SCB SURVEY OF CURRENT BUSINESS

The Journal of the U.S. Bureau of Economic Analysis

New and Revised Statistics for the U.S. Space Economy, 2017–2022

By Tina Highfill, Patrick Georgi, and Chris Surfield | June 25, 2024

The U.S. Bureau of Economic Analysis (BEA) released new, updated, and expanded U.S. space economy statistics for 2017–2022 on June 25, 2024. These statistics provide estimates of the space economy's contribution to U.S. current-dollar and chained-dollar ("real") gross domestic product (GDP) and gross output by industry as well as estimates of private employment and compensation.[1] The new statistics show the space economy accounted for $131.8 billion, or 0.5 percent, of total U.S. GDP in 2022. Real GDP grew by 2.3 percent in the space economy, faster than growth in the overall U.S. economy (1.9 percent). The statistics also show in 2022 the space economy accounted for $232.1 billion of gross output and $54.5 billion of private-sector compensation and supported 347,000 private-sector jobs. The new 2022 statistics and revised 2017–2021 statistics build on previous estimates that were released in June 2023 by incorporating new source data, most notably the results of BEA's 2023 comprehensive update of the National Economic Accounts.

For the first time, this release of the space economy statistics is presented in the same format as BEA's official industry statistics. This means the industry detail is expanded from just over 30 industries to 75 industries, providing even more information about the industrial composition of the U.S. space economy and its changes over time. Additionally, two new datasets are provided that show price indexes for value added (also known as GDP) and gross output, also published with the same 75-industry detail. Lastly, this report focuses on GDP and chained growth rates, further aligning with BEA's official statistical releases.

This report starts with an overview of the major findings from the updated statistics, followed by a description of the revisions made to the previously published estimates for 2017–2021. Next, an overview of the methodology is presented. The report concludes with a review of current and future plans for the space economy statistics including ideas suggested by data users during BEA's inaugural Space Economy Measurement Workshop held in March 2024.[2]

Results

Table 1 provides an overview of the 2022 values and 2017–2022 growth rates. Growth in 2022 outpaced average annual growth over the 2017–2022 period for all available statistics, reflecting a rebound from slow growth and declines in many key industries in 2020 and 2021. Comparing current-dollar growth to real growth shows the impact of inflation (or price change) on the space economy. Current-dollar growth in GDP was 6.0 percent in 2022, while real growth was 2.3 percent, showing that inflation was the main driver of growth in the current-dollar estimates.

Table 1. Overview of the U.S. Space Economy Statistics

Series	2022 values (millions of dollars)	2022 growth (percent)	2017–2022 average annual growth (percent)
GDP	131,776	6.0	1.3
Real GDP, chained (2017) dollars	113,153	2.3	−1.7
Gross output	232,061	7.4	2.0
Real gross output, chained (2017) dollars	201,288	2.9	−0.9
Private compensation	54,453	2.8	1.7
Private employment, full- and part-time employees	347,000	1.8	−1.9

