

2017 Economic Impact Report

NASA Small Business Innovation Research and
Small Business Technology Transfer (SBIR/STTR)

Mission

Create opportunities through SBIR/
STTR awards to leverage small business
knowledge and technology development for
maximum impact and contribution.

Vision

Empower small businesses to deliver
technological innovation that contributes to
NASA's missions, provides societal benefit,
and grows the U.S. economy.

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EXECUTIVE SUMMARY

The National Aeronautics and Space Administration's (NASA) Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are highly competitive, early-stage award programs, which provide qualified Small Business Concerns (SBCs) with opportunities to propose and develop innovative ideas that meet the specific research and development needs of the Federal Government and have strong potential for commercialization. The SBIR/STTR programs stimulate technological innovation in the private sector, increase the commercial application of research results, and encourage participation of socially and economically disadvantaged persons and women-owned small businesses. Specific technological research areas funded by the SBIR/STTR programs typically address the future mission needs of NASA's Mission Directorates – Science, Aeronautics Research, Human Exploration and Operations, and Space Technology.

This report estimates the national economic and fiscal impact generated by NASA's SBIR/STTR programs using the standard practice of input-output modeling. The time frame covered by this analysis is the fiscal year ending September 30, 2016. For purposes of this study, NASA's SBIR and STTR programs derive their economic impact from the annual research and development operations, undertaken by the programs' SBCs. NASA SBIR and STTR small businesses received a total of \$172.9 million (\$152.8 million to SBIR participants and \$20.1 million to STTR participants) for the development of R&D technologies in FY16, resulting in the creation of 2,412 jobs, \$474 million in economic output, and \$57.3 million in fiscal impact.



Economic and Fiscal Impact

A total of \$172.9 million was obligated to small business from 41 states and Washington, D.C. This investment and subsequent economic and fiscal impact propagate throughout the United States, as supplier and income effects also occur in states in which no small businesses received awards.

Table 1: Economic and Fiscal Impact of NASA SBIR and STTR Obligated Funding

	SBIR	STTR	Combined
Investment (millions)	\$152.8	\$20.1	\$172.9
Total Economic Impact			
Employment (jobs)	2,132	280	2,412
Labor Income (millions)	\$149.7	\$19.7	\$169.4
Value Added (millions)	\$232.3	\$30.6	\$262.9
Output (millions)	\$418.8	\$55.2	\$474
Total Fiscal Impact			
Taxes (millions)	\$50.6	\$6.7	\$57.3

SBIR Program Impact

A total of \$152.84 million in NASA SBIR funds supported the creation of approximately 2,132 U.S. jobs, \$149.7 million in additional wages, and \$418.8 million in Gross Domestic Product (GDP). The program generated \$50.58 million of annual total tax revenue for the country in FY2016. SBIR awards contributed \$35.6 million in federal taxes and \$15 million in state and local taxes.

STTR Program Impact

The STTR program supported 280 jobs, contributed \$55.2 million in economic activity, and produced \$6.7 million in federal, state, and local taxes in FY2016.



