2011-2012 Topic Overview

Space Exploration and Development

Resolved: The United States federal government should substantially increase its exploration and/or development of space beyond the Earth's mesosphere.

ii. Negative Response

c. Discovery and Human Spirit

i. Affirmative Arguments

ii. Negative Response

d. Staffed Mission to the Moon

i. Vehicle for Human Transportation

ii. Transportation in Debate Rounds

iii. Negative Response

e. Staffed Mission to Mars

i. Affirmative Arguments

ii. Negative Response

f. International Space Station

i. Utilization of the International Space Station

ii. Transportation to the International Space Station

iii. Affirmative Case Ideas

iv. Negative Response

g. Unstaffed Missions

i. Mars Rover

ii. Negative Response

1. Human Travel Better

2. Logistics

3. Cost

h. Asteroid

i. Asteroid Mapping

ii. Asteroid Mining

iii. Negative Response

i. Satellites

i. Weather

ii. Communication

iii. Negative Response

j. International Cooperation

i. Affirmative Arguments

ii. Negative Response

k. Asteroids

i. Asteroid Mapping

ii. Asteroid Mining

iii. Negative Response

l. Medical Research

i. Affirmative Arguments

ii. Negative Response

m. Space Colonies

i. Why Space Colonies?

ii. Negative Response

n. Extra-Terrestrial Intelligence

i. Methods

1. Radio Experiments

2. Observational Experiments
3. Other Potential Cases

ii. Negative Response

1. Wasteful
2. Malevolent Life Forms

VII. Major Negative Arguments

a. Cost

i. Better Investment Elsewhere
ii. Spinoffs
iii. NASA Tradeoff Disadvantage.

b. Privatize

i. Lower Cost
ii. Innovation
iii. Privatization in the Status Quo
iv. Regulations and Red Tape
v. Launch Systems
vi. International Space Station
vii. Satellites
viii. Space Tourism
ix. Energy

c. Ocean Floor Counterplan

d. Topicality

i. Its

ii. Substantially Increase

iii. Exploration and Development

iv. Space

v. Beyond the Mesosphere

Introduction

For centuries humans have been fascinated with exploring the celestial unknown. Space has caught the attention of scientists, fictional dreamers and writers of motion pictures often fogging the perception of reality and fiction. On the scientific front, modern day launch systems, probes and other advanced technologies mean we are able to explore the world beyond our atmosphere more than ever before. Some seek to discover the origins of the universe. Others look to deep space for signs of life or essential resources. Still others seek to use space as the next military theater.

Space was the high school debate topic for the 1990-1991 season and the college debate topic for the 1985-1986 season. You may want to find a current coach, teacher or judge who remembers these debates to discuss ideas with them as many of the arguments will be similar.

History of Space Exploration and Development

As you begin your research on the space topic it is important to have a general understanding of the history of space exploration. The next few sections will provide an overview for you.

Early Space Exploration

The beginning of human understanding and investigation into the world outside the Earth's limits dates back to the early civilizations of Mesopotamia, China, Egypt, Greece, India, and Central America.[i] The Babylonians are credited with the development of mathematical and scientific astronomy that discovered the cyclical nature of lunar eclipses.[ii] The Greeks continued the work by looking for rational explanations of celestial phenomena they observed. Perhaps one of the most monumental and highly controversial ideas of its time was Galileo's idea of a heliocentric universe in which the Earth rotated around the sun, instead of the other way around. The Roman Catholic Church was not in support of this idea and suppressed his work.[iii] The next century saw the likes of Johannes Kepler and Newton, who through the use of rudimentary telescopes, were able to show the relationship of planetary movement.[ivv] Over the years, many have contributed to the advancement of the field both scientifically and with fictional imagination. However, it wasn't until the 20th century that space exploration went from star-gazing to sending objects and humans into the celestial unknown.

The prospect of traveling out of our atmosphere took a major step forward as the Wright brothers of Dayton, Ohio completed the first successful powered flight at Kitty Hawk, North Carolina. [vi]Although the flight lasted seconds, the achievement laid the infrastructure for future aerospace advancement and experimentation. The next major milestone in space travel came from the development of single stage ballistic missiles by the Germans during World War II. The Germans successfully launched the first human-made object into space on October 3, 1942.[vii] After the war, German scientists in collaboration with the United States led both military and civilian research in space. The first animal launches and aerial photographs came in 1947. On April 12, 1961 Soviet cosmonaut Yuri Gagarin became the first human in space.[viii]

The United States' governmental role in space exploration began in 1915 with the formation of National Advisory Committee for Aeronautics (NACA) to promote and institutionalize aeronautic research during the escalation of WWI, and to keep up with French, German, Russian, and British research and development. NACA was operational until the National Aeronautics and Space Act was signed by Dwight D. Eisenhower on July 29, 1958 creating the National Aeronautic and Space Administration, or NASA as we all come to know the organization today.[ix]

The Space Race

Born out of military threat, civilian space development paralleled weapons development. If a country had the capabilities to launch an object into space, the technology and capability to launch ballistic missiles anywhere on Earth would not be far behind. On October 4, 1957 the Soviet space program launched the world's first human-made satellite Sputnik 1, which was viewed in the United States as a potential national security threat. The United States sought to match and then exceed the capabilities of the Soviet Union. On January 31, 1958 Explorer 1 became the first U.S. satellite in orbit.[x] Competition to explore space escalated into the space race between the Soviet Union and the United States as the developed world entered into the Cold War. [xi]

In a speech to a joint session of Congress on May 25, 1961, John F. Kennedy charged Americans to land a person on the moon and return safely to Earth.[xii]

> *"First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the Earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish."*[xiii]

Alan Shepard became the first American in space aboard *Freedom 7* on a 15-minute suborbital flight in 1961. John Glenn became the first American to orbit the Earth on February 20, 1962.

The next phase of U.S. space exploration was Project Gemini. The objective was to conduct experiments and develop techniques required for lunar missions. The first Gemini flight with astronauts on board was flown by Gus Grissom and John Young on March 23, 1965. Nine subsequent missions followed, expanding capabilities of long-duration human space flight, ability to rendezvous and dock with another vehicle, and collect medical data on the effects of space travel on humans. Additionally, this phase included the first U.S. spacewalks.[xiv]

The famous Apollo mission series represented the next phase on U.S. space exploration. The goal of the Apollo missions was to land humans on the moon and safely return them to Earth. On July 20, 1969 Neil Armstrong, Buzz Aldrin, and Michael Collins aboard Apollo 11 became the first Americans to land on the moon. Collins was not part of the landing expedition, and orbited while Armstrong and Aldrin made the landing. Upon setting foot on the moon Armstrong was famously quoted, *"That's one small step for man, one giant leap for mankind,"* as the world tuned in to watch the historic event.[xv] [xvi]

The Apollo mission series was also famous for the Apollo 13 mission. Apollo 13 experienced a catastrophic explosion in space, which led to a miraculous display of scientific ingenuity to overcome what appeared to be insurmountable odds to keep three astronauts alive and return them to Earth as the world watched. The Apollo mission was terminated after Apollo 17, and humans have not returned to the moon since.

In 1975 the United States teamed up with the Soviet space program for the first time for the Apollo-Soyuz Test Project (ASTP). This joint venture marked the last Apollo flight, as well as the last staffed space launch until the flight of the first space shuttle in April 1981. After the ASTP project NASA embarked on the Skylab space station from 1973-1979. The major focus throughout the 1970’s and 1980’s was the development of the space shuttle, or reusable space vehicle. Joining together again in 1995 the United States and Russia operated together with the U.S. shuttle program and the Russian MIR space station. This project eventually became known as the International Space Station (ISS).[xvii]

In addition to staffed space expeditions, NASA conducted additional unstaffed space expeditions to further explore space. The Mariner program sent probes to near-by planets such as Mars, Venus, Mercury, Jupiter, and Saturn. The Pioneer Program sent smaller probes to celestial bodies on the far outskirts of our solar system. Many other programs and probes were sent into outer space with different scientific capabilities. One of the more famous programs was the Hubble telescope, which orbits Earth and is able to view images deep into space. Other programs have included the Mars pathfinder, exploring the environment on Mars.[xviii]

Timeline of the Space Race

Date	Event	Actor
Oct. 4, 1957	Sputnik 1, the first human made object to orbit the Earth, was launched by the USSR. It remained in space until January 4, 1958.	USSR
Nov. 3, 1957	Sputnik 2, carrying a dog, was launched by the USSR. It remained in orbit until April 13, 1958.	USSR
Jan. 31, 1958	Explorer 1, the first U.S. satellite in orbit, was launched into space. It discovered the Earth's radiation belt.	USA
Mar. 5, 1958	Explorer 2 was launched and failed to reach orbit.	USA
Mar. 17, 1958	Vanguard 1 satellite was launched into orbit. Although communication with it was lost in 1964, it remains the oldest human made satellite still in orbit.	USA
May 15, 1958	Sputnik 3 was launched by the USSR.	USSR
Oct. 1, 1958	NASA was founded.	USA
Oct. 11, 1958	Pioneer 1 became the first launch by NASA.	USA

Jan. 2, 1959	Luna 1, the first human made satellite to orbit the moon, was launched by the USSR.	USSR
Mar. 3, 1959	Pioneer 4 was launched and fell into a solar orbit, becoming the first U.S. sun orbiter.	USA
Sept. 12, 1959	Luna 2 was launched and hit the moon on September 13, becoming the first human made object to hit the moon.	USSR
Oct. 4, 1959	Luna 3 translunar satellite was launched, orbiting the moon and photographing 70 percent of the far side of the moon.	USSR
Apr. 1, 1960	Tiros 1, the first successful weather satellite was launched by the United States.	USA
Aug. 18, 1960	Discoverer XIV launched the first U.S. camera equipped Corona spy satellite.	USA
Apr. 12, 1961	Vostok 1 was launched by the USSR, carrying cosmonaut Yuri A. Gargarin, the first man in space. He orbits the Earth once.	USSR
May 5, 1961	Mercury Freedom 7 carried Alan Shepard, the first U.S. astronaut into space in a suborbital flight.	USA
Aug. 6, 1961	Vostok 2 was launched by the USSR carrying Gherman Titov, the first day long Soviet space flight.	USSR
Feb. 20, 1962	Mercury Friendship 7 took off with John Glenn, Jr. the first American in orbit, and orbited the Earth three times.	USA
May 24, 1962	Mercury Aurora 7 was launched with M. Scott Carpenter, making three orbits.	USA
July 10, 1962	Telstar 1, U.S. satellite, beamed the first live transatlantic telecast.	USA
Dec. 14, 1962	U.S. Mariner 2, the first successful planetary spacecraft flew past Venus, and entered a solar orbit.	USA
June 16, 1963	Vostok 6 carried Valentia Tereshkova, the first woman in space and orbited the Earth 48 times.	USSR
July 31, 1964	U.S. Ranger 7 relayed the first close-range photographs of the Moon.	USA

Mar. 18, 1965	The first space walk was made from Soviet Vostok 2 by Alexei A. Leonov. Duration was 12 minutes.	USSR
Mar. 23, 1965	First staffed flight of the Gemini program, Gemini 3 carrying Virgil I. Grissom and John W. Young. It made three orbits around the Earth.	USA
Mar. 24, 1965	Ranger 9 transmited high-quality images of the moon, many of which were shown live in the first television spectacular about the moon.	USA
June 3, 1965	Edward White made the first U.S. space walk from Gemini 4. Duration was 22 minutes.	USA
July 14, 1965	U.S. Mariner 4 returned the first close-range images of Mars.	USA
Nov. 16, 1965	Soviet Venus 3 was launched, becoming the first craft to hit Venus on March 1, 1966.	USSR
Dec. 4, 1965	Gemini 7 was launched carrying Frank Borman and James A. Lovell, Jr., making 206 orbits around Earth and proving a trip to the Moon possible.	USA
Dec. 15, 1965	American astronauts Walter Schirra, Jr. and Thomas Stafford in Gemini 5 made the first space rendezvous with Gemini 7.	USA
Feb. 3, 1966	Soviet Luna 9 was the first spacecraft to soft-land on the moon.	USSR
Mar. 1, 1966	Soviet Venera 3 hit Venus, the first spacecraft to reach another planet. It failed to return data.	USSR
March 1966	Soviet Luna 10 was the first spacecraft to orbit the moon.	USSR
June 2, 1966	Surveyor 1 was the first U.S. spacecraft to soft-land on the Moon.	USA
Aug. 14, 1966	U.S. Lunar Orbiter 1 entered moon orbit and took the first picture of the Earth from the distance of the moon.	USA
Apr. 23, 1967	Soviet Soyuz 1 was launched, carrying Vladimir M. Komarov. On April 24 it crashed, killing Komarov, the first human space flight fatality.	USSR
Oct. 18, 1967	Venera 4 sent a descent capsule into the atmosphere of Venus,	USSR

	returning data about its composition.	
Sept. 15, 1968	Soviet Zond 5 was launched, the first spacecraft to orbit the Moon and return.	USSR
Oct. 11, 1968	Apollo 7 was the first staffed Apollo mission with Walter M. Schirra, Jr., Donn F. Eisele, and Walter Cunningham. It orbited the Earth once.	USA
Dec. 21, 1968	Apollo 8 was launched with Frank Borman, James A. Lovell, Jr., and William A. Anders, the first Apollo to use the Saturn V rocket, and the first staffed spacecraft to orbit the moon, making 10 orbits on its 6-day mission.	USA
Jan. 1969	Soyuz 4&5 perform the first Soviet spaceship docking.	USSR
July 20, 1969	Neil Armstrong and Edwin Aldrin, Jr. made the first staffed soft landing on the moon and the first moonwalk, using Apollo 11.	USA
July 31, 1969	Mariner 6 returned high-resolution images of the surface of Mars, concentrating on the equatorial region.	USA
Aug. 5, 1969	Mariner 7 returned high-resolution images of the surface of Mars, concentrating on the southern hemisphere.	USA
April 11, 1970	Apollo 13 was launched, suffering an explosion in its SM oxygen tanks. Its moon landing was aborted and the crew, James A. Lovell, Jr., John L. Swigert, Jr., and Fed W. Haise, Jr., returned safely.	USA
Sept. 12, 1970	Soviet Luna 16 was launched, conducting the first successful return of lunar soil samples of an automatic spacecraft.	USSR
Nov. 17, 1970	Luna 17 landed on the moon, with the first robot, Lunokhod 1.	USSR
Dec. 15, 1970	Soviet Venera 7 was the first probe to soft-land on Venus.	USSR
Jan. 31, 1971	Apollo 14 moon mission was launched by the United States with Alan Shepard. They explore the moon and transport lunar material. Shepard becomes the first person to hit a golf ball on the moon.	USA
Apr. 19, 1971	Salyut 1 space station was launched by the USSR. It remained	USSR

	in orbit until May 28, 1973.	
May 30, 1971	The United States launched Mariner 9, which became the first spacecraft to survey Mars from orbit.	USA
June 6, 1971	Soyuz 11 carried G.T. Dobrovolsky, V.N. Volkov, and V.I. Patsayev to Salyut 1, the first occupancy of an orbital station. However, on June 29th the passengers died upon Soyuz 11's reentry.	USSR
July 30, 1971	Apollo 15 astronauts David Scott and James Irwin drove the first moon rover.	USA
Nov. 13, 1971	American Mariner 9 was the first spacecraft to orbit another planet, Mars.	USA
Mar. 2, 1972	Pioneer 10 was launched toward Jupiter, designed to familiarize alien life with humans. It returned the first close-up images of Jupiter in 1973.	USA
July 15, 1972	Pioneer 10 became the first human made object to travel through the asteroid belt.	USA
April 5, 1973	Pioneer 11 was launched flying past Jupiter in 1974 and Saturn in 1979 where it discovered new rings.	USA
May 14, 1973	Skylab workshop was launched by the United States.	USA
May 25, 1973	First crew to Skylab was launched, repairing damage that occurred during launch.	USA
Nov. 3, 1973	American Mariner 10 was launched, on the first dual planet mission. Over the next year, it returned photographs of Venus and Mercury.	USA
May 17, 1974	NASA launched the first Synchronous Meteorological Satellite.	USA
June 24, 1974	Soviet Salyut 3, their first military space station, was launched. It remained in orbit until Feb. 2, 1977.	USSR
July, 1975	American Apollo 18 and Soviet Soyuz 19 docked.	USA and USSR
Oct. 1975	Soviet Venera 9 and 10 sent the first pictures of Venus to Earth.	USSR

