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**Testimony of Mike French
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before the

**Subcommittee on Space and Aeronautics
Committee on Science, Space, and Technology
U.S. House of Representatives**

Chairwoman Horn, Ranking Member Babin, and distinguished members of the Subcommittee, thank you for the opportunity to provide testimony today on the commercial space sector.

The Aerospace Industries Association (AIA) represents an aerospace and defense (A&D) industry that is at the heart of the American economy, generating \$929 billion in economic output and a trade surplus of nearly \$90 billion in 2018 – the largest of any U.S. exporting sector. Our industry is supported by more than 2.5 million dedicated employees – representing 20 percent of the nation’s manufacturing workforce – who are responsible for the continuous stream of innovations that improve American lives.

Moreover, our members helped create the foundation of America’s space efforts, starting with the Mercury Program. They enabled NASA’s exploration of our solar system, put the first humans on the Moon, and supported countless missions since. We are proud that our innovations have shaped history and have been particularly gratified to recognize these contributions as the world celebrates the 50th anniversary of Apollo 11. But our eyes are also focused firmly on the future.

Earlier this year, AIA released a report called “What’s Next for Aerospace and Defense: A Vision for 2050.” Based on in-depth interviews with Chief Technology and Chief Strategy Officers across the industry, the report paints a picture of the innovations that will drive the way we move, connect, explore, and defend our interests thirty years from now. And it should not surprise you to know that many of these technologies rely on space and will depend on an effective partnership between government and the commercial space industry.

Our companies, of course, are not waiting for 2050. They are living these partnerships every day. Northrop Grumman Corporation’s Antares and Cygnus and Sierra Nevada Corporation’s Dream Chaser are partnered with NASA to resupply the International Space Station (ISS).

Virgin Galactic's SpaceShipTwo will soon transport passengers to space, while The Boeing Company's Starliner will soon launch U.S. astronauts to the International Space Station from U.S. soil. They set the stage for taking the next Americans to the Moon and beyond on Boeing's Space Launch System and Lockheed Martin Corporation's Orion spacecraft. These examples are only a glimpse into the role of commercial space companies – from small to midsize to large – in ensuring America's space leadership.

Long-standing Government and Commercial Space Link

The commercial space industry is not a new phenomenon. It is part of a \$360 billion space economy that has existed for decades.¹ It supports commercial activities, like satellite communications, and has supported government space activities since the beginning of the space age. Just look to the Apollo 11 landing, a historic moment made possible by the contribution of more than 370,000 contractors from industry and academia. The Space Shuttle, International Space Station, NASA's missions to explore our solar system, and now NASA's commercial cargo and crew programs are all connected to the contributions and leadership of commercial space companies.

In recent years, there has been much discussion about "commercial space," but that discussion has lacked consistency on what constitutes "commercial." The definition of commercial is often inconsistently applied across companies, programs, and contracting mechanisms. While a common perception is that commercial space companies are small start-ups with private financing, government's commercial space partners have, in fact, spanned a range of corporate types – including established, publicly traded companies; recent startups funded by private capital; and private firms supported by both private and public investment.

There is not just one model for a commercial space business. NASA's high-profile commercial cargo and crew programs provide a perfect example, as the primary partners are companies with diverse portfolios that include significant government contracting activity from three publicly traded companies and one private company.

While commercial space has existed for decades, in recent years, several hundred private investment-backed firms have entered the sector. These firms are not monolithic, and how they fit within the existing commercial space economy is important to understanding their role in current and future government space activities.

These newer companies fall into two general categories. The first is a handful of more fully-capitalized companies actively engaged as direct government contractors or suppliers. The second and much larger group of these companies remain in a pre-revenue phase and are still developing their planned space offerings.

¹ Bryce Space and Technology, 2018 Global Space Economy

This latter group of companies is more likely to be active in “data-buy” programs (e.g., NASA and NOAA’s purchase of commercial remote sensing data), the government’s early stage funding programs (e.g., the Small Business Innovation Research and the Small Business Technology Transfer), and more recent programs intended to engage with these types of firms, such as NASA’s Jet Propulsion Laboratory’s space accelerator.

In addition to private funding, many of these newer firms have also received significant government investments. A recent report found that, of the companies that received private capital from 2000 to 2018, they also received \$7.2 billion in U.S. public funding during this period.² Of firms that received both private and public funding, cumulative total investment from both public and private funding areas was about equal.³

Overall, the commercial space industry is one that is diverse, including small and large companies and companies that receive private and public investment, and has been growing. This presents both new opportunities and risks for the government as it continues to look to the commercial sector to meet its requirements.