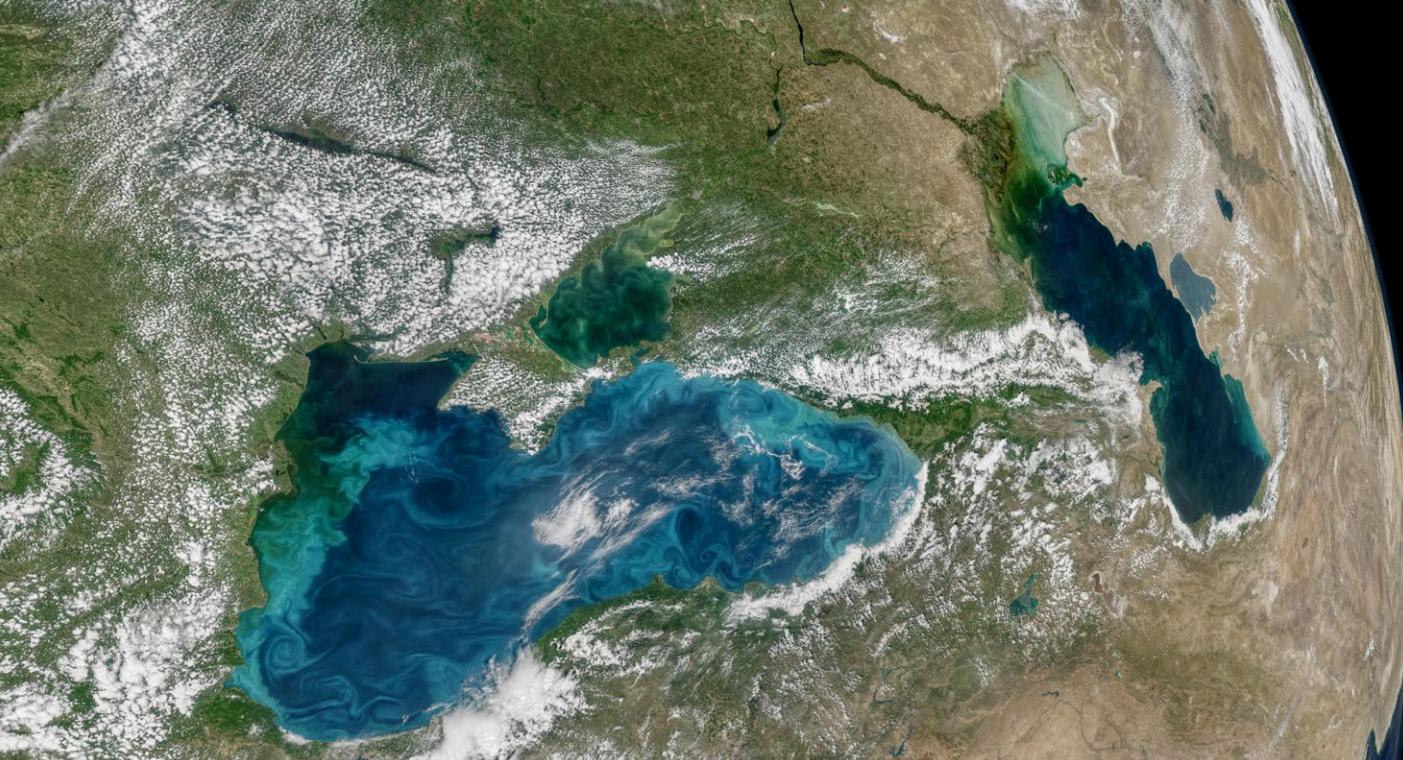
PROGRAM OVERVIEW

NASA considers technological innovation to be vital to the agency's mission and to the nation's prosperity and security. The SBIR and STTR programs are integral in achieving technological innovations. NASA awards SBIR and STTR contracts in three phases. **This report is based on Phase I and Phase II awards made in FY2016. CCRPP is not included because it was not available in FY2016. Phase III is not included because it is funded from sources other than the SBIR/STTR program.**

Figure 1: SBIR and STTR Program Phases*



*The primary difference between the STTR program and the SBIR program is that for STTR, small businesses must partner with a non-profit organization or a university.



ECONOMIC IMPACT

As established by Section 9 of the Small Business Act (15 U.S.C. 638), as amended by the SBIR/STTR Reauthorization Act of 2011, the SBIR/STTR programs of all eligible agencies shall develop metrics to evaluate the effectiveness, and the benefit to the people of the United States, of the SBIR program and the STTR program of the Federal agency that are science-based and statistically driven, reflect the mission of the Federal agency, and include factors relating to the economic impact of the programs.

Recognizing the importance placed upon the effective evaluation of the programs' benefit to the American people, this analysis is the first step in creating a science-based and statistically driven estimate of the economic impact of NASA's SBIR and STTR programs. Specifically, this analysis calculates the impacts of the programs' operations within the U.S. for FY2016. NASA SBIR and STTR awards have a broad national economic impact that is not simply limited to the states that received funding. An analysis of the states receiving awards provides insight into a portion of the economic impacts, but gives a limited view as the total national effects of the program cross state borders. This is because many firms purchase goods and services from suppliers in other states, including states where no SBIR or STTR awards are made. Therefore, the economic impacts of the NASA SBIR and STTR programs are reported at the national level.

The following pages provide details of the NASA SBIR and STTR program awards and the economic impact to the nation. A description of the study's methodology (input-output modeling), the IMPLAN model, and examples of other uses of input-output modeling within the government can be found in the Appendix of this report.

Jobs Sustained and Created

SBIR and STTR research and development activities across the U.S. have generated or retained significant employment across a variety of economic industries in FY2016. As detailed in Table 2 – National Employment Impacts, it is estimated that 2,412 jobs were created or retained by the SBIR and STTR programs in FY2016.