June 22, 1976	Soviet military space station Salyut 5 is launched, remaining in orbit until August 8, 1977.	USSR
July 20, 1976	Pictures of the Martian surface were taken by Viking 1, the first U.S. attempt to soft land a spacecraft on another planet.	USA
Sept. 3, 1976	Viking 2 landed on Mars on the Plain of Utopia where it discovered water frost.	USA
Aug./Sept. 1977	Voyagers 1 and 2 left Earth to meet with Jupiter in 1979 and Saturn in 1980.	USA
Sept. 29, 1977	Soviet Salyut 6 space station was launched.	USSR
Nov. 1978	The Einstein Observatory began its 30 day mission.	USA
Dec. 1978	Two Pioneer spacecraft reached Venus. One dropped four probes into the atmosphere while the other mapped the surface.	USA
Sept. 1, 1979	Pioneer 11 reached Saturn, flying to within 13,000 miles and taking the first close-up photographs.	USA
Apr. 12, 1981	The first mission of the Space Transportation System, Columbia, was launched.	USA
June 19, 1981	The European Space Agency (ESA) launched its third Ariane rocket.	ESA
Dec. 20, 1981	The ESA launched a fourth Ariane rocket.	ESA
Mar. 1, 1982	Venera 13 landed on Venus, and provided the first oil analysis.	USSR
Apr. 19, 1982	Soviet Salyut 7 space station was launched.	USSR
May 13, 1982	Soviet Soyuz T-5 was launched to rendezvous with Salyut 7, the first team to inhabit the space station.	USSR
Aug. 1982	Voyager 2 completed its flyby of Saturn.	USA
Nov. 11, 1982	The space shuttle Columbia's 5th mission, its first operational one, began, deploying two satellites.	USA
Apr. 4, 1983	The space shuttle Challenger lifted off for its first mission and had the first American space walk in nine years.	USA
June 19, 1983	Sally Ride became the first U.S. woman to travel in space.	USA
Oct. 10, 1983	Soviet Venera 15 returned the first high-resolution images of	USSR

	the Venus polar area, and compiled a thermal map of the most of the northern hemisphere.	
Nov. 28, 1983	The space shuttle Columbia carried the ESA Spacelab-1 into orbit.	USA, ESA
Jan.-Nov. 1983	The Infrared Astronomical Satellite found new comets, asteroids, galaxies and a dust ring around the star Vega that may be new planets.	USA, UK, Netherlands
Feb. 3, 1984	Bruce McCandless took the first untethered space walk from the space shuttle Challenger.	USA
July 17, 1984	Soyuz 12 was launched carrying Svetlana Saviskaya, who became the first woman to walk in space.	USSR
Aug. 30, 1984	The third space shuttle, Discovery, took off on its maiden voyage.	USA
Oct. 1984	Salyut 7's crew set a 237-day record in space.	USSR
Oct. 5, 1984	Launch of space shuttle Challenger mission STS-41G carrying the first crew with two women—Sally Ride and Katherine Sullivan. Sullivan became the first American woman to walk in space.	USA
Dec. 1984	Soviet/International Vega 1&@ were launched, dropping probes into Venus' atmosphere before continuing to Halley's Comet.	USSR
Jan. 8, 1985	The Sakigake probe was launched by Japan's Institute of Space and Aeronautical Science, becoming the first interplanetary probe as it rendezvous with Halley's Comet.	Japan
Apr. 29, 1985	The Challenger carried the ESA spacelab-3 into orbit.	USA and ESA
July 2, 1985	The ESA launched the Giotto spacecraft from an Ariane rocket.	ESA
Oct. 3, 1985	The fourth space shuttle Atlantis took off on its first mission.	USA
Oct. 1985	Spacelab D1, the first joint German/ESA mission, was flown.	Germany, ESA
Jan. 1986	Voyager 2 flew past Uranus	USA

Jan. 28, 1986	The space shuttle Challenger exploded shortly after liftoff of mission STS.	USA
Feb. 20, 1986	The core unit of Soviet space station Mir was launched.	USSR
March, 1986	Spacecraft from the USSR, Japan and Western Europe flew by Halley's Comet on its 30th recorded appearance.	USSR, Japan, ESA
Dec. 1987	Yuri Romanenko returned from space station Mir, having arrived there from Soyuz TM 2 and set a record of 326 days in space.	USSR
May 4, 1989	Space Shuttle Atlantis was launched, deploying the spacecraft Magellan.	USA
July 12, 1989	Soviet/International Phobos 2 launched, which orbited Mars to study its surface, atmosphere and magnetic field.	USSR
Oct. 18, 1989	U.S. launched the Galileo spacecraft from Shuttle Atlantis flight STS-34 which took infrared images of Venus and images of asteroid Ida before continuing to Jupiter.	USA
April 5, 1990	U.S. Pegasus rocket was deployed from a B-52 bomber, and launched the Pegsat satellite in the first demonstration of the Pegasus launch vehicle.	USA
April 24, 1990	Space Shuttle Discovery launches on STS-31, deplolying the Hubble Space Telescope astronimcial observatory.	USA
Aug. 1990	U.S. spacecraft Magellan arrives at Venus where for the next year it took radar images of the surface.	USA
Oct. 6, 1990	Space Shuttle Discovery launched the Ulysses spacecraft with two upper stages, on mission STS-41. Ulysses flew toward Jupiter, to be slingshot towards the sun, to obtain data from high solar latitudes.	USA
Feb. 7, 1991	Salyut 7 fell from orbit and burned up over Argentina.	USSR
Apr. 5, 1991	Space Shuttle Atlantis carried the Compton Camma Ray Observatory into orbit. This new space telescope, built by NASA, was the first to provide an all-sky continuous survey in	USA

	the gamma-ray and X-ray spectra.	
June 5, 1991	Shuttle Columbia carried the Spacelab SLS-1 into orbit, to conduct investigations into the effects of weightlessness on humans.	USA

The Future of NASA and Space Exploration

For the past several years, the priorities of NASA have been governed by the Vision for Space Exploration. The Vision was announced by President Bush in January 2004 and endorsed by Congress in the 2005 NASA authorization act. It directed NASA to focus its efforts on returning humans to the Moon by 2020 and some day sending humans to Mars and worlds beyond. The plan to implement the Vision was as follows:

- Retire the space shuttle the first half of 2011 (extended from the original deadline of the end of 2010). Rely on non-U.S. vehicles for human access to space until a replacement vehicle is developed.
- Terminate U.S. use of the International Space Station at the end of 2015.
- Under the Constellation program, develop new systems for space exploration:
    - the Ares I rocket to launch astronauts into low Earth orbit, where the International Space Station is located;
    - the Orion crew capsule, to be launched atop Ares I to carry astronauts into orbit and beyond;
    - the Ares V heavy-lift rocket to send astronauts and equipment to the Moon;
    - and the Altair lunar lander and various lunar surface systems.

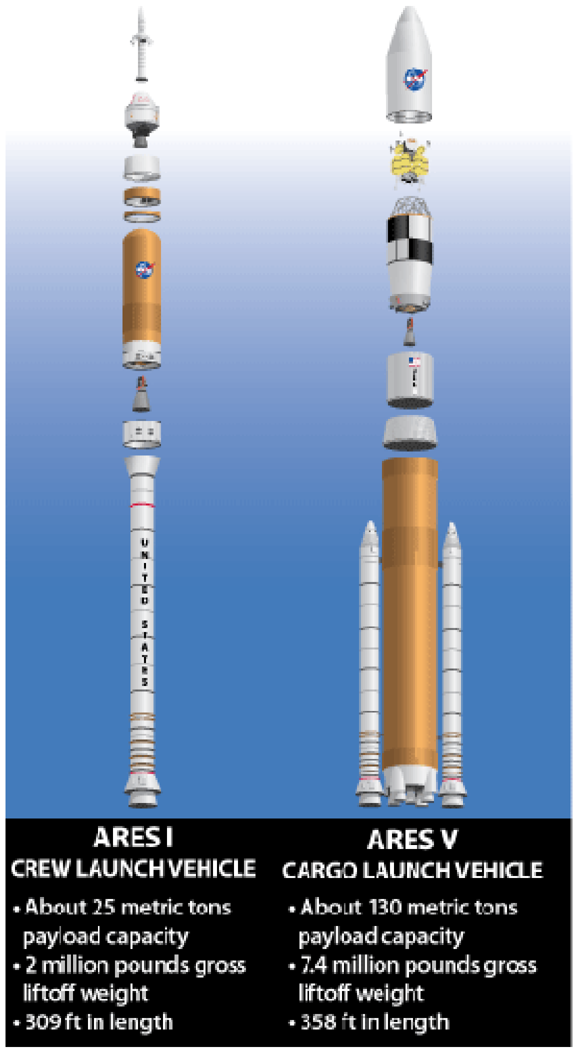
Orion is similar to an enlarged Apollo capsule. It is designed to carry six astronauts and to operate in space for up to six months.[xix]

Orion

Source: The Huntsville Times, http://blog.al.com/space-news/2009/04/nasa_continues_tests_for_space.html

The Ares I rocket is designed to be a high-reliability launcher that, when combined with Orion, will yield a crew transport system with an estimated 10-fold improvement in safety relative to the space shuttle. The development of Ares I has encountered some technical difficulties, but the Augustine committee characterized these as "not remarkable" and "resolvable."[xx]

Ares I and V



Source: "Window into Texas State Government"

http://www.window.state.tx.us/comptrol/fnotes/fn0801/orion.html

Ares V is designed to be capable of launching 160 metric tons of cargo into low Earth orbit. For human missions beyond low Earth orbit, Ares V would launch equipment into orbit for rendezvous with an Orion launched by an Ares I. At present, Ares V is only a conceptual design. The Augustine committee described as "an extremely capable rocket" but estimated that under current budget plans it is unlikely to be available until the late 2020s.[xxi]

The resulting efforts are now approaching major milestones, such as the end of the space shuttle program, design review decisions for the new spacecraft intended to replace the shuttle and decisions about whether to extend the operation of the ISS. At the same time, concerns have gown about whether NASA can accomplish the planned program of human exploration of space without significant growth in its budget. [xxii]

Obama Administration and NASA

Though President Obama referred to our current spot on the timeline of innovation as "our Sputnik moment" in his State of the Union speech, planned innovation as it relates to space is given a backseat to his stated goals of high-speed rail, increased internet connectivity and environmentally-friendly oil alternatives.

In May 2009, when the Obama Administration released the full details of its budget request for FY 2010, it announced plans for a high-level independent review of the future of human space flight, chaired by Norman R. Augustine, an aerospace businessman. Major components of the NASA budget request were placeholders, to be revised following the results of this review. The Augustine committee released its final report in October 2009.[xxiii]

- Option 1: Current Budget, Current Program. This option is the current program, modified only to provide funds for space shuttle flights in FY2011 and for deorbiting the International Space Station in FY2016. The first crewed flight of Ares I and Orion is no earlier than 2017, after the International Space Station has been deorbited. Ares V is not available until the late 2020s, and there are insufficient funds to develop Altair and the lunar surface systems needed for returning to the Moon until well into the 2030s, if ever.

- Option 2: Current Budget, Extend Space Station, Explore Moon Using Ares V Lite. This option extends use of the International Space Station to 2020 and begins a program of lunar exploration using a variant of Ares V known as Ares V Lite. It develops commercial services to transport humans into low Earth orbit. It delivers a heavy-lift capability in the late 2020s, but it does not develop the other systems needed for returning to the Moon for at least the next two decades.
- Option 3: Additional Budget, Current Program. Like Option 1, this option is the current program, modified to provide funds for space shuttle flights in FY2011 and to deorbit the International Space Station in FY2016. The first crewed flight of Ares I and Orion would still be after the International Space Station is deorbited. The additional funding, however, would permit a human lunar return in the mid-2020s.
- Option 4: Additional Budget, Extend Space Station, Explore Moon First. Like Option 2, this option extends use of the International Space Station to 2020 and uses commercial services to transport humans into low Earth orbit. The first destination beyond Earth orbit is still the Moon. There are two variants to this option. Variant 4A develops the Ares V Lite for lunar exploration as in Option 2. Variant 4B extends the space shuttle program to 2015 and develops a heavy-lift vehicle for lunar missions that is more directly shuttle-derived. Both variants permit a human lunar return by the mid-2020s.
- Option 5: Additional Budget, Extend Space Station, Flexible Path for Exploration. Like Option 4, this option extends use of the International Space Station to 2020 and uses commercial services to transport humans into low Earth orbit. Missions beyond Earth orbit, however, follow a "flexible path" of increasingly distant destinations—

such as lunar fly-bys, rendezvous with asteroids and comets, and Mars fly-bys—without initially attempting a lunar landing. A lunar landing would be possible by the mid to late 2020s. Variant 5A employs the Ares V Lite. Variant 5B uses a commercial heavy-lift rocket derived from the Evolved Expendable Launch Vehicle (EELV). Variant 5C develops a shuttle-derived vehicle for heavy lift as in Variant 4B. (These alternative launch vehicles are discussed further later in this report.)

Since the release of the report Congress and President Obama have issued somewhat conflicting mandates on NASA:

- In 2010, Obama cancelled the Constellation Program's plan to develop Orion, and heavy-lift architecture for deep space. Obama says that the government cannot afford the $9 billion effort and urged NASA to seek new partnerships with private enterprise and transform its way of doing things.[xxiv]
- Later that year, Congress wrote language into the NASA Authorization Bill ordering NASA to build two of the elements of Constellation, the Orion deep space craft and a shuttle derived heavy lift launcher and set a 2016 deadline.
- In the most recent budget request for 2012, Obama slashed funding for the Orion and heavy lift rocket development, suggesting a lack of seriousness about following congressional mandates.[xxv]
- Recently some members of Congress, including Senator Bill Nelson, have told NASA and the Obama administration in no uncertain terms that the 2016 deadline was not optional but was enshrined in law.[xxvi]

$1.6 billion of Obama's 2012 budget goes "toward commercial companies to build rockets capable of carrying cargo and astronauts to the space station and low-Earth orbit. Until the companies meet such standards, the U.S. will rely on the Russians for access to the space station after the shuttle fleet retires next year."[xxvii]

NASA says it will not be completing it by its 2016 deadline. In mid-January, NASA submitted a 22-page report to Congress saying that they could not complete the heavy-lift rockets within the time and under the budget provided to it. This is largely because while Congress instructed NASA to build the rocket, they did little to help pay for it.

