

# Is space exploration worth the cost?

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Editor's Note: On January 11, the New York Times blog "Freakonomics" published a lengthy post titled "Is Space Exploration Worth the Cost? A Freakonomics Quorum". The post featured comments provided by a number of people, including David Livingston, in response to the question. The part attributed to Dr. Livingston was just a highly-edited version of what he originally submitted to the Times. What follows is the full article that Dr. Livingston submitted on December 31 in response to their invitation to answer the question, "Is manned space exploration worth the cost?

Why or why not?" As the host of a nearly seven-year-old radio talk show, The Space Show, designed and devoted to furthering space development and manned space exploration, I hear this question often. It is challenging to answer because I find often that I am left wanting for a better response, even from some of the guests and listeners to The Space Show. In general, I do think that collectively we, in the space community, do a lousy job of letting people across America know why manned space exploration is important and worth the cost.

I would like to see NASA and those members of Congress most supportive of the manned space program convincingly let the public know that the value is there, where the value comes from, and why it is there. But then, I have a long wish list for what I would like to see our government do, say, and explain regarding this and other issues. In my opinion, the manned space exploration program is absolutely worth the cost. But first, consider the following because understanding the following points is crucial to understanding what manned space exploration affords us in so many areas:

1. The money spent on manned space exploration is spent right here on Earth and most of it is spent in the US. We do not yet have a Bank of the Milky Way, the First International Bank of Mars, or a Lunar Mutual Savings and Loan. The money that is spent goes to manufacturing, research and development, salaries, benefits, insurance companies, doctors, teachers, scientists, students, blue- and white-collar workers, and corporations and businesses both large and small. The money disperses throughout the economy in the same way as money spent on medical research, building houses, or any other activity we engage in with government or even private spending. | In general, I do think that collectively we, in the space | | community, do a lousy job of letting people across America know | | why manned space exploration is important and worth the cost. | 2. Whenever we look at government spending (or any spending for that matter), it is important that we understand what is being purchased and whether there is a value for that investment.

We should also ask if the value benefits a narrow group of people or a special interest, or does it have the potential to benefit large groups, even humanity. Clearly, several types of public expenditures can be considered investments and they can benefit large groups of people and humanity. So I also look for qualitative factors, such as the ability to inspire others to do hard work, to go the next step, to push the envelope for the next level of advancements for all our benefit.

I also look to see if the public expenditure can change lives for the better and, if so, over what period of time. There are several types of public expenditures that can do some of this, but manned space exploration is able

to do it all. 3. The space age is 50 years old if we calculate using the launch of Sputnik as the beginning point. Manned flight began with Soviet cosmonaut Yuri Gagarin on April 12, 1961, thus manned spaceflight is almost 47 years old.

A good portion of our space technology, development, and know-how was developed here on Earth when the two space powers of the time, the USSR and the US, were making treaties to work together in space, prohibit weapons in space, to rescue each other's astronauts/cosmonauts if necessary, and to treat celestial bodies in a way that prevented territorial ownership while allowing room for resource development for all mankind. Mankind worked together to prevent conflict in space and these efforts now have a proven and unparalleled track record.

Today, we have an International Space Station (ISS) with multiple countries working together for its completion, support, science, and management. The ISS Station Agreement is a model agreement that works and the two former Cold War enemies are working together to be the best we humans can be. This has always been the case with manned space exploration, as well as with all of space exploration. Did we have competition? Yes. Do we have conflict and tension? No. No other discipline, activity, venture, or multinational effort has a track record equal to manned space development.

While there may be challenges ahead for our space behavior, so far we are doing fine in space, certainly much better with each other than we are doing back here on Earth. This is all fine, but how does this translate to manned space exploration being worth the cost to millions of taxpayers when there are other competing and important priorities for a finite amount of taxpayer

money? Of course, we say that the entire NASA budget is less than 1% of the entire US budget, but I have found that saying that does not resonate with most people.

Still, according to the GPO budget information, the US 2007 budget was about \$2.784 trillion and NASA got a little more than \$16 billion. This means all of NASA's spending is marginally more than half of 1% of the total US budget. In contrast, social programs receive about 98 times the amount of money spent on NASA. Another way of looking at this would be to understand that a 1% reduction in government social expenditures could just about double the NASA budget for any given year. When I started this piece, I said I hear this question a lot.

So a few years ago, I decided to see what really happened to a public dollar spent on a good space program in comparison to spending that dollar on an entitlement program as well as a revenue-generating infrastructure program. I used the school breakfast program for the entitlement program. I chose Hoover Dam for the revenue generating infrastructure program. The space program I chose was the manned program to the Moon consisting of the Mercury, Gemini, and Apollo programs. Let me briefly summarize what I discovered.

All of these programs or other similar programs, if properly managed, can produce benefits in excess to the original invested dollar. There is no guarantee that a program will be properly managed and this includes a space program. Properly managed implies many things, but I don't think space is any more or less likely to be well managed than anything else the government does. Not all of our space programs made the short list, as I

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looked at several public space programs for this study before deciding that our Moon program was the best. A mismanaged space program wastes money, talent, and time just like other programs the government does. I decided to see what really happened to a public dollar spent | | on a good space program in comparison to spending that dollar | | on an entitlement program as well as a revenue-generating | | infrastructure program. | What happened to the dollar invested in each of the respective programs? The school breakfast program was successful, increasing the number of kids getting breakfast. However, when funding for this program or this type of program stops, as soon as the last of the funds goes through the pipeline, the program is over. It has no life past government funding.