Table 2: National Employment Impacts

Employment Effect	SBIR	STTR	Combined
Direct Jobs	534	70	604
Indirect Jobs	661	87	748
Induced Jobs	937	123	1,060
Total Jobs	2,132	280	2,412

Economic Output

The total estimated economic output, also known as gross domestic product (GDP), for NASA's SBIR and STTR programs for FY2016 is \$474 million. NASA's SBIR program investment added approximately \$418.8 million to the nation's economic output. The STTR program created approximately \$55.2 million in economic output.

Table 3: National Economic Output

	SBIR	STTR	Combined
Economic Output (millions)	\$418.8	\$55.2	\$474

Fiscal Impact

Total fiscal impact of the programs is \$57.3 million (\$40.3 million in federal taxes and \$17 million in state taxes).

Table 4: Fiscal Impact

	SBIR	STTR	Combined
Federal (millions)	\$35.6	\$4.7	\$40.3
State and Local (millions)	\$15.0	\$2.0	\$17
Total Taxes (millions)	\$50.6	\$6.7	\$57.3

Impacted Industry Sectors

A variety of industries are impacted by NASA's SBIR and STTR programs. Table 5 displays the 10 most impacted industries (based on employment). Not surprisingly, the greatest impact is to the scientific research and development services, reflecting the nature of NASA's missions. As evident from the data, the SBIR and STTR programs not only stimulate growth in research and development, but also spread across a variety of industries such as real estate, healthcare, legal, and many others.

Table 5: Top 10 Impacted Industries Based on Employment

Sector Description	Employment	Labor Income (millions)	Value Added (millions)	Output (millions)
Scientific research and development services	658.2	\$72.1	\$98.4	\$188.4
Real estate	150.9	\$3.9	\$23.5	\$31.5
Management consulting services	101.4	\$8.6	\$8.4	\$13.3
Employment services	90.7	\$3.7	\$5.3	\$6.7
Marketing research and all other miscellaneous professional, scientific, and technical services	78.8	\$4.2	\$3.9	\$6.1
Legal services	60.8	\$5.5	\$8.8	\$12
Full-service restaurants	59.6	\$1.4	\$1.6	\$2.9
Limited-service restaurants	49.4	\$1	\$2.4	\$4.1
Hospitals	44.1	\$3.5	\$3.9	\$6.8
Architectural, engineering, and related services	42.5	\$4	\$4	\$7.3



CONCLUSION

The purpose of the SBIR and STTR programs, as established by law, is to stimulate technological innovation in the private sector; to strengthen the role of SBCs in meeting Federal research and development needs; to increase the commercial application of the research results of the programs; and to encourage participation of socially and economically disadvantaged persons and women-owned small businesses. It is an important program that benefits all parties. Above all, it inspires continued technological innovation for the good of our world and beyond.



APPENDIX

Methodology and the IMPLAN Model

The theoretical underpinnings of input-output (I-O) modeling are based on the notion of inter-industry transactions: industries use the products of other industries to produce their own products. This approach allows one to estimate the number of goods and services from other sectors (input) required to produce goods and services in the sector of analysis (output). The combined effect across all sectors can be summed to calculate a total economic impact. This model is widely used by Government to estimate the regional economic impacts of changes in government expenditures, private enterprise, and individual consumption choices. I-O modeling enables decision-making processes within Government to more fully understand the economic effects (in terms of jobs, output, earnings and taxes) and optimize policy response accordingly.

This report utilizes NASA SBIR and STTR obligated funding data, as reported to the Small Business Administration, in NASA's FY2016 annual report as the basis of the analysis. \$172.9 million in agency obligated funds were transformed into employment financial equivalents (jobs) using U.S. Economic Census data for NAICS 541712 [Research and development in the physical, engineering, and life sciences (except biotechnology)]. This transformation ensures precise modeling because NAICS 541712 represents the participating firms' economic activity and basic characteristics.¹

¹ - Firms in NAICS 541712 are limited in size to 500 employees and are engaged primarily in R&D activities relating to physical, engineering, and life sciences (except Biotechnology). Firms within more broad NAICS categories have differing size limits and may be primarily engaged in research areas not applicable to NASA's SBIR and STTR programs.

Converted employment financial equivalent figures were used as an input and modeled using MIG, Inc.'s IMPLAN software.² The IMPLAN model is a robust, industry-standard I-O model that provides insight into economic impacts at different levels of the economy: from the national level down to the ZIP code level. The IMPLAN model is based on the I-O data from the U.S. National Income and Product Accounts from the Bureau of Economic Analysis. The model contains 536 industry sectors based on the NAICS. Its framework is considered static because the impacts calculated for any scenario by the model are estimates of the indirect and induced impacts for a one-year time period. For application to the NASA SBIR/STTR program, the IMPLAN model was calibrated at a national level and all economic activity was modeled under IMPLAN sector 456. No additional changes were made to the IMPLAN model. All dollar values are displayed in 2016 dollars.