The heavy-lift rockets were supposed to replace the shuttle fleet currently being retired, but with only two missions on the soon-to-be-retired rockets, we may be without a fleet for a few years.

U.S. Space Policy

Before you begin writing your cases, you will need a general understanding of how U.S. space policy is formulated. This section provides an overview for you.

A variety of governmental and nongovernmental organizations help to coordinate and guide U.S. space policy. These include the Office of Science and Technology Policy (OSTP) and the National Science and Technology Council (NSTC), both in the Executive Office of the President, as well as outside advisory groups, such as the NASA Advisory Council, committees of the National Academies, and independent committees such as the Augustine committee. The National Academies have recommended that the President take senior executive-branch officials to align agency and department strategies; identify gaps or shortfalls in policy coverage, policy implementation, and resource allocation; and identify new opportunities for space-based endeavors that will help to address the goals of both the U.S. civil and national security space programs.[xxviii]

The Obama Administration has stated that it intends to reestablish the National Aeronautics and Space Council (NASC), "which will report to the President and oversee and coordinate civilian, military, commercial and national security space activities."[xxix] The NASC was established along with NASA itself by the National Aeronautics and Space Act of 1958. It was most active during the Kennedy Administration, when it recommended, among other policies, the Apollo program to send humans to the Moon. Some analysts attribute its influence during the period to the fact that it was chaired by Vice President Johnson. The NASC was abolished in 1973, reestablished in 1989 as the National Space Council, then abolished again in 1993, with its functions absorbed into the NSTC.

Some aspects of space policy are documented in formal presidential statements of national space policy. In 2006, the Bush Administration issued such a statement, replacing a previous one that had been in place for 10 years. The 2006 policy established principles and goals for U.S. civilian and national security space programs and set guidelines for a few specific issues such as the use of nuclear power in space and the hazard of debris in orbit. It defined the space-related roles, responsibilities and relationships of NASA and other federal agencies, such as the Department of Defense and the Department of Commerce.

Outer Space Treaty

The Outer Space Treaty provides the basic framework on international space law, which outlines that: "The exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind, outer space shall be free for exploration and use by all States, outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means, States shall not place nuclear weapons or other weapons of mass destruction in orbit or on celestial bodies or station them in outer space in any other manner; the Moon and other celestial bodies shall be used exclusively for peaceful purposes; astronauts shall be regarded as the envoys of mankind; States shall be responsible for national space activities whether carried out by governmental or non-governmental activities; States shall be liable for damage caused by their space objects, and States shall avoid harmful contamination of space and celestial bodies."

The Outer Space Treaty was signed by the Russian Federation, the United Kingdom and the United States in January of 1967 and has been enforced since October 1967.

Understanding Space

Earth's atmosphere is made up of five layers; the Troposphere (0-20 km above Earth), the Stratosphere (20-50 km), the Mesosphere (50-85km), the Thermosphere (86-690 km), and the Exosphere (690-10,000km). The physical characteristics of each layer provide unique challenges to human space inhabitation or even transition.[xxx]

For this topic, we are concerned with space beyond the mesosphere. The mesosphere starts at about 50 kilometers above the Earth's surface. It is the layer of the Earth's atmosphere directly above the stratosphere. It is difficult to study, because balloons and planes cannot travel that high. [xxxi]

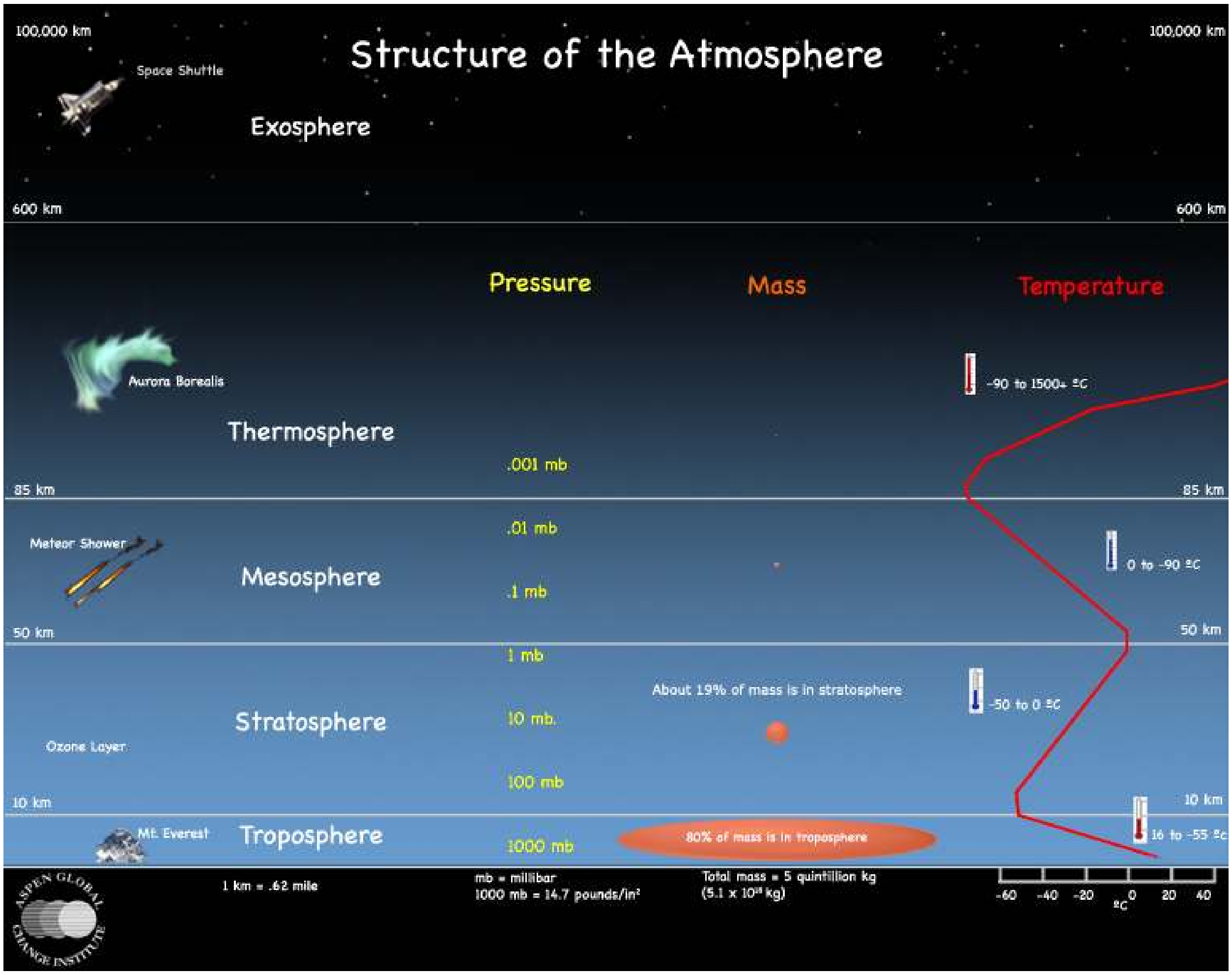
The thermosphere is technically part of Earth's atmosphere, but the density is so low that most refer to it as part of outer space. In fact, many definitions of space say that space begins at 100km, which is the bottom of the thermosphere. The ISS orbits within this layer.

Above the thermosphere is the exosphere. It is the outermost layer of Earth's atmosphere and starts at an altitude of 500km and goes to 10,000km. Many scientists consider 10,000 km to be the official boundary between the Earth's atmosphere and interplanetary space.

Beyond this layer is what is referred to as “interplanetary space,” which holds many of the planets which with we are familiar. Interplanetary space extends to the edge of the solar system, where it becomes interstellar space. The solar system is encompassed by the heliosphere, which extends from the sun’s surface to the edge of the solar system.

The heliosphere forms a sort of magnetic bubble around our solar system, protecting the solar system against harmful cosmic rays.

After the heliosphere and the solar system is interstellar space. This area of space is generally defined by its emptiness, which doesn’t mean that there is nothing there. It contains quantities of gas, dust, and radiation. Interstellar space is commonly referred to as “the great frontier” because it is largely untraveled and unexplored.



Source: Aspen Global Change Institute

Space Terminology

As you are researching this topic you are likely to come across words that are new to you. Below we have defined key terms you may come across as you begin to read about this topic.

Term	Definition
Antimatter	A hypothetical form of matter of which the atoms are composed of anti-particles, as protons, electrons, etc. assumed to carry charges opposite to those associated with ordinary matter. Particles having such properties have been produced in particle accelerators.

Astronomical Unit	The mean distance of Earth from the Sun, i.e. 92,955,807 miles (149,597,870 km).
Cislunar	Relating to the space between the Earth and the orbit of the Moon.
Cosmic year	The time it takes the Sun to revolve around the center of the galaxy, approximately 225 million years.
Dark Matter	A form of matter which has not been directly observed but whose existence has been deduced by it's gravitational effects.
Exosphere	The part of the Earth atmosphere above the thermosphere which extends into space. H and He atoms can attain escape velocities at the outer rim of the exosphere.
Fission	The release of energy through splitting atoms.
Flyby	Space flight past a heavenly body without orbiting.
Flyby Spacecraft	A spacecraft which follows a continuous trajectory past a target object, never to be captured into an orbit. It must carry instruments that are capable of observing passing targets by compensating for the target's apparent motion.
Geocentric	Earth centered.
Geospace	Also called the solar-terrestrial environment, geospace is the domain of Sun-Earth interactions. It consists of the particles, fields, and radiation environment from the Sun to Earth's space plasma environment and upper atmosphere. Geospace is considered to be the fourth physical geosphere (after solid Earth, oceans, and atmosphere).
Gyroscope	A spinning, wheel-like device that resists any force that tries to tilt its axis. Gyroscopes are used for stabilizing the attitude of rockets and spacecraft in motion.
Heliocentric	Centered on the Sun.
Heliosphere	The space within the boundary of the heliopause, containing the Sun and solar system.
Heterosphere	The Earth atmosphere above 105 km altitude where species-wise concentration profiles establish due to diffusive equilibrium, with N2

	dominance below 200 km, O dominance from 200 to 600 km, and He dominance as of 600 km altitude.
High gain antenna	A dish-shaped spacecraft antenna principally used for high rate communication with Earth This type of antenna is highly directionally and must be pointed to within a fraction of a degree of Earth.
Homosphere	The Earth atmosphere below 105 km altitude where complete vertical mixing yields a near-homogeneous composition of about 78.1% N2, 20.9% O2, 0.9% Ar, and 0.1% CO2 and trace constituents. The homopause (or turbopause) marks the ceiling of the homosphere. The homosphere can be broadly divided into three distinct regimes: the troposphere (0 to 12 km), the stratosphere (12 to 50 km) and the mesosphere (50 to 90 km).
Hydrosphere	The water on or around the surface of a planet.
Inferior conjuction	Alignment of Earth, Sun, and an inferior planet on the same side of the Sun.
Inferior planets	Planets whose orbits are closer to the Sun than Earth's, i.e. Mercury and Venus. Also called inner planets.
Jovian Planet	Any of the four biggest planets: Jupiter, Saturn, Uranus, and Neptune.
Kelvin	Scale of temperature named after the English physicist Lord Kelvin, based on the average kinetic energy per molecule of a perfect gas. Absolute zero is equivalent to -273.16oC (-459.4oF).
Kinetic Energy	An object's energy of motion; for example, the force of a falling body.
Lander Spacecraft	A spacecraft designed to reach the surface of a planet or moon and survive long enough to telemeter data back to Earth.
Light Speed	299,792,458 meters per second +/- 1.2 m/sec (186,282.39 miles/sec). U.S. National Bureau of Standards, 1971.
Light Time	The amount of time it takes light or radio signals to travel a certain distance at light speed.
Light Year	The distance light travels in one year, approximately 9.46 trillion km (5.88 trillion miles).

Lithosphere	The crust of a planet.
Low-Earth Orbit	An orbit in the region of space extending from the Earth's surface to an altitude of 2,000 kilometers. Given the rapid orbital decay of objects close to Earth, the commonly accepted definition is between 160-2,000 km above the Earth's surface.
Low-Gain Antenna	An omni-directional spacecraft antenna that provides relatively low data rates at close range, several AU for example.
Lunar Module	The craft used by Apollo missions for Moon landings. The lunar module consisted of a descent stage, used to land on the Moon and as a platform for liftoff, and an ascent stage, used as crew quarters and for returning to the orbiting command module.
Mach	The ratio of the speed of a vehicle (or of a liquid or gas) to the local speed of sound.
Magnetic Field	A region of space near a magnetized body where magnetic forces can be detected.
Magnetic Pole	Two meanings: (1) the points on Earth towards which the compass needle points. (2) A concentrated source of magnetic force, e.g. a bar magnet has two magnetic poles near its end.
Magnetopause	The boundary of the magnetosphere, lying inside the bow shock. The location in space where Earth's magnetic field balances the pressure of the solar wind. It is located about 63,000 km from Earth in the direction of the Sun.
Magnetosphere	That region of space surrounding the Earth which is dominated by the magnetic field.
Mantle	Middle layer of the Earth; between the crust and the core.
Maria	Dark areas on the Moon, actually lava plains, once believed to be seas.
Medium Earth Orbit	An orbit in the region of space above low Earth orbit (2,000 kilometers) and below geosynchronous orbit (35,786 kilometers). Sometimes called Intermediate Circular Orbit.
Medium Gain	A spacecraft antenna that provides greater data rates than a low-gain

Antenna	antenna, with wider angles of coverage than a high gain antenna, about 20-30 degrees.
Meridian	Great circle that passes through both the north and south poles, also called line of longitude.
Microgravity	An environment of very weak gravitational forces, such as those within an orbiting spacecraft. Microgravity conditions in space stations may allow experiments or manufacturing processes that are not possible on Earth.
Micrometeoroid Protection	Shielding used to protect spacecraft components from micrometeoroid impacts. Interplanetary spacecraft typically use tough blankets of Kevlar or other strong fabrics to absorb the energy from high-velocity particles.
Minor Planet	An asteroid.
Moon	A small natural body which orbits a larger one. A natural satellite.
Multistage Rocket	A rocket having two or more stages which operate in succession each being discarded as its job is done.
Omni directional	Capable of transmitting or receiving signals in all directions, as an antenna.
One-Way Light Time	The elapsed time it takes for light, or a radio signal, to reach a spacecraft or other body from Earth, or vice versa.
Orbit	The path of a body acted upon by the force of gravity. Under the influence of a single attracting body, all orbital paths trace out simple conic sections. Although all ballistic or free-fall trajectories follow an orbital path, the word orbit is more usually associated with the continuous path of a body which does not impact with its primary.
Orbit Insertion	The placing of a spacecraft into orbit around a planet or moon.
Orbiter	A spacecraft designed to travel to a distant planet or moon and enter orbit. It

Spacecraft	must carry a substantial propulsive capability to decelerate it at the right moment to achieve orbit insertion.
Pegasus	A rocket-vehicle concept for transportation of commercial high-priority freight or 172 passengers.
Photosphere	The visible surface of the sun.
Planet	A nonluminous celestial body larger than an asteroid or a comet, illuminated by light from a star, such as the sun, around which it revolves. The only known planets are those of the Sun but others have been detected on physical (non-observational) grounds around some of the nearer stars.
Plasma	A gas-like association of ionized particles that responds collectively to electric and magnetic fields.
Plasmasphere	The region of the atmosphere consisting of cold dense plasma originating in the ionosphere and trapped by the Earth's magnetic field.
Quasars	Quasi-stellar objects. They are believed to be among the most distant objects in the observable Universe, emitting more energy than some of the most powerful galaxies.
Rocket	A missile or vehicle propelled by the combustion of a fuel and a contained oxygen supply. The forward thrust of a rocket results when exhaust products are ejected from the tail.
Satellite	A body, natural or artificial, in orbit around a planet. The term is used most often to describe moons and spacecraft.
Scan Platform	An articulated, powered appendage to the spacecraft bus which points in commanded directions, allowing optical observations to be taken

	independently of the spacecraft's attitude.
Service Module	That part of a spacecraft which usually carries a maneuvering engine, thrusters, electrical supply, oxygen and other consumables external to the descent module. Discarded prior to reentry.
Stratosphere	A division of the Earth's atmosphere extending from altitudes ranging 5-10 miles to 18-30 miles.
Thermosphere	The Earth atmosphere between 120 and 250 to 400 km (depending on the solar and geomagnetic activity levels), where temperature has an exponential increase up to a limiting value Texo at the thermopause. The temperature Texo is called the exospheric temperature.
Throttle	To decrease the supply of propellant to an engine, reducing thrust. Liquid propellant rocket engines can be throttled; solid rocket motors cannot.
Thrust	The force that propels a rocket or spacecraft measured in pounds, kilograms or Newtons. Thrust is generated by a high-speed jet of gases discharging through a nozzle.
Trotopause	The level separating the troposphere and the stratosphere, occurring at an altitude of 5-10 miles.
Troposphere	A division of the Earth's atmosphere extending from ground level to altitudes ranging 5-10 miles.
Ultraviolet	A band of electromagnetic radiation with a higher frequency and shorter wavelength than visible blue light. Ultraviolet astronomy is generally performed in space, since Earth's atmosphere absorbs most ultraviolet radiation.