Shifting Procurements Strategies

The government has a series of tools available to meet these requirements in the space arena. In NASA’s case, these tools include:

- **Off-the-Shelf / Low-Dollar Items:** simplified acquisition methods run by the Government Services Administration, other agencies, or NASA itself;
- **Federal Acquisition Regulation (FAR):** fixed-price and cost-plus contracts to both buy services and develop new capabilities; and,
- **Space Act Agreements:** a statutorily provided transaction authority that allows NASA to partner with industry in an either cost reimbursable, no exchange of funds, or funded arrangement.⁴

In deciding which of these frameworks to use, the government typically considers the requirements it needs from a product or service and what the commercial market currently provides. In the case of a widely available commercial product, like printer paper for example, the government is well served to buy the off-the-shelf product.

² U.S. Government Support of the Entrepreneurial Space Age, Space Angels, 2019

³ U.S. Government Support of the Entrepreneurial Space Age, Space Angels, 2019

⁴ NASA has limited its use of funded Space Act Agreements when it determines it is acquiring a good or service. In that case, NASA will use the FAR.

Conversely, as the government seeks to build a next generation stealth bomber, meeting its requirements will involve significant new developments that are not commercially available. The government will also desire a significant level of control in both the development and ultimate use of a stealth bomber, given its function and capabilities. In this case, the government would be best served to use a cost-plus FAR framework.

In some cases, the market may have an available product, but the government may also desire a level of control or enhanced capabilities that cannot be met commercially. Satellite communications are a market example of where the government takes multiple approaches. The government procures commercially available satellite bandwidth for its use from satellites operated by companies (essentially, buying an off-the-shelf service). The government also contracts with commercial space companies in a fixed-price or cost-plus model to build specialized communications satellites the government itself will use and control.

In the space context, the government has shifted its procurement strategies in some areas based on an assessment of where the commercial space industry's capabilities and market fall along the printer paper to stealth fighter spectrum. This is most visibly seen in NASA's commercial cargo and crew programs. In these programs, NASA used a "public investment/private service" model, which is when government subsidizes the creation of a commercial service as the primary customer, while also requiring companies to invest varying levels of private funds into the development of that service.

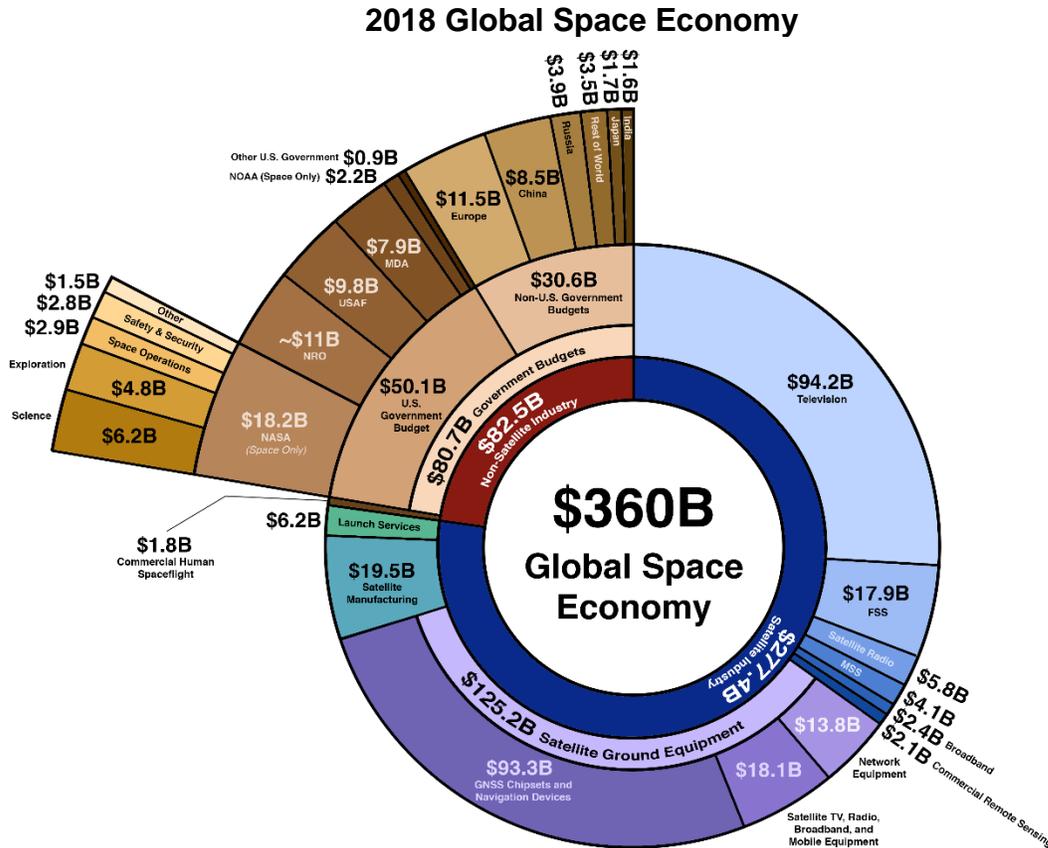
Under this model, NASA funded the majority of the development of new launch vehicles and spacecraft by purchasing the future "service" of companies transporting NASA cargo and astronauts to the International Space Station. The prime companies in these two programs are The Boeing Company, Northrop Grumman Corporation, Sierra Nevada Corporation, and SpaceX.

