

Air and Space this Week

Item of the Week

NASA BENEFITS EVERYONE!

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I have spent a lot of time and effort promoting NASA activities to the public over the years; I bet you have, too. Most Americans know that the activities of the Space Program have produced a significant return-on-investment in a variety of fields. Yet some still think that NASA puts dollar bills in a rocket and sends it away. NASA recently released an analysis for the direct economic impact on the United States for last year, and I want to bring it to your attention in this Item of the Week. But it's worth more than just the direct economic impact that benefits all of Earth's inhabitants, there is a lot more in benefits less-generally recognized. Here's some suggestions for the next time you get in a discussion on the value of NASA and Space exploration.

TANGIBLE, SEMI-TANGIBLE, AND INTANGIBLE

When I worked with the public at NASM or NASA, or when I was helping Museum volunteers interact with the public about why NASA and Space exploration are so important for America, I usually break down the benefits into three categories, those in the title of this section.

Tangible benefits are those to which a specific and precise dollar value can be assigned. Examples would include NASA payroll, value of NASA contracts to business, and taxes paid on such activities.

Semi-tangible benefits are those that clearly have an observable economic value, but the nature of the benefit is such that a precise dollar-value can only be estimated at best. Examples would be the development of a new technology that turned out to have a use – economic value – not foreseen by its developers. For example, the development of digital computing and digital imaging was catalyzed by NASA's needs. Such technologies have generated large benefits, so much so that the technology would have been developed, NASA or no NASA. However, the development was utilized sooner than it would have been otherwise, and the accrued value during that time period has clear value, but the exact amount is difficult to assess.

Intangible benefits are those to which no direct economic value can be assessed, but the fact that value is there cannot be denied. The example nearest to our hearts is the stimulation and engagement of the education process. Many, many scientists now reaching retirement age, when asked what event in their life sparked their interest in STEM topics as a field of study and/or career path, will say that the Space program was their stimulus. It still is that way today.

One of the reasons I spotlight episodes of Jim Green's "Gravity Assist" programs is that Jim always asks this one question to each of the folks he showcases, "Was there an event in your formative years that caused you to follow the career path you did?" And, not surprisingly, in each case the motivation was Space program-related.

NASA'S RECENT ANALYSIS OF BENEFITS FOR 2021

Here is the note from last week's A+StW installment I promised to follow up on: "**NASA Benefits All Americans**: NASA released its second Agency-wide economic impact report last week. NASA's work generated more than **\$71B** in total economic output, supported more than **339,000 jobs**, and produced **\$7.7B** in taxes at all levels during FY2021! For details, see Benefits: Spin-offs section below or the NASA Release here: <https://www.nasa.gov/press-release/nasa-s-economic-benefit-reaches-all-50-states>."

NASA Administrator Bill Nelson stated, "Investment in NASA's missions is an investment in American workers, American innovation, and American competitiveness for the 21st century. NASA is positioning our partners in commercial space and the national economy to win the future of spaceflight in 21st century as we prepare to return astronauts to the Moon, and then go on to Mars. While our work will always push the limits throughout the cosmos, it also strengthens the planet beneath our feet. NASA partners with small businesses, industry, academia, and other government agencies to address engineering challenges, and to transfer out our technologies, capabilities, and data all for public benefit here on Earth. NASA may be a small federal agency, but we punch above our weight, fueling growth in American industry with good-paying, quality jobs in all 50 states and maintaining our leadership in space and science."

The report covers all of the items in the "Tangible" category, and some of the items in the "Semi-Tangible" category. For a summary of the report, see: <https://go.nasa.gov/3gQIFuJ> and for the full report, see:

https://www.nasa.gov/sites/default/files/atoms/files/nasa_fy21_economic_impact_report_full.pdf

SEMI-TANGIBLE BENEFITS

The Spin-offs mentioned earlier for this particular category have two basic types: products/technology that was developed by/for NASA with the knowledge at the time that the stuff being created would also have other uses and applications, and those that were developed by/for NASA where someone creative came along later and found an unforeseen use/value of that particular product/technology. The economic value of the former is a bit easier to assess than the latter; that is why some of those things are rolled into the recent NASA report.

A really good example of a spin-off technology developed by/for NASA where other uses for it were part of the planning process is "[Anti-Corrosion Coatings](#)," covered in the "U.S. Space Foundation Hall of Fame" item from last week's A+StW. "Cape Canaveral in many ways was a

good place to launch rockets. But the local environment posed serious problems for launch infrastructure. For example, the gantries needed for launch operations had to be able to withstand the thermal shock from rocket exhaust and resist corrosion due to the prevalent salty ocean spray. “An effective anti-corrosion coating was important to protect the valuable hardware and substantially reduce maintenance cost,” one that could “withstand the extremely hot exhaust and thermal shock created during ... launching.” Research conducted at NASA Goddard Space Flight Center showed that inorganic coatings containing zinc dust and potassium silicate could fit the bill. The product that resulted not only met NASA’s needs, it now is in general use to protect bridges, pipelines, oil platforms, buoys, and many other products. It even was used to protect the Statue of Liberty after its major refurbishment a while back!”