Universal time	The mean solar time of the meridian of Greenwich, England. Formerly called Greenwich mean time.
Universal time coordinated	The world-wide scientific standard of timekeeping; based upon carefully maintained atomic clocks and accurate to within microseconds. The addition or subtraction of leap seconds, as necessary, keeps it in step with Earth's rotation. Its reference point is Greenwich, England; when it is midnight there, it is midnight UTC.
Vector	A quantity that is specified by magnitude, direction and sense.
Zero gravity	A condition in which gravity appears to be absent. Zero gravity occurs when gravitational forces are balanced by the acceleration of a body in orbit or free fall.

Affirmative Arguments and Case Ideas

Why should we spend millions or even billions of dollars and countless hours to explore space? To be successful this year, affirmative debaters will need to find a good answer to this question. U.S. geopolitics have changed significantly since the United States first made the decision to pour resources into space exploration to win the space race against the Soviet Union. Is exploring space still important or even beneficial to the United States?

There are many possible benefits to space exploration and development that affirmative debaters can discuss in their case. More than 50 years ago, President Eisenhower's advisors stated that the space program was justified by both "the compelling urge of man to explore and to discover" and by "scientific observation and experiment which will to add to our knowledge and understanding."[xxxii]

Today there is no consensus about the most important role of the space program. A recent Congressional Research Report (CRS) echoed this sentiment:[xxxiii]

> *Is the urge to discover a sufficient reason to explore space, or must exploration also meet needs here on Earth? Should economic benefits be an explicit focus for NASA or just a positive side effect? To what extent should improving STEM education be a NASA function, as opposed to a consequence of its other functions? Should the emphasis of international space programs be competition or cooperation?*

The priorities that affirmative teams assign these objectives may determine their affirmative plan. For example, if the affirmative argues that national prestige is a high priority, it could choose to emphasize NASA's high profile human exploration activities, such as establishing a moon base or exploring Mars. If scientific knowledge is a high priority, the plan could emphasize unstaffed missions such as the Mars rovers. If international relations are a high priority, the plan could encourage joint space activities with other nations. If scientific knowledge is of interest, the plan could focus on the Hubble telescope.

We describe several of these and many other possible programs below. Use this list as a starting point as you begin to research this topic.

Spinoff Technology

Many devices that you are no doubt familiar with and may use every day were developed because of space exploration! Take a look at the list below.

- **Adjustable smoke detectors-** NASA developed adjustable smoke detectors in cooperation with Honeywell Corporation so astronauts would be aware of fires or loose noxious gasses. They are now standard in homes.
- **Long distance telecommunications**- The satellites NASA monitors provide us with the ability to communicate across long distances, fueling our global economy.
- **Safety grooving**- There are grooves covering runways and highways that allow water to drain and that provide more friction for wheels. This was initially developed by NASA for safer takeoffs. It is estimated that safety grooves have reduced highway accidents by nearly 85 percent.
- **Cordless tools**- Cordless tools were developed by NASA so that astronauts on Apollo 11 could have portable devices with which to collect samples.
- **Water filtering systems**- NASA optimized water-filtering technology and now hundreds of filters use the technology NASA created making water safer to drink.
- **Memory metal alloys**- Metals, such as the ones in sinks and shower valves that reduce water flow at high heat levels to prevent scalding, change shape in response to temperature. NASA developed these to use in the International Space Station.
- **Better software**- NASA developed technologies that allow computing devices to memorize user preferences. This is now used in a variety of personal computing software.
- **Better athletic shoes-** Today's best athletic shoes reduce shock and give more stability because of space suit technology.

- **Better sports equipment-** NASA's research in lightweight metals known as "metallic glass" has increased the strength and decreased the weight of sporting goods like tennis rackets. Their research into shock absorption has also led to higher quality helmets.
- **Better baby food-** NASA developed a vegetable-like oil additive while researching food for astronauts. Enriched infant formulas that were developed out of this technology are believed to assist in mental and visual development.
- **Freeze drying-** NASA developed freeze drying to provide food to astronauts. Now freeze drying is used to keep foods edible longer. This is particularly handy in underdeveloped countries.
- **Solar power-** The technology NASA used to power unstaffed high altitude aircrafts are the most advanced solar cells available.
- **Carbon monoxide detection**- NASA developed carbon monoxide detection for satellites.
- **Medical advances-** Research into microgravity is allowing medical scientists to do research not possible on Earth, which is leading to advancements with such diseases as diabetes, Parkinson's, Alzheimer's, pancreatic cancer, cystic fibrosis and hemophilia. Research also yielded the image processing used in CAT Scanners and MRI technology, kidney dialysis machines, insulin pumps, programmable heart pacemakers, fetal heart monitors, and surgical probes used to treat brain tumors in children.
- **Temper foam**- Temper foam was originally developed to absorb shock and offer improved protection and comfort in NASA's airplane seat. It is now used in comfy mattresses, football helmets, medical cushions and seating systems for the severely disabled, among other things.

- **Foam insulation for prosthetic limbs**- NASA also developed a light and virtually indestructible foam insulation to protect space shuttles' external tanks. This technology can be used as an alternative for the heavy plaster molds used to manufacture prosthetic limbs. The material is easier to use and much cheaper, in turn making prosthetic limbs less expensive.
- **Remediation solution**- A environmentally friendly remediation solution developed at Kennedy Space Center to restore grounds contaminated by chemical compounds used during rocket in the early days of the Space Program is now cleaning up areas around the United States that have been impacted by high concentrations of harmful chlorinated solvents. Commercially, the remediation solution applies to contamination sites created by dye and paint manufacturers, dry cleaners, chemical manufacturers, metal cleaning and degreasing facilities, leather-tanning facilities, pharmaceutical manufacturers, adhesive and aerosol manufacturers, among others.
- **Crash test dummies**- A robotic vision system designed at Goddard Space Flight Center to determine the position and orientation of bar code targets without the use of lasers led to the development of sophisticated crash test dummies and computer crash test models that provide repeatable, computerized evaluations of laceration injuries.
- **Tools to investigate crime scenes**- Spinoff technologies have also aided the criminal justice system. After a hailstorm damaged the foam insulation covering the external tank on the space shuttle (while on the launch pad), Kennedy Space Center developed a scaling and measurement-imaging device to determine the exact scale of the damage incurred. This device, manufactured by Armor Holdings Inc., of Jacksonville, Florida, is now very helpful in law enforcement, as it is being used to shoot scaled photos of

blood patterns, graffiti, and other criminal evidence. Also, a mineral identification tool that was developed under a Small Business Innovation Research (SBIR) grant for NASA's Mars Rover Technology Development program is now serving as a powerful tool for U.S. law enforcement agencies and military personnel to identify suspicious liquid and solid substances. The tool can measure unknown substances through glass and plastic packaging materials.

- **Liquidmetal**- Marshall Space Flight Center testing of metallic materials in an undercooled state has contributed to the development of Liquidmetal, a new type of metal that is twice as strong as titanium but behaves more like a plastic with its flexible, moldable properties. Liquidmetal is found in many commercial products, including sporting goods (baseball bats and hockey sticks), jewelry and wristwatches, cell phones, orthopedic implants, and coatings for industry.
- **Infrared Cameras-** Infrared hand-held cameras used to observe blazing plumes from the Shuttle have helped firefighters pinpoint hot spots in fires.

These few examples are just the beginning of NASA technology that has "spun-off" into commercialized products for popular use. The technologies used in space travel and related industries often produce developments that are helpful in industries from health to music. This happens so often that NASA publishes an annual journal called *Spinoff* that details these products. It maintains a searchable archive of them here: http://www.sti.nasa.gov/spinoff/database

Spinoffs are not primary justifications for space exploration, but a side benefit. They have constantly been cited as among the most valuable results. In context of the recent economic recession we have become more conscious of government spending. Affirmatives can argue that the spinoff technology produced by space exploration decreases the overall cost of the program.[xxxiv]

Negative Response. Negatives can argue that while initially there were many spinoffs from space exploration, now we are likely to get a smaller return for each additional dollar spent. It is not clear that spinoffs can be expected from the new U.S. moon and Mars program, because new technology development is not central to it. A recent CRS report pointed out that NASA has cut back research in nanotechnology and robotics to pay for the design and prototyping of launch vehicles that will be new in a sense but based on principles developed for the Apollo program four decades ago. "Through the 1970s, development of space and missile technology helped drive the development of computers, but that period is now over and computer science progress is stimulated by developments in a myriad of other areas, from bioinformatics to nanoelectronics and from home information technology to computer vision for cars."[xxxv]

In addition, negatives can argue that spinoffs cannot be the primary justification for the affirmative's space program because we cannot predict what spinoffs will result from space exploration in advance. The payoffs are surprising and are not guaranteed. Negatives can argue that there are better dollar-for-dollar returns elsewhere. We discuss this argument further in our Negative Arguments section on page 74 and page 83.

Space Militarization and Weaponization

Next, affirmative debaters can argue that we should increase space militarization and weaponization. From the atomic bomb's strategic utility in putting an end to the largest war of the 20th century, to the more recent deployment of Unmanned Arial Vehicles to assist in the War on Terror, the U.S. ability to maintain military dominance since WWII has largely been a product of the nation's ability to maintain a competitive edge in technological advancement.

Affirmative debaters can argue that the next arena for military activity is space. Modern technology has made military exploration and development of space a very possible reality for the new century.

The push for a national presence in space began during the Cold War with the space race between the United States and the Soviet Union. While the Soviet Union won the race to the first space orbiting satellite with Sputnik, the United States followed soon after with its own achievements including putting the first human being on Earth's moon. While these well known examples of early space exploration may seem like ancient history to many high school students debating this topic, it highlights the very real perceptual importance of leading humanity's expansion into space.

The strategic importance of having an altitudinal advantage in war fighting is a long documented one with the legendary military text *The Art of War* mentioning the importance of remaining uphill in battle over two and a half thousand years ago. Space is now the new "high ground."[xxxvi]

Affirmative debaters choosing to focus on this issue may increase efforts to militarize and weaponize space. National security space programs, conducted by the Department of Defense (DOD) and the intelligence community are less visible than NASA, but their budgets are comparable to NASA's. The Cato Institute reports that there are currently several ways the military currently uses space:[xxxvii]

- **Integrated Tactical Warning and Attack assessment (ITW&AA**). ITW&AA is a unique military requirement that cannot be met using nonmilitary resources. It is essentially monitoring the signs of attacking long-range aircraft and missiles, either toward the United States or within a theater/region of operations.

- **Weather and Environmental Monitoring.** Weather and environmental satellites are an example of dual-use space satellites. According to the RAND report: "Weather satellite information is crucial to mission planning for all the armed services."
- **Satcom.** Communications probably represents the single biggest use of space for both the military and civilian/commercial sectors. The DOD operates several communication satellites and uses commercial satellites, especially for high-speed mobile services.
- **Surveillance and Reconnaissance.** Space-based remote sensing for surveillance and reconnaissance is essentially an extension of aerial observation done previously by balloons and aircraft.
- **Navigation and Positioning.** The DOD operates a constellation of 24 satellites that make up the space segment of the Global Positioning System. These satellites transmit precise time signals; and receivers in view of the satellites can calculate their positions and velocities anywhere in the world.

According to the Cato Institute, "Control of space is at the crux of the debate about the future of U.S. military space policy. Clearly, we have been using and will continue to use space for military purposes. But, whereas we are currently using space assets to support terrestrial (ground, sea, and air) military operations, what Sen. Robert C. Smith (R-N.H.), the Space Commission (which was chaired by current Secretary of Defense Donald Rumsfeld), and others have proposed is that the United States move toward "weaponizing" space for space control."

Donald Rumsfeld chaired two blue ribbon commissions at the request of Congress. The second, called the Commission to Assess United States National Security Space Management and Organization had several findings related to space weaponization:[xxxviii]

- The United States is more dependent than any other nation on the use of space.
- Space systems can be vulnerable to a range of attacks.
- Nations hostile to the United States can possess or can acquire the means to disrupt of destroy U.S. space systems.
- The United States is an attractive candidate for a “space Pearl Harbor.”

The commission noted that U.S. national security space interests should be recognized as a top national security priority and that the United States must develop the means both to deter and to defend against hostile acts in and from space. Maybe even develop the ability to launch attacks from beyond our atmosphere while keeping the weapons systems a safe distance away from many nation’s retaliatory strike capabilities.

Affirmatives can argue that the importance of weaponization becomes even more apparent when the alternatives are taken into consideration. The world without U.S. dominance in space will not be a world without space exploration, but rather will be one in which another nation, perhaps with interests contrary to U.S. national security, gains the upper hand in negotiating humanities future outside of Earth. The People’s Republic of China, for example, has recently pushed a very aggressive space agenda that has the potential to become a tool of their military to threaten United States military power.

We feel relatively safe now because countries that are potential threats to the United States like Iran and North Korea cannot get their weapons to the United States with their current technology. However, if they are able to go into space we would have a hard time stopping them from attacking us if they wished to do so. Affirmatives can argue that this means we must be concerned about space weaponization.

Space will continue to be explored. The only question is what role the United States will play in the development of new technologies and exploration strategies and the effect they will play in the future of humanity's expansion into space.