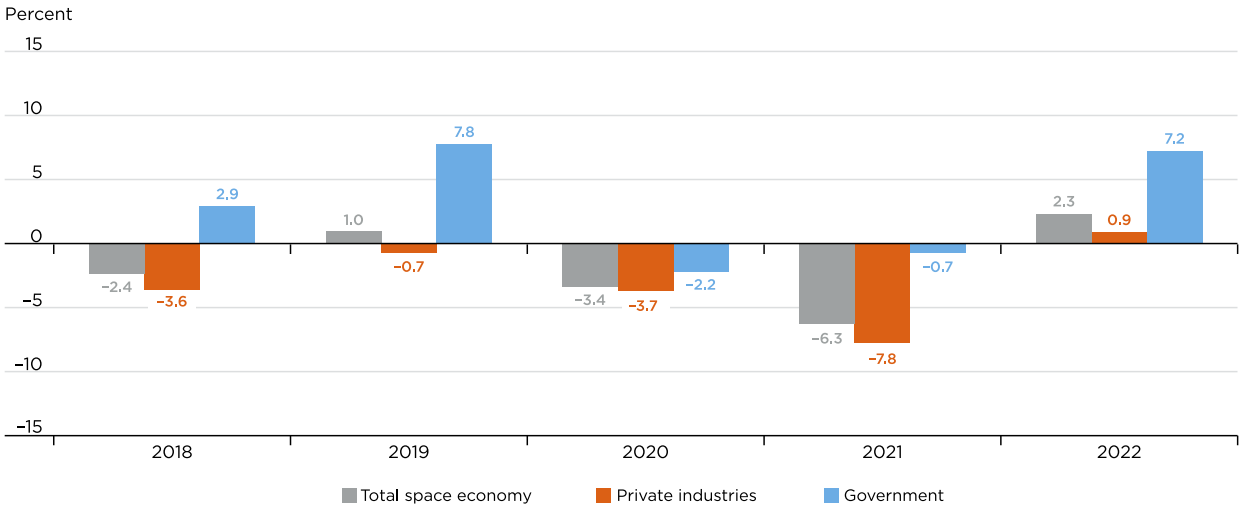
GDP Gross domestic product

GDP and gross output

In 2022, real GDP in the space economy grew by 2.3 percent, propelled by growth in all categories of government (7.2 percent), most notably federal national defense (16.2 percent). Professional, scientific, and technical services also experienced double-digit growth of 11.7 percent. Both the federal national defense industry and the professional, scientific, and technical services industry engage heavily in research and development (R&D) activities, which are driving these results. Real gross output grew by 2.9 percent in 2022 and exhibited similar industry trends as the GDP statistics.

Chart 1 shows the annual growth rates of real GDP for 2018 through 2022 broken out by government and private industries, highlighting the relatively stronger growth in the government industry for all years. GDP for the government industry represents spending on federal, state, and local government employee compensation plus consumption of fixed capital.[3] While there are many government agencies involved in space activities, the majority of government space economy production is attributable to the federal government, chiefly NASA (the National Aeronautics and Space Administration) and the U.S. Space Force. Table 2 shows the federal government agencies and federally funded R&D centers with direct space activity that comprise the federal government space estimates.[4]

Chart 1. Real GDP Growth in the U.S. Space Economy, 2018–2022



GDP Gross domestic product
U.S. Bureau of Economic Analysis

Table 2. Federal Government Agencies and Federally Funded Research and Development Centers With Direct Space Activity

Category	Agency or center	
Nondefense	U.S. Department of Commerce	National Institute of Standards and Technology
	U.S. Department of Energy	National Oceanic and Atmospheric Administration
	U.S. Department of the Interior	National Science Foundation
	U.S. Department of Transportation	Smithsonian Institution
	NASA (National Aeronautics and Space Administration)	
Defense	U.S. Air Force	Missile Defense Agency
	U.S. Army	U.S. Navy
	Defense Advanced Research Projects Agency	Office of the Secretary of Defense
	Defense Information Systems Agency	Space Development Agency
	Defense Innovation Unit	U.S. Space Force
	Defense Logistics Agency	
Federally funded research and development centers	Aerospace	Los Alamos National Laboratory
	Brookhaven National Laboratory	National Center for Atmospheric Research
	Jet Propulsion Laboratory	National Optical Astronomy Observatory
	Lawrence Livermore National Laboratory	National Radio Astronomy Observatory
	Lincoln Laboratory	National Solar Observatory

Real GDP growth in the space economy was partly offset by contractions in the broadcasting and telecommunications industry (−3.0 percent) and "other transportation equipment" manufacturing (−7.3 percent). The broadcasting and telecommunications industry is led by direct-to-home (DTH) satellite television, which experienced a decline in revenue and subscribers over the entire 2017–2022 period. The other transportation equipment manufacturing industry, which consists mostly of products related to space vehicles and space weapons systems, has experienced swings in growth throughout the period that ranged from −7.3 percent in 2022 to 23.0 percent in 2019.