The IMPLAN model contains two components: the descriptive model and the predictive model. The descriptive model maps the economy within the region of analysis using a series of accounting tables that trace flows of funds (dollars) between purchasers and producers in the defined region. The model also captures the Region's movement of exported and imported goods and services. The descriptive models also includes IMPLAN's Social Accounting Matrices, which define the flow of funds between institutions — such as transfer payments from governments to businesses and households and taxes paid by households and businesses to governments.

The predictive model contains a set of multipliers that can be used to analyze the changes in final demand and their subsequent ripple effects throughout the region of analysis. These ripple effects are often larger than the initial effect as recipients of the initial payments spend a portion of the funds, and the recipients of the new funds spend a portion of the funds as well, and so on and so forth. These effects are reported in terms of value added to the economy (GDP), jobs, and tax revenue. All employment figures estimated through the IMPLAN model include all full-time, part-time, and temporary positions.³ Similar I-O models include the Bureau of Economic Analysis's (BEA) RIMS II model as well as various proprietary models such as REMI, EMSI and REDYN. While each model has its own unique aspects, the theoretical underpinnings are shared and thus the modeling results are comparable.

² - IMPLAN was originally developed in 1979 by a joint effort between the U.S. Forest Service, the FEMA, and the U.S. DOI, Land Management with the goal of assisting in land and resource management planning. The model is used by additional government agencies to quantify various economic activities. For more details: Miller, Ronald E., and Peter D. Blair. Input-output Analysis: Foundations and Extensions. Englewood Cliffs, NJ: Prentice-Hall, 1985.

³ - IMPLAN Pro User Guided. Blair. Input-output Analysis: Foundations and Extensions. Englewood Cliffs, NJ: Prentice-Hall, 1985.

Government Uses of I-O Modeling

Specific to the federal level, agencies utilize I-O analysis in assessing the economic potential of scientific and social programs, military and other installations, budget adjustments, as well as infrastructure and other development projects. Select Examples of Federal Uses of I-O Modeling:

Department of Defense (DoD): Uses various I-O models to assess the economic impacts of large scale budgetary decisions, such as the effects of the 2012 sequestration.⁴ The DoD also calculates the effect of smaller regional budgetary decisions, such as the closure of Hill Air Force Base in the State of Utah.⁵

Department of Transportation (DOT): Utilizes I-O analysis in conjunction with Benefits Cost Analysis to further inform their decision making process when deciding which projects to undertake.⁶ The agency also encourages state and local agencies to utilize similar methodologies when pursuing local projects as well.

Department of Interior (DOI): Calculates the entire agency's annual economic impact. In 2009, their analysis concluded that the agency supports over 1.4 million jobs for Americans and over \$370 billion in economic activity.⁷

Department of Agriculture (DOA): Calculated in 2010 that given an increase of \$1 billion in expenditures the SNAP, formerly the Food Stamp Program, is estimated to increase economic activity (GDP) by \$1.8 billion and generate approximately 13,500 jobs. This analysis further codified previous estimates from 2002, which suggested a \$1 billion increase in spending generated \$1.8 billion in economic activity.⁸

Limitations

The economic and fiscal impacts calculated in this study are attributable to NASA's SBIR and STTR award funding for FY2016, i.e. the directly measurable economic impacts associated with approximately \$172.9 million worth of aerospace research and development contracts awarded by NASA. This study does not attempt to estimate the additional positive indirect economic and fiscal impacts of technical innovations developed by the program, nor does this study attempt to estimate the additional economic and fiscal impacts that can be attributed to SBIR and STTR award participants because of their participation in the program. These additional economic and fiscal impacts which occur at the firm level, such as future sales of newly developed innovations, the increase in future government contracts, increased outside investment, new product lines, and other business expansion, are difficult to fully capture but are thought to be significant. NASA's SBIR and STTR programs anticipate conducting future research in the form of case studies and longitudinal firm performance studies in order to more fully capture and quantify these indirectly measurable economic effects.

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8 - "Quantifying Economic Benefits State and Local US EPA." EPA, n.d. Web 5 March 2017. <http://www.epa.gov/statelocalclimate/state/activities/quantifying-econ.htm>

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