A recent analysis of numerous GAO reports directly related to DOD space programs found that 16 recommendations still categorized as open including topics such as space acquisitions, polar-orbiting environmental satellites, DOD's operationally responsible space concept and training of Air Force personnel. While the United States currently has satellites for surveillance and telecommunication purposes, these capabilities can be added to or enhanced with continued exploration and understanding of space. These issues may be fertile ground for affirmative cases.

Negative Response. Negatives can argue that as important and potentially vulnerable as current U.S. space-based assets might be, deploying actual weapons (whether defensive or offensive) would likely be perceived as very threatening to the status quo and is likely to trigger a dangerous arms race. Negatives can point out that no country currently has weapons in space and that U.S. move to deploy weapons might provide unneeded impetus for other countries to follow suit.[xxxix] Any move to weaponize space would likely precipitate a response to counter such capability. And weapons in space would indeed be tempting targets for a preemptive attack by an adversary.

To be sure, not deploying weapons in space is no guarantee that potentially hostile nations (like China) will not develop and deploy anti-satellite threats. However, negatives can argue that it is virtually certain that deploying U.S. weapons in space will lead to the development and deployment of such counter weapons.

Negatives can argue that United States should therefore not be the first to weaponize space—either with defensive weapons or with offensive ASATs.

Negatives might argue that deploying defensive decoys—rather than weapons—would not inevitably lead to such an arms race. So negatives might create a counterplan to weaponize with defensive weapons only. However, this still might be threatening to some countries that perceive any weaponization as militaristic and a threat.

Discovery and the Human Spirit

Another motivation for space exploration and development that we will discuss is discovery and knowledge. Affirmative debaters can argue that we have a desire to understand our universe and space exploration can satisfy that curiosity. We might learn about number theory, physics, other solar systems or any number of concepts. The affirmative can argue that space exploration is important because we are curious about our world. These plans will advocate knowledge for knowledge's sake and are not justified by any sort of economic payoff.

An affirmative case focusing on discovery for the sake of discovery might explore a planet or launch a new telescope beyond the mesosphere to study a specific phenomenon like cosmic rays.

Negative Response. Negatives can argue that these motivations are so vague that it is not clear why space exploration is a particularly good way of satisfying them, rather than, for example, research on the inner space of the human mind, exploration of the rich environment of the Earth's oceans, or development of new social institutions to increase human altruism.[xl] For more on this, see our discussion of an ocean floor counterplan on page 83.

Staffed Mission to the Moon

Next, affirmatives can propose a staffed mission to the moon. The moon is the closest destination beyond Earth's orbit and could serve as a stepping stone for subsequent destinations. Advocates of a mission to the moon argue that, as Earth's nearest neighbor, the moon is of great scientific interest. They further claim that missions to the moon could provide an opportunity to develop and test technologies and gain experience working in space. According to some advocates, the moon might literally be a staging point for future missions.[xli] For some in Congress concerned about national security or national prestige, the prospect of a staffed Chinese mission to the moon is a strong motivation to reestablish a U.S. presence.

Vehicle for Human Transportation to the Moon. Currently the shuttle program is the only way the United States can transport humans to the moon, but the shuttle program is scheduled to end later this year.

In 2002, NASA indicated that the shuttle would continue flying until 2015 and perhaps until 2020 or beyond. The Columbia disaster in 2003 forced NASA to revise that plan. The Columbia Accident Investigation Board, established after the Columbia disaster to make recommendations on how to proceed, recommended 15 specific actions to be taken before returning the shuttle to flight. In addition, the board found that "because of the risks inherent in the original design of the space shuttle, because the design was based in many aspects on now-obsolete technologies, and because the shuttle is now an aging system but still developmental in character, it is in the nation's interest to replace the shuttle as soon as possible as the primary means for transporting humans to and from Earth orbit."[xlii]

The board recommended that if the shuttle is to be flown past 2010, NASA should develop a vehicle recertification at the material, component, subsystem and system levels as part of a broader and "essential Service Life Extension Program."[xliii]

Transportation in Debate Rounds. Transportation to and from outer space could be a concern in some debate circuits; however, you may attempt to avoid the issue. The majority of plans in the contemporary debate world are not multiple pages in length. Typically they are very short—just a sentence or two. This is often to avoid giving the negative links to other arguments or ground for a plan-inclusive-counterplan (PIC). In addition, matters like this could be characterized by the affirmative as a peripheral matter and something related to enforcement. Such matters typically get little attention in most debate rounds. For example, the current military deployment topic does not specify exactly how the troops would be withdrawn from the country specified. Which commander gives the order? Would the troops return by aircraft or by boat? Would the troops just be redeployed to the United States or could they be deployed elsewhere in the world, or would they all be released from military service? Most negative teams never raise such issues. The concern with launch systems could be something similar.

Either way, affirmative teams that plan to put humans on the moon will need to consider transportation issues.

Obama's space policy ends the NASA shuttle program, cuts NASA funding for the planned Orion capsule to carry NASA crew into space and "urges NASA to use the services of commercial space companies to deliver cargo and astronauts into low earth orbit."[xliv]

Private companies are already stepping in to fill the gap. In late 2010, the government authorized SpaceX to launch into low orbit and reenter the Earth's atmosphere. "It will be the first-ever commercial spacecraft to be licensed for reentry. Founded by South African entrepreneur Elon Musk, SpaceX has been a leader in the drive to develop commercial space travel. Its company's Dragon capsule is scheduled to orbit the Earth four times next month, transmit data, receive commands, then reenter the atmosphere and splash into the Pacific Ocean."[xlv]

There are many ways the private sector can work to explore and develop space. For more on this topic, see our discussion of private alternatives in our negative arguments section on page 76.

Advocates of the government program say the best option is to continue with the status quo (i.e., Orion, Ares I and eventually Ares V). Development of Orion and Ares I is well underway by NASA and its contractors. As mentioned earlier, Congress has mandated that NASA continue to develop Orion. Development of Ares V has not yet begun but Ares I and Ares V are to share some components. NASA says it is not possible to meet the 2016 deadline under current projections.[xlvi]

Negative Response. Negative debaters can argue that traveling to the moon is not an exciting goal and will not increase support for the space program. Since we have already traveled to the moon, it will seem like we are retracing our footsteps.[xlvii] If you choose to make this argument, you might suggest a more inspiring goal, such as traveling to Mars.

In addition, negative debaters can argue human travel to the moon is too expensive and there is a better use of the money. The Augustine committee concluded that Orion "will be acceptable for a wide variety of tasks in the human exploration of space" but expressed concern about its operational cost once developed. Debaters might counterplan to send rovers to learn about the moon, arguing that sending humans into space is a wasteful luxury and its only purpose is to get public support for NASA. Rovers cut down dramatically on the cost as they do not require oxygen or food and they do not need to return to Earth safely.

In response to affirmatives that argue that we need to go to space to enhance our prestige, negatives can argue that this, too, is a waste of money. Jerry Degroot notes, "The time has come to pull the plug on meaningless gestures in space." He says gestures like these seem "like lunacy when terrestrial frontiers such as disease, starvation and drought cry out for cash." He says "practical Earth-based" science suffers because of the billions we spend on outer space. "It is no wonder that the most articulate opposition to the Apollo missions came from Nobel scientists who objected to the way their budgets were bled in order to fund an ego trip to the moon," he says. [xlviii]

In a speech before congress President John F. Kennedy challenged the United States to put a man on the moon before the end of the 1960's. In an impressive display of scientific advancement and ingenuity, NASA accomplished this task in 1969. Fifty years after the challenge, and forty-some years after the first lunar landing, this milestone remains the furthest staffed expedition in the history of humankind. The space race to put a person on the moon was a huge symbolic move in the context of the Cold War, but had a hefty price tag. Today, the United State lacks international pressures to return to the moon or farther. Also, in context of a global economic recession, a mission of this proportion is not a priority. Although there is potentially more that could be achieved on the moon, it would not be prudent for the United States to pursue subsequent staffed missions to the Moon at this juncture. Justification for investing in long ranged staffed space flights would require an objective to achieve a milestone beyond what we accomplished over forty years ago.

Staffed Mission to Mars

Mars is the fourth planet from the sun and located approximately 56,000,000 km to 399,000,000 km from the Earth.[xlix] The window of opportunity to launch and take advantage of shortest distance occurs approximately every 26 months. The most prominently discussed alternative to human travel to the moon is to proceed to Mars directly.

Mars is the only other planet in our solar system besides Earth that scientists believe may be inhabitable. Scientists have been looking for a planet with similar characteristics as ours as a possible new home if Earth finally breathes its last breath. And even though Mars is cold, dry and lacks virtually all air, it was once warmer and wetter. If we can find water in the rocks or beneath the surface, people may be able to eventually live there as early as 2030.[l]

Negative Response. There are many arguments available to negative debaters.

Launch Systems. Travel to Mars must overcome the same challenges as travel to the moon with regards to finding a vehicle capable of transporting humans to space.

Technology Limitations. The Augustine committee rejected a staffed mission to Mars in the near future because it considered current technology insufficiently developed to make a Mars mission safe. It found that Mars is "unquestionably the most interesting destination in the inner solar system" and the "ultimate destination for human exploration" but "not the best first destination." A spacecraft that lands on Mars must overcome the lunar or Martian "gravity well" before returning to Earth. The fuel required to accomplish this makes this destination challenging. Overcoming the logistical hurdles to put humans on Mars would most certainly require unprecedented scientific and technological advancements.[li]

As a potential alternative, the Augustine committee considered fly-by missions to either the moon or Mars, missions that would orbit either the moon or Mars, missions that would land on the moons or Mars and missions to near-Earth objects such as asteroids or comets. They also considered missions to various Lagrange points. Lagrange points are special locations in space, defined relative to the orbit of the moon around the Earth or the Earth around the sun. Negative debaters might consider a counterplan to do any of these missions instead of the affirmative plan.

Limitations on Human Travel. In addition, a mission to Mars would have to overcome time limitations on human travel in space. Despite current simulations to test how humans would respond to long term isolation and confined space situations, these tests are on the ground at home and the separation is too hard to simulate.

Cost. Similar to a staffed mission to the moon, negative debaters can argue that human travel into space is extremely wasteful since much of the scientific exploration can occur with only rovers which do not require oxygen, food or to return to Earth safely. Negative debaters can argue that in the current economic climate it is impossible to justify spending billions of dollars on these missions when the benefit is unknown.

International Space Station

When the International Space Station (ISS) was first announced, its assembly was to be complete by 1994. In 1998, when construction actually began, it was expected to be complete by 2002, with operations through at least 2012. Completion is now scheduled for later this year (2011).

Utilization of the ISS. Under the Vision, U.S. utilization is scheduled to end after 2015, but widespread efforts to extend that date are ongoing. As recently as 2003, NASA briefing charts showed operations possibly continuing through 2022. The 2015 end date for U.S. utilization of the ISS arises from the engineering specifications of the U.S. ISS components, which were designed for a 15-year lifetime from the date of deployment. The various components were launched sequentially during the assembly process, but the nominal reference point is considered to be the launch of the U.S. laboratory module Destiny in February 2001. Despite the 15-year specification, past experience "clearly indicates that systems are capable of performing safely and effectively for well beyond their original design lifetime" if properly maintained, refurbished, and validated. The first milestones for a decision on service life extension will occur in 2014. [lii]

Many ISS advocates want to continue utilization past 2015 in order to receive a greater return on the cost and effort that have been invested in ISS construction. Russia has stated that, if necessary, it will continue operations on its own. The Augustine committee found that extending ISS operations would "significantly enhance" the return on investment to both the United States and its international partners, while a decision not to extend operation would "significantly impair U.S. ability to develop and lead future international spaceflight partnerships."[liii]

Transportation to the ISS. The U.S. space shuttle has been the major vehicle taking crews and cargo to and from the ISS. Russian Soyuz spacecraft also carry both crews and cargo. Russian Progress spacecraft carry cargo only, as they are not designed to survive reentry into the Earth's atmosphere. A Soyuz is always attached to the station as a lifeboat in the case of an emergency.

If the Shuttle program is not extended, the government can contract with private companies to provide transportation to and from the space station. Paying Russia for flights on the Soyuz is also a short-term option for U.S. human access to the ISS after the shuttle program is ended. In 2009, in order to permit such payment, Congress extended a waiver of the Iran, North Korea and Syrian Nonproliferation Act until July 1, 2016.

One element of NASA's plans for ensuring cargo access to the ISS during the gap is the Commercial Orbital Transportation Services (COTS) program to develop commercial capabilities for cargo spaceflight. Under the COTS program, SpaceX Corporation is developing a vehicle known as Dragon, and Orbital Sciences Corporation is developing a vehicle known as Cygnus. Both would be cargo-only and would have about one-eighth the capacity of the space shuttle.

Affirmative Case Ideas. An affirmative case may seek to increase space exploration by continuing use of the ISS past 2015**.** Affirmative plans can also have NASA conduct specific scientific research projects on the ISS. For example, NASA might research elongated space stay and its effect on the human body to determine whether space habitation and long term space exploration is feasible on the ISS. In addition, astronauts can also test plants and animals as well as the physics of fluids in order to obtain a better understanding of superconductivity.

Negative Response. Negative debaters can argue that the cost of missions to the ISS is prohibitively expensive. It is estimated that the cost of the ISS to the United States is between $30 and $160 billion per year. Negative debaters can argue that the United States should sell the international space station to private companies or rent space to private companies for research. The Cato Institute has written extensively on this issue, "When the station is complete it should be spun off as a private entity or at least be operated on a commercial basis by private companies… Even if the station is sold at a loss, at least taxpayers will not continue to lose money on its operation. Under nonsubsidized private management, a real market will develop for use of the station based on the actual costs for private launchers to transport payloads and technicians to they called a Mars Direct approach that would use existing technology and dispense with the space stations, Moon bases, and NASA's other expensive infrastructure."

In addition to cost, extending the life of the ISS would require overcoming several technical challenges. At present, failed parts are returned to Earth in the space shuttle for refurbishment. After the end of the shuttle program, this repair strategy will no longer be possible. Most of the vehicles that are being considered for the post-shuttle period are not capable of returning cargo back to Earth.

Unstaffed Missions

Given the costs and risks of human space exploration, affirmative teams can craft a plan to curtail or postpone future human exploration missions and shift the emphasis of the nation's space program to unstaffed missions. The cost of human exploration is substantial, and according to the Augustine committee, it is not a continuum: there is an entry cost below which a successful program cannot be conducted at all.

Several options are available as alternatives to human space exploration. Congress could seek to accomplish some of the same goals through other means, such as through robotic exploration. It could focus on NASA's other activities, such as Earth science and aeronautics.

Debaters can argue that any space exploration that involves putting humans into space is extremely wasteful. Unstaffed missions cut way down on costs by using rovers that require no oxygen, no water and do not have to come home safely. Affirmative teams that choose this route can characterize human missions as a wasteful luxury and argue that its only purpose is to garner popular support.

Advocates of robotic missions assert that robotic exploration can accomplish outstanding scientific missions and inspire the public just as effectively as human exploration. The Mars rovers are a familiar example of a successful robotic science mission that has captured considerable public attention. Advocates also claim that robotic missions can accomplish their goals at less cost and with greater safety than human missions. They do not need to incorporate systems for human life support or human radiation protection, they do not usually need to return to Earth, and they pose no risk of death or injury to astronauts. Some analysts assert further that exploring with humans rules out destinations beyond Mars because current plans include no destinations beyond Mars and treat Mars itself as the long-term goal.