An addendum to the GDP and gross output tables shows the value of the space economy without DTH satellite television, satellite radio, and educational services. This value represents a narrower definition of the space economy suggested by data users interested in understanding what the U.S. space economy would look like without the effect of these three components. Over the 2017–2022 period, the narrower definition of the space economy resulted in more positive growth rates than the standard definition for both real value added and real gross output. In 2022, real value-added growth was 3.9 percent using the narrow definition, compared to 2.3 percent using the broad definition. Likewise, growth in real gross output was 5.1 percent in 2022 using the narrow definition versus 2.9 percent using the broad definition. The faster growth is mostly due to the removal of DTH satellite television, which has been declining over the period and has an outsized impact on the overall space economy.

Prices

As with the overall U.S. economy, price increases were apparent in most industries in the space economy in 2021 and 2022. The wholesale trade industry in particular experienced price increases well above the average increase in the space economy. In 2021, value-added price indexes increased by 39.7 percent for wholesale trade, compared with 6.8 percent for the overall space economy. Price increases slowed in 2022 but were still relatively higher for wholesale trade value added (7.9 percent) compared to the total space economy (3.6 percent). Wholesale distributors typically sell items to other businesses for use as intermediate inputs into other goods. The wholesale trade sector in the space economy consists of the margins or markups charged by wholesale distributors for space-related items, such as GPS (Global Positioning System) transceivers and antennae. The increase in prices for wholesale trade in the space economy mirrors the increase in prices for the household appliances and electrical and electronic goods merchant wholesalers industry. Since wholesale trade represents a large share of the space economy, 19 percent of GDP in 2022, large price increases in this industry significantly affect growth in the overall space economy.

Going against the trend of price increases, manufacturing experienced price declines over the 2017–2022 period, driven by falling prices and quality increases in the computer and electronic products industry.[5] This industry includes manufacturing of satellite and ground equipment, as well as GPS equipment and positioning, navigation, and timing equipment. Value-added price indexes for total manufacturing declined by 2.4 percent on average between 2017 and 2022, with the largest decrease in 2018 (−4.4 percent).

Private employment and compensation

Private industry employment for the space economy was 347,000 in 2022, and compensation was $54.5 billion. Manufacturing accounted for 31.1 percent of total private employment but 43.1 percent of compensation in 2022, due to its relatively high average annual compensation level ($217,296). Information was the second-largest industry in terms of private employment in 2022 (21.9 percent) and third largest in terms of compensation (18.0 percent). Conversely, wholesale trade was the second-largest industry in terms of compensation (19.2 percent) and third largest in terms of employment (21.6 percent), reflecting a higher average annual compensation than information ($139,333 versus $128,789). For details on government employment in the space economy, see the box at the end of this article.

Revisions

Revisions to the 2017–2021 estimates were mainly driven by incorporating the results of BEA's 2023 comprehensive update of the National Economic Accounts. Although BEA's national economic statistics are updated annually to incorporate new source data and other improvements, every 5 years the statistics undergo a more substantial "comprehensive update." A key feature of comprehensive updates is benchmarking GDP and its components to data from the most recently available U.S. Census Bureau quinquennial Economic Census. The 2023 comprehensive update to the national statistics generated sizeable revisions to certain space-related industries, notably wholesale trade and computer and electronic products manufacturing. In both cases, the revisions largely reflected updated business revenue data from the Economic Census. Wholesale trade value-added levels were revised up by $2–4 billion per year, whereas computer and electronic products manufacturing levels were revised down by $3–8 billion per year. While the 2017–2021 average growth rate for wholesale trade was not greatly impacted (revised down from 3.7 percent to 2.0 percent), the revisions to computer and electronic products manufacturing fluctuated over the time series, resulting in a downward revision to average annual growth from 1.5 percent to −2.6 percent.