There was no residual benefit lasting years after the demise of the program. I was unable to find an inspirational or motivational quality for the program leading to downstream business, economics, science, or other advancement and development. One could make the case that kids who benefited from the program went on through school to accomplish great things and I don't doubt that. I simply could not document it in my research. Hoover Dam was very interesting. This project paid off its bond cost early, was a major contributor to our winning World War 2, and has been a huge economic factor for development in the western part of the country.

It's a major wealth builder for the United States. However, Hoover Dam requires overhead and maintenance investment on a continual basis. It needs repairs, updates, modernization, security, and it employs a labor force. Were we to stop investing in Hoover Dam, over time it would lose its effectiveness and cease to be the value to our nation that it is at this time

and has been during its history. Its value to us depends on our willingness to maintain, protect, and update it as necessary.

Hoover Dam and Lake Mead have given birth to thousands of private businesses, economic growth for the region, and much more. However, as with the entitlement program above, I could not find an inspirational or motivational aspect to Hoover Dam. I've not heard anyone say they wanted to be an engineer because of Hoover Dam. I'm sure this factor exists to one degree or another, but I could not document it either. What I discovered about our manned lunar program was different. When I did this study, it was 34 years after the last dime had been spent on Apollo, the last of the manned Moon programs.

Thirty-four years later, when I would ask guests on The Space Show, students, and people I met who were involved in science, engineering, and space-related fields and businesses about what inspired or motivated them to start a space business or pursue their education, over 80% said they were inspired and motivated because of our having gone to the Moon. Businesses were started and are now meeting payrolls, paying taxes, and sustaining economic growth because the founder was inspired by the early days of the manned space program, often decades after the program ended!

This type of inspiration and motivation seems unique to the manned space program and of late, to some of our robotic space missions. Interestingly, I found the same to be true when I asked the same question to Space Show guests from outside the United States. Thirty-four years after all funding had stopped for the Apollo program, investment and wealth building, both for our nation and others, was still going on as a result of our manned space

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exploration years earlier. This was a standout feature when comparing manned space exploration to other two types of government spending.

As for the return we received on the dollars spent going to the Moon, the results are often controversial and inflated depending on the source. Some specific narrow segments such as medical and other technical fields have returns several hundred times the dollars invested. In fact, one bit of research I found said that the Office of Management and Budget (OMB) had to refute some of very high returns because at the time they could not do the computer work to determine an effective multiplier with so many variables leading to such high outcomes.

Overall, the return was probably more modest, perhaps four to seven dollars returned to the taxpayers for each dollar invested. This return outperformed the other investments as well, though in many ways my project was like trying to compare apples and oranges. However, I can accurately report that manned space exploration has the potential to return to the taxpayer many times the dollars initially spent on the program. Since we spend this money right here, employing our own people to do cutting-edge as well as traditional workforce projects, our people and our nation benefits from the manned space program.

This means we build wealth for our nation and our people. Equally important, we inspire millions of school children to do the hard schoolwork in math, business, science, engineering, and finances so they can work in space and related scientific and technical fields. This is important to us all as these disciplines are needed to lead us to new and better ways of living right here on Earth, now and in our future. Finally, we must not forget the spinoff

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technologies from our entire space program, but especially from manned exploration, and the fact that the manned space program continues to generate wealth and investment long after the program has ceased and its federal funding has been terminated. | It's not just about what we learn out there in space, or about | | ourselves, or how to be a better steward of precious Earth. | | It's about how we live here on Earth together and what type of | | future we want for ourselves and children. | We have our work cut out for us as we move forward in this new century. We don't seem to get along well with each other here on Earth, but we do quite well in space.

Space is our model for all nations. Notice how many more nations are talking about and wanting to get into the manned space act. India, Russia, China, Japan, and the European Space Agency, for starters, all want a manned mission to the Moon and it won't stop there. These countries and agencies know that manned space exploration builds wealth for their nation, solves problems and enhances life for their people right here on Earth, and shows us the way for how we can all live together in peace.

Manned space exploration is absolutely worth the investment. It's not just about what we learn out there in space, or about ourselves, or how to be a better steward of precious Earth. It's about how we live here on Earth together and what type of future we want for ourselves and children. Manned space exploration is the path to how we build a better life for ourselves here on Earth, and how we can give hope and provide inspiration for our youngsters to grow up, do the schoolwork, and accept the challenges that await them to make our world even better.

Whatever we spend on manned space exploration is a bargain and our investment will be returned to us many times over, both quantitatively and qualitatively. From my perspective, we are getting this value at a bargain, as if we were all going to the dollar store for an end of the year sale. [pic] Dr. David Livingston ([email protected]com) is host and founder of The Space Show, the only radio talk show dedicated to expanding space commerce, understanding the importance of becoming a spacefaring culture, and how best to achieve that status.

The Space Show's interviews with national and international space business, development, and science leaders are streamed online and podcasted. All programs are available for free download through The Space Show website. Dr. Livingston holds a Masters and Doctorate in Business Administration and has nearly 40 years of experience managing and starting various types of businesses. David is also a business, financial, and marketing consultant and holds a position as an adjunct professor in the Space Studies Department at the University of North Dakota.