Mars Rover. Between 1960 and 2007 the United States and Russia have made 37 attempts to launch a human made object to either orbit or land on Mars for scientific research. 17 of these attempts were "successful" in achieving the intended goal of the mission.[liv] Many scholars name four broad goals for exploration on Mars: determine whether life ever arose on Mars, characterize the climate of Mars, characterize the geology of Mars, and prepare for human exploration.[lv]

There are some similarities between Earth and Mars, which suggests that life could have, or does exist. Both planets have roughly the same amount of land surface area. The atmospheric chemistry is relatively similar to Earth compared to other planets. Both Mars and Earth have large, sustained polar caps that are believed to be both comprised of water and ice. Also, there are similarities in regards to the tilt and rotation around the axis, providing some evidence of climate change. [lvi] However, without further investigation scientists lack certainty of the actual potential of Mars.

Additionally, the exploration of Mars is providing valuable information for robotics. The robots we send to explore Mars have to withstand extreme conditions not found on Earth, and when they break down, no one is there to fix them or solve problems on their behalf. So scientists have engineered ways to allow the robots to solve their own problems, leading to drastic leaps in robotic innovation. These innovations may lead to better technology for robotically controlled technologies on Earth. [lvii] According to a cosmonaut undergoing a simulation of a staffed exploration to Mars “This study is not useful only for Mars, but also for life on Earth".[lviii]

Although exploration of Mars has been occurring since the 1960’s, sending humans to Mars is not yet possible. The most advanced expedition to Mars has been NASA's twin “robot geologists” or more commonly referred to as rovers. The Mars Exploration Rovers were launched on June 10 and July 7, 2003, in search of answers about the history of water on Mars. They landed on Mars January 3 and January 24, 2004.[lix] [lx]

Affirmative teams might choose to argue that unstaffed missions to Mars are a necessary precursor to human travel to Mars and that their plan makes future human travel to the planet an option. A few analysts portray robotic exploration as an alternative to human exploration. For the most part, however, the two alternatives are considered complementary, rather than exclusive. The Augustine committee, for example, found that without both human and robotic missions, any space program would be hollow.[lxi]

Negative Response. There are many arguments available to negative debaters.

Human Travel Better. Negatives can argue that science is not NASA’s only purpose and claim that human exploration is more effective than robotic exploration at such intangible goals as inspiring the public, enhancing national prestige and satisfying the human urge to explore and discover.

Logistics. Negatives can further argue that the logistics of sending even unstaffed objects to Mars are astounding. Traveling to Mars is not as simple as flying in a straight line from point

A to point B. Expeditions utilize the "minimum energy trajectory" to maximize payload capacity and fuel efficiency. Once underway, the one way trip between planets will take around 9 months.[lxii]

From the previous 37 missions, scientists have gained valuable knowledge about physics outside of our atmosphere, but there are still many unknowns about all the variables of long distance space flight, landing, operations, and telemetry, among other things. This is evident by the 20 mission "failures" on unstaffed missions to Mars. Some have crashed into Mars' moons, some have broken up leaving Earth's atmosphere, and some have lost communication.[lxiii] Humans still occasionally have problems providing cell phone reception on Earth, let alone continuous communication with an object over 56,000,000 km away. Breakups of the missions might increase space debris. For a discussion of space debris and its harms see page 89 of our Negative Arguments section.

Cost. Additionally, a mission to Mars, even without humans, is not cheap. Each unstaffed expedition costs in the hundreds of millions of dollars. Programs take years of preparation, and involve coordination with many different stakeholders.[lxiv] For a deeper discussion of the costs of space travel see page 74 of our Negative Arguments section.

Asteroids

Affirmative debaters can develop a case around a mission to an asteroid. There are two major issues with which you should be familiar: asteroid mapping an asteroid mining.

Asteroid Mapping. Asteroids and other similar objects are in motion in space, and if by chance one was large enough and headed in our direction, the result of a collision could be devastating. Many scientists believe this is what killed the dinosaurs.[lxv] Many movies such as

Deep Impact or Armageddon have provided us with a doomsday scenario of this event occurring again. In 1908 in remote Siberia a large asteroid collided with Earth. Fortunately, remote Siberia in 1908 was not populated, but early photos show the devastating effect to vegetation. As science has advanced, we have invented surveillance systems to scan for objects that have a potential to collide with Earth.[lxvi]

In 2005, Congress mandated that NASA map 90 percent of all nearby asteroids 460 feet (140 meters) across or larger. The purpose of the mandate was to predict when and if these massive rocks could crash into the Earth. Affirmatives can argue that this project needs to be more heavily funded so that NASA can complete it. An affirmative case might fund a mission devoted to mapping all the asteroids and other similar materials in the solar system.

The United States also only has $1 million set aside to research technology to combat these potentially dangerous asteroids. Nuclear weapons can be used as a last resort, but that takes years of planning in order to effectively protect the Earth, something that NASA does not have the capability to do because of lack of funding.[lxvii]

If an asteroid was on track to collide with Earth, we may be able to prevent it if we know in advance. There are several ways to deflect asteroids, though none have ever been tried. The approaches fall into two categories – impulsive deflectors that nudge the asteroid instantaneously or within a few seconds, and "slow push" deflectors that apply a weak force to the asteroid for many years.[lxviii]

Asteroid Mining. Asteroid mining also has potential as an affirmative case. Asteroids are rich in valuable materials such as "nickel-iron metal, silicate minerals, semiconductor and platinum group metals, water, bituminous hydrocarbons, and trapped or frozen gases including carbon dioxide and ammonia," and 10 percent of near-Earth asteroids are easier to get to than the moon.[lxix]

An affirmative case can send robots to mine asteroids since some have valuable and rare minerals. Affirmative debaters can argue that asteroids could easily be a gold mine if the United States were to invest in the technology to get us there and to bring the materials home. The materials found on asteroids are extremely rare on earth, and most of the sources are known asteroid impact sites. "One average 500-metre-wide asteroid contains hundreds of billions of pounds-worth of metal -- more than has ever been mined in the course of human history." [lxx]

Negative Response. Negative debaters can argue that these projects are too expensive. An asteroid mapping case may cost over $320 million and some estimate that asteroid mining could cost in the range of tens of billions of dollars.[lxxi] Negatives can argue that the fact that we might find something useful is a weak reason to spend this amount of money. Negatives can argue that there are better dollar-for-dollars returns for our money elsewhere. See our section on cost on page 74 for a fuller discussion of this issue.

Satellites

In addition to asteroids, debaters will find cases and advantages centered around satellites this year. Below we discuss two types of satellites: weather satellites and communication satellites.

Weather Satellites. Affirmative debaters can advocate that the United States launch more weather satellites. The White House has asked for a substantial increase in weather satellite spending.[lxxii] With more satellites, scientists can more effectively predict weather. Debaters would be able to claim several advantages to a weather satellite plan.

First, predicting weather can help predict the spread of disease. Satellites can be used to track things like sea surface temperature and cloud cover, which are good indicators of heavy rainfall. In 2006, scientists used these predictors to prevent the Rift Valley Epidemic, a virus that could have been devastating. Heavy rainfall is an indicator of mosquito population increase, which could easily have led to increased spread of the disease. Because of the information, people were able to take precautions, making satellites "a powerful tool in curbing the spread of disease."[lxxiii]

Next, weather satellites are also integral to the effective distribution of electricity. Solar happenings and severe weather can impact how electricity is distributed and what precautions energy providers take to continue to provide consistent power. In this regard, the information given by weather satellites provides benefits for both providers and consumers. [lxxiv]

Finally, satellites like these can also provide officials with important information about disasters. Satellite images of oil that was leaking from the site of the DeepWater Horizon oil spill last year provided valuable information about the size and appearance of the spill. NASA extensively mapped the area and scientists used the information to make crucial decisions.

The benefits of weather satellites are unexpected and many. The affirmative can argue that the United States would get more utility out of these weather satellites if there were more of them and that avoiding disaster and disease saves money and would eventually outweigh the costs of the satellite. Further, affirmatives can argue that even if the satellites become extremely expensive, the number of lives saved are beyond value.

Communication Satellites. Communication satellites, or COMSATS, are a critical component of communication infrastructure in the United States on both the civilian and military sides. Project SCORE was the first U.S. communication satellite, launched in 1958, the year after the Soviet Sputnik satellite was put into orbit. Since this time, there has been a wide proliferation of communication satellite usage, primarily by the telecommunication industry.

The first large scale commercial use for communication satellites was by telecommunications companies. AT&T and Bell Laboratories were early pioneers of this technology, which allowed greater efficiency in (and in many cases creating the possibility for) long distance telephone communication. Previously, any area not connected with telephone wires was unable to be reached by telephone and often required radio transmissions for contact.

Other uses for communication satellite include satellite radio outlets (such as XM Radio or Sirius Radio), satellite television broadcasts or use in establishing Internet broadband connections. Together, these, along with their use in telecommunications, make communication satellites critical to the functioning of the United States communications and the nation's economic competitiveness.

An affirmative case might advocate that the federal government should invest more in rural broadband access. A study completed in 2009 said that access to Internet in rural communities varied greatly by community. The study also emphasized the importance of Internet availability to these parts of the United States. It said, "Rural communities that had greater broadband Internet access had greater economic growth, which conforms to supplemental research on the benefits that rural businesses, consumers, and communities ascribe to broadband Internet use." [lxxv]

Negative Response. First, negative debaters should ask the affirmative team if their satellite orbits "beyond the mesosphere." Earth's mesosphere is beyond the range of satellites, and hence cases that increase exploration and/or development to satellites may not be topical.

Even satellites that operate in the mesosphere, but only look back to Earth, may not be topical because they do not go *beyond* the mesosphere.

In addition, negative debaters can argue that an increase in satellites may cause an increase in space debris. Space debris is the space equivalent of pollution on Earth and can cause damage to other objects in space. For more on the dangers of space debris see page 89.

International Cooperation

Affirmative debaters can argue that joint space projects between nations may improve international cooperation. If an affirmative team wishes to focus on international cooperation, they might create a plan that conducts exploration in cooperation with a certain country. Prime candidates might be Russia, China, Japan, India, Israel and/or the European Union. The focus on such debates would not be the project per se, but the increased cooperation with an important country. The benefits on which the debate will focus most likely will be political, rather than scientific.

The United States has cooperated with other countries on space projects in the past with some success. From the beginning, international partners were an important component of the ISS program for several reasons, "one of which is that the United States is unwilling or unable to single handedly pursue a large-scale human space flight endeavor."[lxxvi]

NASA's space shuttle program will soon be coming to an end. This lapse thrusts the United States into an interesting international predicament in lieu of its participation and responsibilities at the ISS. According to recent news articles "to get to the $100 billion space station after next June, NASA will buy seats for our astronauts on the Soyuz rocket, just like wealthy space tourists have done." The article continues to say "Some space experts insist that makes us weak and vulnerable, that the Russians have us over a barrel. But the truth is our space programs have long relied on each other, and may soon cooperate with China and other countries to go deeper into space."

As Director General of the European Space Agency Jean-Jacques Dordain, explained "We know, at ESA, that international cooperation is difficult, even sometimes very difficult, the difficulties generally increasing with the number of partners, though this is not always true. It is always easier not to cooperate than to cooperate. But, we have learned that it can also be more difficult, if not impossible, to succeed alone." [lxxvii]

Currently NASA is considering cooperation with other nations in a joint venture for returning humans to the moon. A recent report states "NASA has signed a landmark agreement to collaborate with emerging space-faring nations for the exploration of the moon. This collaboration will include Canada, Germany, India, Italy, Japan, South Korea, Britain and France in the aim to work with NASA developing new technologies and send a series of robotic exploratory missions to pave the way for a manned return mission. The director of NASA's planetary science division points out that these eight member states are keen to send their first astronauts to the lunar surface. Whilst some may view this collaboration as an attempt by NASA to 'spread the cost' of space travel (especially in the current climate of budget cuts), the main point of this deal is to make manned missions to the Moon more of an international effort." [lxxviii]

Negative Response. Negative debaters can counter that cooperating on a space project is a ridiculously expensive way to build a strong relationship with a country. These debaters can suggest a counterplan for cooperation on another activity with a smaller price tag such as counterterrorism efforts, nuclear power development, biological weapons proliferation, or other scientific pursuits on Earth.

In addition, negatives can argue that there are so many topics on which nations might cooperate, that it is not clear why space exploration would be a particularly good choice, unless it is precisely because it does not require the nations to agree about anything relevant to existing terrestrial disputes.

Also, it is not clear that international cooperation in space projects really improves relationships. "The joint US-USSR Apollo-Soyuz test project in the 1970s did not lead to much, and the International Space Station has accomplished little except perhaps transfer of funds from the United States to Russia when the latter was in need of foreign aid during the Clinton administration. Peace between China and the West is practically assured by their intimate economic linkages, and if world economic depression of some other catastrophe were to threaten peace, a joint space program would be too weak a bond to prevent conflict. To my knowledge, nobody has proposed a joint space program between NASA and Hama, Hezbollah, Iran or the Taliban, and rockets are being fired constantly against Israel, rather building friendly relations with Radical Islam."[lxxix]

Finally, negatives can argue that cooperation will make projects more difficult. According to D. James Baker, director of the global carbon measurement program at the William J Clinton Foundation, "A common misperception among policymakers and individual agencies is that collaboration on these missions will save money or somehow boost capabilities. However, multiagency partnerships generally have just the opposite effect and drive up overall mission costs because of schedule delays, added levels of management, and redundant administrative processes."

Later he notes that, "While there are varying amounts of cooperation among agencies, generally the more interdependent agencies are for mission success, the higher the degree of complexity and risk associated with the project." Additionally, while an agency will often enter into a partnership because its individual share of the mission is made more affordable, the risks involved in meeting schedules and performance objectives are typically underestimated.[lxxx]

Medical Research

The atmospheres of space and Earth are very different, and many medical issues may be advanced by research in the zero or microgravity of space. Consider these examples:

- Microgravity became an important factor when NASA studied the production of antibiotics during shuttle missions. What scientists found was that production of antibiotics was enhanced significantly in the absence of gravity. In fact, it increased by 200 percent![lxxxi]
- A NASA device, called a bioreactor, which was built to conduct cell studies in space may be used to grow patches of human tissue. The bioreactor mimics microgravity. Cells free fall gently and slowly connect with other cells to form tissue. These tissues could be used to repair heart defects or to replace damaged tissues. A more immediate use of these tissues is to test new pharmaceuticals.[lxxxii]
- Ceramic material, which can best be formulated and constructed in microgravity, creates better prosthetic limbs.

Affirmative debaters can create a case that attempts to answer specific medical questions in space, arguing that space may hold the answer many medical problems we face.

Negative Response. Given how difficult it has proven to launch staffed spacecraft to Earth orbit, both in terms of cost and danger, doing medical treatment in Earth orbit simply is not plausible at the present time. "Although some promising experiments were done growing crystals in weightlessness, space-based manufacturing could not compete with the vast range of materials innovations being rapidly delivered by nanotechnology."[lxxxiii] Negatives can argue that it would be too difficult and costly to enact the affirmative plan. Negatives can refer to page 74 for a deeper discussion of this argument.