Another major update from the comprehensive update was the move to using 2017 as the reference year for chained-dollar value added and gross output as well as prices. In previous releases, the chained-dollar and price statistics used a 2012 reference year. As a result, the real value-added and gross output values in this release are not directly comparable to previous releases.

In addition to revisions stemming from the comprehensive update, the 2021 values were updated to reflect the incorporation of new R&D spending data from the National Science Foundation (NSF) Business Enterprise Research and Development Survey and the NSF Survey of Federal Funds for Research and Development, satellite internet usage data from the Federal Communications Commission, and updated information on federal defense spending on space weapons systems and related investment. None of these updates caused notable revisions to levels or growth rates for any industry.

Methodology

In BEA's statistics, the space economy consists of space-related goods and services that are used in space, or directly support those used in space; require direct input from space to function, or directly support those that do; and are associated with studying space. A brief overview of the methodology used to develop the space economy statistics is provided in this section. For a more detailed description of the methodology and source data including background information on BEA concepts and general national accounting methods, see the December 2020 *Survey of Current Business* article.

The space economy statistics are built using BEA's comprehensive supply and use tables (SUTs) and National Income and Product Accounts (NIPAs), which provide insight into the internal workings of the U.S. economy and detail the contribution of specific industries and products to GDP. The SUTs measure the flows of goods and services purchased by each industry, the incomes earned from production in each industry, and the distribution of sales for each product. The NIPA data present the value and composition of U.S. GDP, the types of incomes generated in its production, and its associated employment. The Economic Census is the primary data source for the SUTs. Other data sources include the U.S. Departments of Agriculture, Education, and Energy as well as private organizations.[6] The goal of the space economy statistics is to highlight the space-related production and spending that are already present in the SUTs and NIPAs.

The goods and services included in the space economy statistics are chosen from BEA's comprehensive list of nearly 5,000 categories of goods and services that constitute the SUTs. In practice, the space economy statistics represent a rearrangement of existing data to isolate spending and production directly attributable to the space economy. For example, the space economy statistics show the production of space-related educational services, such as astrophysics and astronautical engineering, while the SUTs show the production of all educational services, regardless of the subject. Likewise, construction spending on space activities, such as construction of space ports and observatories, is already embedded in the SUTs, and the space economy statistics simply isolate such production.

The space products (goods and services) that comprise the space economy were identified using past research and input from subject matter experts. Notably from the Organisation for Economic Co-operation and Development (OECD) *Handbook on Measuring the Space Economy*, products identified in a Bureau of Industry and Security assessment describing the U.S. space industry supply chain, reports from the private sector (including the Satellite Industry Association and Space Foundation), input from U.S. and international space agencies (including NASA, the Canadian Space Agency, and the Australian Space Agency), BEA industry analyst input, and industry expert feedback.

Many product categories within the SUTs comingle products that constitute both space and nonspace economic activity. For example, the SUTs contain a single category for internet services, so the share of internet services provided by satellites must be estimated. In these cases, we use external data sources to isolate just the space activity. Table 3 shows a list of the primary data sources used to estimate space activity within products. In most cases, the external datasets used as indicators for space-related production included information about revenue or spending. When revenue or spending data were not available, space-related employment and wage information were often used to identify space activity within products.

Table 3. U.S. Space Economy Industries, Products, and Data Sources Used to Supplement the Supply and Use Tables

Industries	Space products	Supplementary data sources
Manufacturing, wholesale trade, and retail trade	Space vehicles; space weapons; satellites; ground equipment; search, detection, navigation, and guidance systems (GPS/PNT equipment)	U.S. Census Bureau (Census) Economic Census product line data; government budget documents
Information	Telecommunications; broadcasting; software	U.S. Bureau of Labor Statistics (BLS) Occupational Employment and Wage Statistics (OEWS); Federal Communications Commission; U.S. Securities and Exchange Commission
Government	Military; civilian; federally funded research and development centers services	Public budget documents; National Science Foundation (NSF) Survey of Federal Funds for Research and Development
Professional and business services	Research and development; engineering and technical services; computer systems design; geophysical surveying and mapping services	BLS OEWS; NSF Survey of Federal Funds for Research and Development; NSF Business Enterprise Research and Development Survey
Construction	Space facilities; observatories; planetariums; satellite dish installation	Census Value of Construction Put in Place Survey
Other various services	Launch services; insurance; education; observatories; planetariums	AXA XL; National Center for Education Statistics Integrated Postsecondary Education Data System; public documents

