

Lesson 22: The Issues and Future of Space Exploration

Summary

This learning module and related exercises will expose students the issues of space exploration and the other NASA-partnering agencies and institutions as well as private companies engaged in space-related technology. Students address socio-scientific issues and apply the nature of science to real-world decisions regarding human space flight.

Learning Goals

Students will be able to:

- Become aware of NASA partnering agencies and private companies engaged in space-related technology
- Design a mission and experience the panel review/decision process.

Context for Use

This particular module does not apply to any Earth analog approaches, but rather exposes students to the philosophy and ethics of privatized vs. government-funded research programs. Students practice with the realities of a cutting a budget in preparation for the Mission to Mars project.

Description and Teaching Materials

In-Class Activity

In-Class Activity 1: Manned-Space Flight: Is it needed?

In-Class Activity 2: Space flight going private

Homework/Lab

Homework 1: Cut A Budget: An Ethical Debate

Teaching Notes and Tips

1. *Homework 1* should be given prior to the Mission to Mars project due date to give students experience.

2. Become aware of the issues yourself before engaging in a discussion with students regarding privatization.

Assessment

Each *In-Class Activity* and *Homework* has its own measure of Assessment.

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References and Resources

- Mission to Mars Rubric
- [Space X Press Release](#)



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Homework 1

Future Mars Missions & Societal Issues_MFE

Cut a Budget: An ethical debate?

Objective: Critique the viewpoint of a proponent of increased NASA funding and cut a theoretical mission budget to fit NASA cut backs.

A Viewpoint on NASA funding

Watch the following YouTube video, narrated by Neil deGrasse Tyson, concerning the national budget and NASA. Neil deGrasse Tyson is an astrophysicist and director of the Hayden Planetarium.

Video: <http://www.youtube.com/watch?v=Fl07UfRkPas&feature=youtu.be>

1. Do you agree with any of Neil deGrasse Tyson's points?
2. Similarly, do you disagree with any of his points?
3. Do you find Dr. Tyson's line of argument flawed? If so, why?

A Proposed Budget

Below is a proposed hypothetical NASA budget with all budget elements compliant with NASA documentation:

<http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2013.pdf>

4. Scrutinize the budget and make a 30% cut to your budget. NASA will approve this mission if you can cut your budget by 30%. For reference on what each budget item means see the above .pdf url link. (1) Show and justify all changes you make to achieve the 30% cut. (2) Attach an extra sheet of paper for justification if necessary. (3) Add items you think are necessary.



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Proposed Budget

(Sample, direct costs)

Mission: Orbit Europa

Duration: 4 years

<u>Category</u>	<u>Sub-Category (#)</u>	<u>Cost per Unit</u>	<u>Cost Total (4 years)</u>
Direct Labor	PI- Scientist (1) (1FTE)	\$112,000	\$448,000
	Co-I Scientist (3) (1/2 FTE))	\$55,000	\$660,000
	Co-I Engineer (5) (1FTE)	\$95,000	\$1,900,000
	Co-I Educator (1) (1/2 FTE)	\$40,000	\$160,000
	Post-Docs (3)	\$48,000	\$576,000
	Graduate Students (7)	\$24,000	\$672,000
	Undergraduate Students (3)	\$3,000	\$36,000
Other Labor	Consultant- Science (2)	\$15,000	\$120,000
	Consultant- Education (1)	\$10,000	\$40,000
Equipment	Orbiter (includes thermal, power, navigation, launch vehicle, etc)	\$425,000,000	\$425,000,000
	Cameras (1)	\$31,000,000	\$31,000,000
	Spectrometer (1)	\$17,600,000	\$17,600,000
	Website development	\$40,000	\$80,000
Supplies	Publications	\$2,000	\$10,000
	Software	\$20,000	\$20,000
	Computer Stations	\$50,000	\$50,000
Travel	LPSC Meeting Registration	\$100	\$800
	AGU Meeting Registration	\$350	\$2,800
	AAAS Meeting Registration	\$400	\$3,200
	Per Diems (\$40/day /person)	\$320	\$10,240
	Airfare (roundtrip/person)	\$600	\$4,800
	Lodging (night/person)	\$140	\$4,480
	Transportation (trip/person)	\$40	\$960
Facilities/Administration	Imaging lab (yearly)	\$15,000	\$60,000
	Imaging rendering lab (yearly)	\$15,000	\$60,000
Mission Total			\$478,519,280