Energy

Next, some affirmative teams may craft plans designed discover or collect energy from space. Humans have looked to the terrestrial Earth for sources of energy since the inception of life.[lxxxiv] Currently, there is a substantial dependence on raw materials and combustion processes for energy. However, as raw materials become scarcer and the demand for energy increases, many have made initiatives to look for alternative energy sources. As far as humans know, resources on Earth are generally finite. Affirmatives can argue that the resources of outer space hold the potential to meet the needs of our energy consumption. There are a variety of options for alternative sources of energy in space.

Solar Technologies. Affirmative teams may argue that solar power stations in orbit might provide clean, limitless energy to the Earth. Available technology would allow large solar energy collectors to be placed in orbit that could beam energy to Earth via laser or microwave. Such a system could radically reduce American dependence on imported fuel. Further, such a system could sell energy to the International Space Station or to private space stations. Indeed, access to such a system might make it easier to maintain satellites and space stations in orbit and to provide expanded services and activities on stations. The reason is that with an established electrical grid in orbit, stations will need only minimal or backup power generating capacities of their own. Thus they will be less costly to launch.

Solar technologies exist on Earth, but they are limited by sun exposure. Areas that have extensive cloud cover or experience extended periods of darkness will have limited benefit from solar power. Recent projects look to capitalize on solar panels in space as the exposure to the sun is far greater than anywhere on Earth. [lxxxv] An article by ABC News and the Electric Power Research Institute states "Free of atmosphere or dust or clouds, the arrays would collect at least eight times more solar energy than they could if they were on the ground. The arrays would function for 24 hours a day, nearly every day of the year."[lxxxvi]

Deep Space. If there was such of a thing as "low-hanging fruit" in regards to energy abstraction from resources in space it would be solar technology. However, there may be more energy potential far beyond our solar system and galaxy. Scientists have identified sources of energy in deep space. This is evident from our understanding of kinetics as well as simply the ability to observe radiant light of distant objects.

Solar Winds. Other options include harnessing energy from solar winds. "Dr. Dirk Schulze-Makuch, a researcher at Washington State University, worked together with a group of scientists to determine the best course of action to take when generating a renewable energy source from solar wind. According to the research, a ten meter solar sail with approximately 300 meters of copper wiring, paired with a receiver, would be capable of generating enough electricity to power 1,000 average homes."[lxxxvii]

Negative Response. Identifying and harnessing alternate forms of energy in space will require significant advancements in technology and increased space exploration. To overcome these barriers the affirmative plan would require a large investment. Negatives can argue that the billion dollar price tag is not worth the benefits. For more on this see the Negative Arguments section on cost on page 74.

Moreover, negatives can argue that plenty of resources exist here on Earth that we can explore. These resources would not be as expensive to mine because they are here on Earth and we are more familiar with them.

Space Colonies

Long-term or permanent colonies for human settlement in space are more science fiction than reality, however, this idea is discussed in the literature on space and will, no doubt, be an affirmative case this year.

People have considered space colonies for decades. Potential colonization targets include the Earth's moon, Mars, or the moons of other planets.

Why Colonize Space? Astronomers have witnessed that many celestial bodies are finite. If Earth has a finite time line, are humans able to adapt by finding alternative means of perpetuation? If there is a general consensus that Earth will not be around forever, is it in our best interest to explore space to see what resources we can find?

Those who advocate space colonization largely due so based on concerns of limited resources on Earth. Increases in consumption patterns and human population size mean that we need more resources than ever before. Advocates believe that colonization of space would allow us to decrease population density and potentially discover new resources that could benefit humanity. Another often cited advantage to a space colony is the ability to sustain human life in the wake of some global cataclysm such as an asteroid hitting Earth, a nuclear war, or another event that would seriously damage the planets ability to sustain life.

Negative Response. The reality of space colonization is still obviously a long way off—probably centuries into the future. We cannot currently maintain people in space now for several reasons. First, on Earth we are protected from radiation by the Earth's magnetic field. In space, we are not protected from radiation. This may lead to increased rates of cancer and other problems.[lxxxviii] In addition, in zero-gravity, human's muscles deteriorate.

Negatives can argue that space colonization is too resource intensive to be a viable alternative to life on Earth. It would require a massive investment of time, labor and capital to be able to create a sustainable colony anywhere outside of Earth itself. Not only would it be extremely time consuming to develop the required technology, but implementing it under all the construction constraints of the moon or another planet is as of now unfeasible.

Search for Extra-Terrestrial Intelligence

The search for Extra Terrestrial Intelligence (SETI) has interested human beings for thousands of years. However, it is only recently, with advancements in our technological capabilities, that humans have had a serious potential to be able to contact intelligent forms of life, if they exist, beyond our own solar system. Many have advocated SETI as a way to enhance our cultural and technological capabilities. If we were to make contact with other intelligent life, a relationship could be established wherein we gain from the development and capabilities of the extra terrestrial life. Many believe that because the universe is so vast that there is a high probability that other life is out there, but because of limited will, technology, or both, humans have yet to discover them.

Methods. The two most common methods used to attempt to find signs of extra-terrestrial life are through Radio Experiments and Observational Experiments. Potential affirmative cases could advocate either.

Radio Experiments. This method employs radio frequency technology either to send messages through space in hopes of making contact with some form of intelligent life or to detect radio frequencies that may have been sent previously by other forms of intelligent life. This concept grew in popularity in the early part of the 20th century parallel to the rapid advancement of radio technology. By mid-century, there were a number of organized attempts by the scientific community to send messages into space in attempts to make contacts with extra terrestrial life.

Observational Experiments. In contrast (or addition) to radio experiments, affirmative teams could advocate the use of optical or visual methods for SETI. Advocates argue that the use of powerful lasers at specific wavelengths has the potential to find and contact intelligent life. While this is less developed than attempts using radio technology, the method has a high potential for exploration and will be an important portion of the topic to understand.

Other Potential Cases. Some affirmatives may also try to use physical explorations or probes to attempt to contact intelligent life. These methods would face numerous complications such as sustaining life on such a mission, or controlling physical probes deep in space which do not contain humans on board to control them. Another potential case might increase domestic research or interpretation of messages we may receive from extra terrestrial life. If such a message were to be received, it would need to be decoded, and hence, increasing government capabilities in this regard may play an important role on this topic.

Negative Response. There are many arguments available to negative debaters.

Cost. Negatives can argue that devoting resources to these experiments is wasteful. The chance that we might find something is a poor justification for spending millions of dollars. Many believe that the financial costs alone prove overwhelming to the United States federal government, which is already under heavy budget constraints and running a deepening deficit. For a fuller discussion on the costs of space programs see page 74 of the negative arguments section.

Malevolent Life Forms. Another argument negatives can make against SETI is that if the experiments are successful and humanity does make contact with intelligent life beyond Earth, there is no guarantee that these forms of life will be benevolent. Our planet could instead come under attack by forms of life perhaps much more advanced than ourselves with superior military technology for resources or because of other motives.

Major Negative Arguments

There are many options available to negative debaters on this topic. Negative responses to each possible affirmative plan were listed above. Below we discuss several additional major negative arguments.

Cost

Negatives can argue that space exploration is simply too expensive. The key question negatives should ask is whether the benefit the affirmative claims is worth an investment of millions or billions of dollars in the space program. Below are several arguments negatives can make to claim that the payoff of the affirmative case is not worth the cost.

Better Investments Elsewhere. Negative debaters can argue that there is a better use of the money the affirmative would like to pour into the space program. Negatives can argue that domestic needs (as in needs on planet Earth) should take precedence. The billions we have spent on the failing ISS could be going to our education system, [lxxxix] decaying infrastructure [xc] and roads, [xci] failing prison systems, poverty relief, finding a cure to cancer or decreasing the trillion dollar U.S. deficit.

In 2004 a panel of economic experts, including distinguished economists and Nobel Laureates, gathered in Copenhagen to discuss which ten problems were the most pressing for the world community to address. The panel was asked to answer the question, "What would be the best ways of advancing global welfare, and particularly the welfare of developing countries, supposing that an additional $50 billion of resources were at governments' disposal?" The panel developed a list of the ten global priorities:[xcii]

1. Diseases: Control of HIV/AIDS
2. Malnutrition: Providing micro nutrients
3. Subsidies and Trade: Trade liberalization
4. Diseases: Control of malaria
5. Malnutrition: Development of new agricultural technologies
6. Sanitation & Water: Small-scale water technology for livelihoods
7. Sanitation & Water: Community-managed water supply and sanitation
8. Sanitation & Water: Research on water productivity in food production
9. Government: Lowering the cost of starting a new business
10. Migration: Lowering barriers to migration for skilled workers

Negatives can note that space exploration did not make the list and that the affirmative will have a hard time arguing that space exploration will achieve any of these goals. The negative can argue that our limited funds should go to these higher priorities instead of funding the affirmative's plan to increase space exploration.

Spinoffs. As we discussed earlier, affirmative teams may argue that space programs are beneficial because of spinoffs, like foil or medical technology, which offsets the cost of space exploration. However, negatives can note that initially there were some spinoffs, but we are likely to get less return for each additional dollar spent. It is not clear that spinoffs can be expected from the new U.S. moon and Mars program, because new technology development is not central to it. A recent Congressional Research Service report pointed out that NASA has cut back research in nanotechnology and robotics to pay for the design and prototyping of launch vehicles that will be new in a sense but based on principles developed for the Apollo program four decades ago. "Through the 1970s, development of space and missile technology helped drive the development of computers, but that period is now over and computer science progress is stimulated by developments in a myriad of other areas, from bioinformatics to nanoelectronics and from home information technology to computer vision for cars."[xciii]

In addition, negatives can argue that the payoffs are surprising and not guaranteed. We cannot predict what spinoffs will result from space exploration in advance so they cannot be a primary justification for the space program. The assertion that something might be gained by space exploration is a poor justification for spending billions of dollars.

NASA Tradeoff. Next, the negative can argue that the affirmative plan will cause a budget tradeoff within NASA.

Negatives can argue that the costly affirmative plan will trade off with other, more important, NASA programs. Since increases in the NASA budget are unlikely, the negative can argue that funding for a program like the affirmative plan will be redirected from other NASA activities. Negative debaters can find NASA programs that might likely be cut and argue that these programs are more important and beneficial than the affirmative plan.

For example, NASA has a number of funded programs dedicated to promoting science, technology, engineering, and mathematics (STEM) education. [xciv] [xcv] Negatives can argue that these programs are crucial. Improving STEM education for both adults and students at all grade levels is critical to national competitiveness and a higher standard of living for a society.[xcvi]

Negatives can argue that without an increased funding of space exploration, NASA simply would not be able to maintain an emphasis on these programs and do the affirmative plan at the same time.

Privatize Space

[Note to Dr. Goodman: Private space would not be a topical affirmative case because the resolution asks debaters to increase the U.S. government's space exploration, not to increase space exploration in general. A case that increases space exploration through private actors would face an uphill battle to win that this increases the U.S. government's space exploration. We think this will be much more successful as a negative argument.]

Negative teams can make a compelling argument that we should privatize space exploration and development instead of expanding government efforts, as the affirmative team will argue. The Cato Institute notes this could mean shutting down NASA, selling the space station and shuttles to private purchasers and allowing the private sector to provide and pay for all future nonmilitary exploration and development in space.

The Cato Institute suggests that in the absence of disbanding NASA, the government could build down government civilian space activities by barring NASA from building and operating launch systems and requiring NASA and all other nondefense government agencies to purchase future launch services from the private sector.

President Obama supports efforts to privatize parts of NASA. In his proposed FY 2012 budget he cut funding for government launch systems and encouraged NASA to work closely with private sector contractors to develop this technology.

Robert Garmong, a writer for the Ayn Rand Institute, believes that the free market will demand space travel and it will be profitable. "The free market works to produce whatever there is demand for, just as it now does with traditional aircraft. Commercial satellite launches are now routine, and could easily be fully privatized," he says.[xcvii]

Peter Diamandis agrees that the private sector is itching to get into space. "Companies and investors are realizing that everything we hold of value—metals, minerals, energy and real estate—are in near-infinite quantities in space. As space transportation and operations become more affordable, what was once seen as a wasteland will become the next gold rush," he says.

He gives the example of "S-Type" asteroids, which are packed with iron, magnesium silicates and things like cobalt and platinum. The average half-kilometer S-type is worth more than $20 trillion dollars. "The public would definitely want to get their hands on one of those."[xcviii]

Lower Costs. The Cato Institute argues that if NASA was privatized years ago the price of space exploration would have decreased due to market competition.

> *Civilian space efforts have been dominated by NASA, a government agency that for all its good intentions has retarded as much as facilitated activities in space. By contrast, during that same period entrepreneurs in the commercial market gave birth to the computer, telecommunications, and Internet revolutions. In fact, it is free markets that have commercialized and offered to all people everything from cars to televisions to affordable air travel and virtually every product and service imaginable. If, in the 1970s, NASA had begun to turn over space activities to the private sector, space stations and Moon bases might be a reality today. Market competition usually brings down the real price of goods and services. For example, the price of airline travel in constant dollars since the mid-1970s has been cut by as much as half. Shipping costs for oil have dropped by 75 percent. In 1981 a megabyte of computer memory, which was not even available in*

the first IBM personal computers, would have cost around $45,000. Today a megabyte can be had for only a few dollars. And in the communications satellite industry, the one space activity principally in the private sector, costs have dropped dramatically in real terms. By contrast, as nearly as can be determined from impenetrable NASA accounting, the cost of putting payloads into orbit has skyrocketed.

Innovation. Opening things up to a larger market necessarily uses more minds, which means more creativity and more ideas. Garmong asserts that this innovation could solve the problems NASA has had for decades: "These problems can only be fixed by the kind of bold innovation possible only to minds left free to pursue the best of their thinking and judgment" … in other words, the private sector.

Garmong says that the space shuttle was created to satisfy the needs and wants of "clashing constituencies" and wasn't given a clearly defined goal to meet a real need. The form of the "need" came as "showy manned vehicles," which ended up being "an over-sized, over-complicated, over-budget, overly dangerous vehicle that does everything poorly and nothing well."[xcix]

Basically, because there was no market driving the purpose of the space program, and instead it was built as an avenue for the government to, essentially, show off, it produced innovations that served no real purpose and were not as effective as they could be. This would be different if, instead of endless tax dollars to back the space program, it had private financiers backing it that expected results that would produce a profit.

Esther Dyson compares the lack of innovation under government control to the Internet, saying, "The U.S. Defense Department may have created the Internet, but had it kept control of the technology, it's unlikely the Web would have become the vibrant public resource it is today.

That credit goes to the investment and activity of private citizens and private companies, starting in the late 1980s and early 1990s."[c]

Michael Merrit points out that, now that the space race with the Soviet Union is over, there is nothing propelling the government towards innovation. Whereas private companies have an interest, and must compete with each other or they do not survive, in Merrit's words, "They don't need a global conflict to ensure their innovation." [ci,cii]

Privatization in the Status Quo. Space exploration privatization is something that the United States government has toyed with for quite a while. Occasionally, parts of the space exploration program have been handed over to private companies, but often they remain within government funding, limiting their creativity.

Regulations and Red Tape. Private companies still labor under regulatory burdens that hamper their efforts. In the 1980s the creation of the Office of Commercial Space Transportation (OCST) in the Department of Transportation was supposed to avoid jurisdictional confusion. In 1995 the OCST was transferred to the Federal Aviation Administration as the AST (office of the Associate Administrator for Space Transportation). Securing permission to launch still involves safety requirements, reentry licensing, financial responsibility requirements, site operations licensing, and various environmental impact requirements.