GPS Global Positioning System

PNT Positioning, navigation, and timing

Macroeconomic statistics like GDP, compensation, and employment are typically published by industry and not by product. Although products can be produced by multiple industries, most products are made by a primary industry.[7] For example, most guided missile and space vehicle equipment is made by the guided missile and space vehicle manufacturing industry, but guided missile and space vehicle equipment can also be made by the aircraft manufacturing industry. Space economy gross output by industry represents the share of each product's space-related gross output for each industry that makes the product. By choosing individual products, production is captured from all relevant industries.

GDP by industry for the space economy is derived from the relationship between the industry output for space activities and total industry output. This means the ratio of intermediate consumption associated with the industry output for space activities is assumed to be the same as the ratio of total industry intermediate consumption to total industry output. Private-sector compensation and employment statistics are derived through the same procedure as value added. Meaning, the ratio of an industry's space economy output to total output is applied to total employment and compensation for the industry.

Translating product-level statistics to industries showcases “secondary production” of space-related goods and services by many industries not typically considered to be space industries. For example, the detailed industry tables show that two mining industries, oil and gas extraction and support activities for mining, contributed $2–10 million to space economy GDP annually between 2017–2022. In this case, the space product is R&D performed by companies in the mining industry with applications for the space economy (as opposed to mining performed in space). Having the full industry detail for all space economy statistics allows for a more nuanced and comprehensive view of space-related production in the economy.

Current and Future Plans

The comprehensive update of BEA's industry statistics occurred in two phases, where the first phase covered the years 2017–2022, and the second covered years 2016 and earlier. This space economy release corresponds with the first phase of the comprehensive update, hence data are currently only available for 2017–2022. Future space economy releases will update the time series back to 2012.

In March 2024, BEA held a first-of-its-kind workshop that brought together dozens of experts from across various U.S. government, private industry, academia, and international organizations for indepth deliberations and discussion on the measurement of the space economy. This included experts from OECD, NASA, the U.S. Space Force, the Canadian Space Agency, the National Space Council, and many private industry organizations. Two main takeaways from the workshop were the desire to have more timely estimates and to pursue state-level estimates, both of which are being prioritized for future releases, subject to resources and data availability. Another takeaway was limited interest in reorganizing the statistics to reflect space activities seen in many private reports, such as launch and satellite services. The consensus was that having these activities would likely cause confusion when the values differed, and that BEA's industry-level statistics provide a view of the space economy not available in private industry reports. BEA will continue to actively engage with data users and incorporate their feedback into the future releases.

Please visit BEA's space economy website for other information about the space economy, including datasets, research articles, webinars, and infographics.

Space-Related Government Employment

Private industry employment and compensation for the space economy are derived from the relationship between an industry's gross output attributable to space activities and an industry's total gross output. Specifically, the ratio of an industry's space economy output to total output is applied to each industry's employment and compensation to calculate those estimates. This relational method is suitable because BEA's SUTs and industry data contain very detailed information on goods and services produced by private industries. However, BEA's industry data do not have detailed employment and compensation data on the myriad of space-related government services provided by government agencies. As a result, the method used to estimate private employment and compensation is not suitable for estimating space-related government employment and compensation, and an alternative methodology was implemented to produce government estimates.

Using publicly available government budget documents and datasets, a set of prototype estimates is constructed and included with this updated release for the broader space economy. For a more detailed explanation of the methodology, challenges, and limitations of this alternative method of estimating space related government employment, please see "New and Revised Statistics for the U.S. Space Economy, 2012–2021", specifically the "Measuring Space-Related Government Employment" section.

