon-musk-spacex-announcement-today.html>

## Books

*Legal framework for establishing outposts in outer space and position of private companies in outer space exploration* by Michal Zajpt

*Private Space Exploration (Kid’s Library of Space Exploration, Vol. 9)* by C. F. Earl

*Private Space Travel: A Space Discovery Guide* by Margaret J. Goldstein

*SpaceX’s Dragon: America’s Next Generation Spacecraft* by Erik Seedhouse

*Virgin Galactic: The First Ten Years* by Erik Seedhouse

## Videos

Everyone’s Space

[http://izzit.org/products/detail.php?video=everyones\\_space](http://izzit.org/products/detail.php?video=everyones_space)

Inventing the Future

[http://izzit.org/products/detail.php?video=inventing\\_the\\_future](http://izzit.org/products/detail.php?video=inventing_the_future)

Landmark Moments in Private Space Exploration

<https://www.youtube.com/watch?v=7p4noMCyTPM&index=19697&list=UL3UHPRZ2SpME>

Private Space Flight: Lessons in Driving Big Change

<https://www.youtube.com/watch?v=1ZkOPprBQw8>

The Paradox of Progress

[http://izzit.org/products/detail.php?video=paradox\\_of\\_progress](http://izzit.org/products/detail.php?video=paradox_of_progress)

## Websites

European Space Agency

<http://www.esa.int/ESA>

SpaceX

<http://www.spacex.com/>

X-Prize Foundation

<http://www.xprize.org/>



Name \_\_\_\_\_ Date \_\_\_\_\_

Class \_\_\_\_\_ Period \_\_\_\_\_ Teacher \_\_\_\_\_

## Private Frontier: Space K-W-L Chart

**Directions:** Complete the **K** and **W** sections prior to watching the video. After you have seen the video, complete the **L** section and answer the two questions below the K-W-L chart.

<b>K</b>	<b>W</b>	<b>L</b>
What I know about private space exploration:	What I want to know about private space exploration:	What I've learned about private space exploration:

After watching the video and discussing it in class, who do you think should fund and lead space exploration?

\_\_\_\_\_

Why? \_\_\_\_\_

\_\_\_\_\_

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Name \_\_\_\_\_ Date \_\_\_\_\_

Class \_\_\_\_\_ Period \_\_\_\_\_ Teacher \_\_\_\_\_

## Private Frontier: Space Stakeholder Chart

**Directions:** Fill in the chart below based on the video and on your perceptions of the stakeholders, those impacted by private space exploration.

Stakeholders	Possible Point of View	Your Reasoning / Explanation
Space exploration company representative and employees		
Member of Congress with space exploration company within his or her district		
Member of Congress with a NASA parts supplier within his or her district		
NASA employees		
Taxpayers		
What conclusions can be drawn about the debate over private space exploration?		