Because of this regulatory regime, Kistler Aerospace, which is developing a reusable launch vehicle, was required to meet with local interest groups and Native American tribes and to draft an extensive environmental impact statement as part of its effort to secure permission to launch from a federal test facility in Nevada. J.P. Aerospace of California was competing for the private Cheap Access to Space (CATS) prize of $250,000 for placing a payload 124 miles above the Earth by November 8, 2000. It began the effort to secure permission to launch from the Black

Rock Desert in northern Nevada in May 2000. The company was informed in late September by the government that it would take another two months to process the license. J.P. Aerospace missed the deadline. Other companies too have lost business because of the licensing process. Potential customers generally want two-month lead times for launches. Because it often takes launchers six or more months to secure a license, it is obvious how private providers are hindered. Thus, deregulation is a key to unleashing the private sector in space.

Export control regulations administered by the Department of State under the international Traffic in Arms Regulations have often been another concern for this industry. The regulations limit the export of satellites and related components because of the potential for their use in military systems. In order to expand opportunities for U.S. industry, some analysts and policy makers have advocated transferring the regulation of these technologies from ITAR to the Export Administration Regulations administered by the Department of Commerce to loosen restrictions.

In spite of these regulations, many private companies have already made strides in space.

Launch Systems. A number of companies offer or plan to offer private launch services. Lockheed Martin in the past decade has successfully commercialized its Atlas rocket launch services. It used to sell nearly all of its services to the government; now more than half its customers are private parties. It has held costs down and has had a backlog for launches. Further, Boeing also builds and launches the Delta rockets and is also competing for cargo and providing private-sector services. Private companies such as Kelley Aerospace and Technology and Kistler Aerospace Corporation also are developing other vehicles to place payloads in orbit. Of particular interest are the development plans for a totally reusable rocket developed by former astronaut Buzz Aldrin, who was on the first Moon landing mission. Aldrin also is an engineer and through his company has developed an innovative approach to phasing in the next generation of rockets for human flight.

International Space Station. The NASA Authorization Act of 2008 directed NASA to make sure of commercial crew services to the maximum extent practicable consistent with safety requirements. The Augustine committee more broadly considered relying on commercial services in lieu of Ares I for all crew access to low Earth orbit. The COTS program is already considering this possibility for ISS crew transfer and crew rescue.

Satellites. Currently communication satellites represent the most privatized space industry. The Augustine committee found that the commercial space industry is "burgeoning." Private satellite companies produced 95 billion dollars in revenue last year, and exhibited a 17 percent annual growth rate between the years of 1996 and 2002. The communications and information revolution produced a high demand for satellites, giving a boost to the private space sector. The Satellite Industry Association estimates that there were 253,600 jobs in that industry worldwide in 2001, up from 205,400 in 1999, with 136,500 Americans employed. The Space Transportation Association chairman, Tidal McCoy, puts the number of employees in space related industries at 497,000. The International Space Business Council puts current industry revenues even higher, at $96 billion in 2000. A Department of Commerce report projects that in 2002 revenues from satellite communications, space transportation, the global positioning system, and remote sensing will be $105 billion. Telecommunications, GPS services, and even satellite radio have been the major areas of interest to the private sector.

Space Tourism. The space tourism industry has grown in recent years. Between 1996 and 2002, 245 launches were made for commercial ventures while government (non-classified) launches only total 167 for the same period. Commercial space flight has spurred investment into the development of an efficient reusable launch vehicle (RLV) which can place larger payloads into orbit. Several companies such as SpaceX are currently creating new RLV designs.

A number of commercial companies are now developing reusable spacecraft to carry private individuals on short-duration flights into the lower reaches of space. Concurrently, several companies are developing spaceports to accommodate anticipated increases in commercial space launches. The safety of commercial space launches, spaceports and space tourism are regulated by the Federal Aviation Administration.

In recent years, much publicity has been given to the idea of space tourism. The Futron Corporation claimed there was a substantial market for space tourism, based on a poll of affluent individuals, a fraction of whom might pay $50,000 for flight into space.

Solar Energy. Another promising space market is space-based solar energy. Available technology would allow large solar energy collectors to be placed in orbit that could beam energy to Earth via laser or microwave. Such a system could radically reduce American dependence on imported fuel. Further, such a system could sell energy to the International Space Station or to private space stations. Indeed, access to such a system might make it easier to maintain satellites and space stations in orbit and to provide expanded services and activities on stations. The reason is that with an established electrical grid in orbit, stations will need only minimal or backup power generating capacities of their own. Thus they will be less costly to launch.

But the current cost of putting a pound of payload in orbit is as much as $10,000. Making such a space-based energy system economical could require costs as much as two magnitudes lower, around $100 per pound. Technology that would allow energy to be generated in one country, say from natural gas, bounced off an orbiting device via laser or microwave, and received somewhere else on the planet could be made commercially viable at launch costs of perhaps $1,000 per pound. Although no company has made a commitment to develop such a system in the near future, many organizations have studied the technology. Lower launch costs could lead to the development of such a system.

Ocean Floor Counterplan

Next negatives, can argue that instead of exploring space to find resources and learn about the Earth, we can explore our own ocean floor. There are many untapped resources like oil, minerals and life species as well as much we can learn about tectonic plates and earthquakes from the ocean. Moreover, negatives can argue that this exploration would be much less expensive than the affirmative plan.

The ocean covers more than 70 percent of our planet, but scientists estimate that we've only explored about 5 percent of it. When you consider how close to home our oceans are compared to say, Mars, that really puts things into perspective. And now that we have the technology, deep ocean exploration is a very real possibility.

In a budget request to the federal government, the National Ocean and Atmospheric Association (NOAA) said, "Developments in biotechnology, sensors, telemetry, power sources, microcomputers and material science now permit the U.S. to dream of rivaling space exploration in our ability to go to and study the undersea frontier." Space and the ocean are both unexplored "frontiers," so why not explore the one closer to home, less expensive and safer?

Ocean exploration has previously produced many benefits. The NOAA says that on ocean exploration trips scientists found enzymes that, "have become critical to industries that replicate DNA, new anti-inflammatory drugs are being produced from deep-sea organisms, and new knowledge will allow us to be better stewards of ocean resources." [ciii]

The ocean holds the potential for many medical breakthroughs. Researchers at Scripps Institution of Oceanography at the University of California, San Diego, have found that sediments in the deep ocean are a significant biomedical resource for microbes that produce antibiotic molecules. These researchers say that finding new sources of medicine is becoming extremely important because Earth's bacterium is becoming increasingly resistant to current antibiotics. [civ]

Additionally, the excitement and frontier-spirit we get from exploring space can also come from the ocean. In 1998 a report by the Department of Commerce said, "Ocean exploration gives mankind a sense of human progress and heritage. It provides the experience and knowledge necessary to undertake stewardship of the ocean and its resources, and thus sets a course for future generations to navigate. What lies ahead is still unknown. Whatever it is, however, will be influenced by what is found through tomorrow's exploration – and, will likely be different than today's predictions!" [cv]

Exploring the ocean will not only produce medical and technological advancements, but it may also help us explore space. The NOAA says, "Life on Earth is found in conditions ranging from the coldest arctic ice to extremely hot hydrothermal systems on the ocean floor. Microbes are also found in very acidic conditions, very salty conditions, and very alkaline conditions."

There are similar conditions in space. For instance, Jupiter's moon Europa is completely covered by ice, but scientists believe that there likely exists an ocean under all that ice that could be 10 times as deep as our ocean. [cvi]

Topicality

Topicality will be an important argument for negative debaters on this topic. Space is a complex idea and debaters will have to answer questions such as:

- What is space exploration?
- Is a single piece of technology substantial?
- Can robots explore?
- Is space tourism exploration or development?
- Is exploration and development by private companies topical?

To help you better understand the role topicality will play on this topic, we briefly address key terms in the resolution below.

Its. Because the resolution says the "United States federal government should substantially increase ***its*** exploration of space beyond the Earth's mesosphere" cases that use other agents like private sector actors or other countries may not be topical. The resolution does not just ask you to increase space exploration in general, but the United States federal government's exploration. Cases that use private companies or other countries as actors do not increase the United States federal government's exploration of space. This is ground for negative counterplans so make use of these arguments on the negative side of the debate.

Substantially Increase. Because the resolution says the affirmative must "substantially increase" exploration, negatives can argue that a case that merely puts a single probe into the atmosphere is not substantial.

In addition, debaters will define increase in different ways. Some will say increase means to increase an existing program. Others will say that increase means to create a new program. This will become an interesting issue when dealing with some NASA projects that have come to an end. For example, after the last shuttle mission, will the shuttle program be an existing program? Make sure you develop answers to these questions as you craft your case.

Exploration and/or Development. Next, it will be important to find solid definitions of "exploration and development." Check out Daniel Lester, professor astronomy at UT Austin. He writes that dictionary definitions of exploration may be irrelevant.

Despite these ambiguities in meaning, it is still emphasized by many that the USA is a nation founded by explorers, and that, however troubling their legacy might be, those explorers have instilled in us a national ''spirit of exploration''. A discussion about the definition of ''exploration'' can, in principle, devolve into a comparison of dictionary definitions, and that is not very satisfying. Were we to do this, we would quickly find that the verb ''explore'' is defined (as per the Oxford English dictionary) as to: (1) travel through an unfamiliar area in order to learn about it; (2) inquire into or discuss in detail; and (3) examine by touch. Two of these would apply to human space flight. By these definitions, one might argue that exploration involves little more than walking into the woods a few hundred yards from home and planting tracks on a few square inches of ground that might never have been touched by human feet. This seems absurd, of course. Such definitions could even be rendered irrelevant by Chief Justice Potter Stewart's ''I know it when I see it'' test (which he famously used to define obscenity) [5]. Such a test, in which exploration is defined at gut-level, seems endemic to practical modern views of space exploration.

Next he explains what he thinks space exploration means.

The historical record offers a rich set of examples of what we call exploration: Christopher Columbus sailing to the New World, Roald Amundsen driving his dogs towards the South Pole, and Neil Armstrong stepping into the soft dust of the Moon. Yet these examples illustrate the difficulty in pinning down exploration as an activity. If we *define exploration as travel through an unfamiliar area in order to learn about it we exclude Columbus, whose discovery was serendipitous rather than purposeful. We would also have to exclude Amundsen and Armstrong, and indeed many of the pantheon of explorers, who tended to dash across new terrain rather than investigate it systematically. Even more expansive terms such as ''discovery'' sometimes offer a poor fit for the object of modern expeditions: did Robert Peary discover the North Pole in 1909, an axis point that Greek astronomers knew about 2500 years ago? Not in any meaningful sense of the word. Students of exploration, then, must make peace with this uncomfortable fact: ''exploration'' is a multivalent term, one which has been (and undoubtedly will continue to be) used in different ways by different people. Geographical discovery, scientific investigation, resource extraction, and high-risk travel are activities tucked inside this definitional basket.*

That Americans have broadly embraced exploration as a part of their national identity seems clear. Yet, as the above examples show, this embrace provides little insight into the meanings of exploration, the effect of such meanings on the planning of missions, or the value of such missions to the nation. Why does such an important term as ''exploration'' retain such ambiguity? One finds many answers, but perhaps comedian Gary Owen explains it best. Certain words, Owen states, are ''freedom words'', terms with meanings broad enough to label things that would be hard to categorize. Like Owen's made-up word ''insegrevious'', exploration has come to mean whatever its users want it to mean.

He later explains that space exploration must include a human component.

Within the political sphere, space exploration gains its relevance largely through symbolism, both as a human quest and a geopolitical strategy. Of the half dozen *campaign speeches that mentioned space flight at the 2008 Democratic National Convention, none mentioned science. For all of them space flight was useful as a measure of human (and more specifically American) achievement. In the Republican campaign arena, John McCain's policy statement about exploration was quite revealing: Although the general view in the research community is that human exploration is not an efficient way to increase scientific discoveries given the expense and logistical limitations, the role of manned space flight goes well beyond the issue of scientific discovery and is a reflection of national power and pride [22]. In the national conversation about the meaning of space exploration, not much has changed since the Augustine Commission considered these questions in 1990 [23]. ''Some point out that most space science missions can be performed with robots for a fraction of the cost of humans'', they said, ''and that therefore the manned space program should be curtailed. Others point out that the involvement of humans is the essence of exploration, and that only humans can fully adapt to the unexpected.''*

Space. You should also be careful with cases that are Earth focused. The resolution asks us to explore and develop space beyond the Earth's mesosphere, not to explore Earth from beyond the mesosphere. Negatives might argue that affirmative cases that attempt to solve or study problems here on Earth from space, like a case that studies how to adapt to global warming on Earth, is not exploring space because it is too Earth focused.

Beyond the Mesosphere. Many space flights, satellites and even the International Space Station may not be topical. For example, the ISS orbits in the mesosphere, not ***beyond*** the mesosphere.

Negative debaters can argue that the phrase "beyond the mesosphere" is key to negative ground. Certain factors like cost, launch systems, and safety issues are associated with travel beyond the mesosphere. As the negative, you can argue that your ground is lost with a case that studies space beyond the mesosphere from Earth or even from lower orbit because many of your standard disadvantages or case arguments might not link to the affirmative case.

For help on how to make a topicality argument see our Topicality information here [insert a hyperlink to our How to Make a Topicality Argument handout].

Space Debris

Negatives can also argue that the affirmative plan will create space debris. Space debris is an emerging concern of space exploration. It is the outer space equivalent of pollution on Earth. Every launch into space creates some trash or debris. It can be a little bit of a rocket or a bolt that comes lose. Some pieces can be large, the size of a bicycle. Some of it can be very tiny, almost microscopic.

Over the past 40 years, abandoned or obsolete human made space objects have been left in orbit around the Earth. In general, we don't worry much about them because most will eventually fall out of their orbit and burn up in the Earth's atmosphere.

Some of this debris gets into orbit and stays there. The problem is that because the debris moves very quickly, it has the potential to strike a space station, shuttle or another piece of important equipment and do a large amount of damage. Even a small piece can do lots of damage since it could be traveling very fast.

Orbital debris generally moves at very high speeds relative to operational satellites. In low Earth orbit (altitudes lower than 2,000 km) the average relative velocity at impact is 10 km/sec (36,000 km/hr or 21,600 mph).[cvii] At this velocity, even small particles contain significant amounts of kinetic energy and momentum.

To put this in perspective, a bullet is deadly because it is an object traveling at high speeds; its momentum comes mainly from its high velocity. Now think of much smaller objects traveling at speeds 10 times faster than a bullet; there are thousands of them out there, and they can come from any direction at any time. This is the environment most space craft and astronauts operate under on a regular basis.

The nightmare scenario is a cascade of space debris. As space debris scatters, they collide with other objects to create even more debris and so on. This phenomenon is call the Kessler syndrome. While space debris might be a manageable threat now, it can seriously hinder space exploration in the future if not dealt with.

The seriousness of the situation came with two recent events in space.[cviii] The ISS had to alter its orbit to avoid a particularly dangerous patch of space debris. The damage, even to a station as well armored as this one, would have been in the millions and halted much important research. The second event was the first collision of two satellites in February of 2009. What if this had happened to a major communications satellite? The damage would also have high cost and only further exacerbate the problem with more space debris.

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