Table I shows the updated government employment statistics, which now include 2022 to align with the broader space economy estimates. Revisions to 2017–2021 primarily come from updated statistics from the National Center for Education Statistics datasets. Total available nondefense government employment increased from 19,017 in 2017 to 19,699 in 2022 (average annual growth rate of 0.7 percent). The largest agency with available space-related employment data was NASA, whose employment increased from 15,728 in 2017 to 16,128 in 2022. The National Oceanic and Atmospheric Administration had the second-largest nondefense workforce in 2022, with 2,056 employees identified as working on space-related activities. Not shown in the table are space-related defense employment figures including the 12,764 employees in the U.S. Space Force for 2022 (U.S. Space Force personnel figures were first broken out from total U.S. Air Force figures for 2021).

Table I. Experimental Estimates of Available Space-Related Nondefense Government Employment

	2017	2018	2019	2020	2021	2022
Nondefense federal, state, and local space total[1]	19,017	18,998	19,087	19,269	19,249	19,699
Nondefense federal space total	17,951	17,871	17,877	18,074	18,065	18,478
U.S. Department of the Interior—USGS (National Land Imaging Program/Land Remote Sensing (Landsat and operations))	148	180	132	135	169	177
Federal Aviation Administration—Office of Commercial Space Transportation	98	97	97	91	104	117
NASA space total (excludes aeronautical employment)	15,728	15,455	15,654	15,871	15,762	16,128
NOAA space total	1,977	2,139	1,994	1,977	2,030	2,056
National Environmental Satellite, Data, and Information Service	742	851	752	727	784	794
National Ocean Service (navigation, observations, and positioning)	547	549	563	568	579	572
National Weather Service (observations)	688	739	679	682	667	690
State and local space total	1,066	1,127	1,210	1,195	1,184	1,221
Oklahoma Space Industry Development Authority	7	6	6	6	6	7
Estimated state universities' space-related faculty	1,059	1,121	1,204	1,189	1,178	1,214

NASA National Aeronautics and Space Administration
NOAA National Oceanic and Atmospheric Administration
USGS U.S. Geological Survey

1. Missing from this list are state and local spaceports and administration (aside from Oklahoma) and National Science Foundation Research and Development centers and observatories.

Acknowledgments

The authors wish to thank the following BEA employees for their assistance in preparing this report: Peter Beall, David Curtis, Peter Fisk, Connor Franks, Danielle Helta, Tom Howells, Colby Johnson, Billy Jolliff, Pam Kelly, Lisa Mataloni, Ted Morgan, Wade Petty, Andy Pinard, Shelly Smith, David Sullivan, and Dave Wasshausen.

Footnotes

1. GDP, or value added, by industry represents the market value an industry adds to production, or the industry's gross output less the cost of its intermediate inputs. Gross output represents the market value of the goods and services produced by an industry and is similar in concept to revenue. Real estimates reflect quantities produced and exclude the effects of inflation.
2. See the BEA presentation "Current space economy statistics and priorities for the future" for more information.
3. For more details, see the "Revisions Summary" section of BEA's 2022 report "Updated and Revised Estimates of the U.S. Space Economy, 2012–2019."
4. Classified government services performed by national intelligence personnel are currently excluded from the government industry statistics due to a lack of source data. Government spending on purchases from the private sector shows up as production within the industry that produced the good or service. For example, if the U.S. Space Force purchases a satellite from a private company, that purchase is accounted for in the computer and electronic products industry within the manufacturing sector.
5. For more details, see Tina Highfill and Matthew Weinzierl, "Real growth in space manufacturing output substantially exceeds growth in the overall space economy," *Acta Astronautica* 219 (June 2024): 236–242.
6. See *Concepts and Methods of the U.S. Input-Output Accounts* for more details on source data and methodology.
7. BEA organizes industry statistics using the North American Industry Classification System, a classification system developed jointly by the United States, Canada, and Mexico to provide improved comparability in industrial statistics across North America.