A very lucrative example of a spin-off product that was not foreseen when it was developed by/for NASA is Tempur foam. How many of you sleep on a Tempur-Pedic mattress or pillow? The material was developed for aircraft seating and other aeronautic uses, but someone figured out that the material would also be comfortable to sleep on. Now, Tempur-Pedic bedding dominates the U.S. market, especially after they bought out Sealy a decade ago. For more about this hugely-valuable spin-off, see [here](#).

ON THE SEMI-TANGIBLE / INTANGIBLE BORDER

NASA activities have a cachet that some organizations have found valuable over the years. Ask a person in the street about NASA benefits and they might mention “Tang” and/or “Velcro.” It turns out that both products were developed independently of NASA. However, both used the use of the products in the Space program as part of their advertising pitch to the consumer. It’s a “coolness-by-association kind of thing, “If NASA astronauts can rely on our product, you can, too.” Space pens, Space watches, and a large variety of T-shirts, hats, etc. are still widely sold.

Particularly noteworthy are the video advertisements that use NASA successes from the past. All advertisers use symbolism to evoke a desired emotion/memory without having to use a lot of ad time/space to do so. Advertisers desiring to make their product/service seem “high tech” still use Apollo imagery to do so, even if the targeted age group is the grandchildren of those who were young when we walked on the Moon.

INTANGIBLES

Now for benefits whose dollar value cannot be calculated, let alone calculated precisely.

One way of looking at the Space Race to the Moon is that it was a contest between competing economic/government systems to demonstrate to the rest of the world their respective value and success. Becoming a space-faring country is still seen broadly as having arrived as a player; whether that be as a single country (China, India), as a consortium of countries (ESA), or as a partner country/consortium.

Many of you are, or have been, in a professional/personal position where you helped others learn about the world around us. You have seen first-hand, and known people personally, where an interest in Space exploration was the engaging first step on a life-enhancing educational experience. How can anyone put a dollar value on that?

Our society has benefitted greatly from inventions and advances that were made by people inspired to study and be motivated to be in a position to create because of Space exploration. Those advances may well have come eventually, but they came earlier because of that motivation. YOU are the best example of this. Your personal comfort zone and quality-of-life have been strongly affected by Space-catalyzed advances (*e.g.* cell phones, GPS, etc.). They, too, would have been developed in all likelihood, but they were developed in time for YOU to benefit because of Space exploration.

If you are at “Legacy Time,” like I am, you likely are looking for signs that the lives of your grandchildren will be as good as possible, and you take heart in knowing that the stimulation of education will be an important key to that happiness. A lot of that stimulation will come from Humanity still meeting its need to explore, and what better place for such exploration is there than the worlds around us?

Lastly, one of the hallmarks of (under)graduate education in geology is the “We’re All Screwed” lecture that comes up, usually in the second year of study. The professor runs down all of the geological materials that are essential to modern society, their rates of consumption, and their likely reserves. Holy Malthus, what a downer! They are called “non-renewable resources” for a reason! We are in a race to learn more about sustainability, before resources run out. We’ve been conducting unconstrained experimentation using the only “test tube” in which we can live. If we are going to have a successful future for our offspring, excellent planning and decision-making is required now, and the basis for such is stimulating STEM and critical thinking education as much as possible.

REFERENCES

See the [Benefits: Spin-offs](#) and [Benefits: Tech Transfer](#) sections on the A+StW website and the links contained therein!

NASA Benefits to You: <https://www.nasa.gov/topics/benefits/index.html>

More from NASA: <https://www.nasa.gov/specials/60counting/tech.html>

NASA Home and City: <https://video.search.yahoo.com/yhs/search?fr=yhs-hidden-epic&ei=UTF-8&hsimp=yhs-epic&hspart=hidden&p=nasa+in+everyday+life#id=3&vid=407095d4d9bf9f550240ea1dbed5ff97&action=click>

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JPL: Twenty Things: <https://www.jpl.nasa.gov/infographics/20-inventions-we-wouldnt-have-without-space-travel>

I USE NASA STUFF EVERY DAY! https://www.nasa.gov/audience/forstudents/k-4/home/F_I_Use_NASA_Stuff_Everyday.html

BBC: <https://www.bbc.co.uk/newsround/47812837>

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