This is in contrast to a model where NASA would fund the development of a launch vehicle or spacecraft that NASA *itself* would operate to transport cargo and astronauts. Further, NASA crafted the procurement to require industry to commit some level of internal investment to the effort. This was again based on an assessment of the market and a determination that industry would be willing to make this commitment based on the opportunity to gain commercial business from the ensuing capabilities.

Market Maturity Important to Procurement Choices

NASA recently announced its intent to use this newer "public investment/private service" model for the procurement of a human lunar lander for the Artemis Program. The extension of the public investment/private service model to new areas requires a nuanced understanding of the commercial space market today and a realistic assessment of its direction to ensure overall risks and opportunities are being considered.

A partnership in an area with a robust, competitive market will allow different opportunities and risk postures than partnerships in areas that are considered nascent markets.



Source: Bryce Space and Technology

According to 2018 data, satellite services are a leading driver of the space economy, with significant economic activity also occurring in satellite manufacturing, ground systems, and launch services (see 2018 Global Space Economy graph).

The existence of a multi-billion-dollar commercial satellite launch market was critical to NASA’s procurement decision regarding the commercial cargo and crew programs. Given the existence of this market, NASA weighed the present capabilities of U.S. industry with the status of the market and determined this was an area where the “public investment/private service” model procurement strategy was viable.

At the time, NASA understood this presented a risk. Although the market was established and launch solutions existed, NASA would not be buying an “off-the-shelf” capability. Launch vehicles and spacecraft would still have to be developed by industry to provide the procured services. Further, NASA assessed industry would be willing to put in some level of internal investment, with the rationale that the ensuing launch vehicles could be used by the companies to gain commercial business apart from NASA.

As NASA considers using the “public investment/private service” procurement model more widely, it is important to assess the market in emerging areas and whether they are presently or expected to be revenue generating. From a NASA procurement perspective, using a “public investment/private service” model framework creates a different risk posture if used in areas that lack a current or near future market.

Looking at the global space economy, there is not an active commercial lunar market. The lack of a current market in deep space activity presents three primary risks in using a “public investment/private service” model procurement strategy.

First, given there is no current commercial market in deep space, there are not established commercial services for NASA to buy today. Therefore, the service of landing humans on the Moon will require a great deal of development before it can be provided to NASA. These services today are far from “off the shelf”

Second, requiring commercial companies to invest internal funds in an area with limited market prospects may prevent firms that are otherwise highly capable from competing to provide the service. As the future market is more speculative, the risk of investment and the potential time to see a return increases. Depending on the level of required investment by NASA, this could especially impact medium and smaller companies that are unable to take these risks, even if they have leading capabilities.

Third, purchasing these capabilities as services will require a detailed assessment and clear, predefined determination of government versus industry responsibilities to ensure the overall program is integrated successfully. Determining these responsibilities required significant cooperation between government and industry in the commercial cargo and crew programs, and there is the risk this will be increasingly complex in a deep space program.

From NASA’s perspective, these risks will require the agency to make a robust assessment of whether the technical, schedule, and price proposed by industry will close present capability gaps to meet NASA’s technical and schedule requirements. Further, NASA will have to consider whether any proposed industry investment is supported by a realistic assessment of future business. Having reviewed the market and considered these factors, there may be areas where NASA determines a different procurement path is necessary.

Finally, no matter the procurement model, NASA will require clear human safety requirements as well as a level of insight, oversight, and transparency into the development of human-rated systems. Currently, it will be NASA astronauts flying on these systems and the government serving as primary funder and customer. To the extent the “public investment/private service” model is extended to lunar activity, NASA is likely to be held responsible for safety at the end of the day. In this regard, Congress can learn from what worked well and where NASA ran into roadblocks during the commercial crew development process.

Congress as a Space Ally

Congress' review of the commercial space landscape and its policy decisions will shape both government action and the commercial space market.

As you consider NASA's next authorization and appropriations bills, Congress should provide direction about the motivation and objectives of our deep space exploration investments and the role of NASA and its commercial partners in these arrangements. In some cases, Congress may find a set of space activities are core national capabilities, similar to assets owned and operated by the Department of Defense, while in others, it may find industry-ownership and control beneficial.

Of course, Congress' actions are not limited to procurement policy, but have impacts across the space policy domain. An often forgotten and essential component to commercial space growth is the need for reliable, interference free, radio frequency spectrum for everything from launch and re-entry to accurate, timely, and reliable weather forecasting data. Spectrum is space's invisible nervous system, allowing critical data to be transmitted to and from Earth. Without access to this spectrum, our nation's space assets and capabilities cannot communicate. Building a viable commercial space landscape requires a comprehensive approach to our nation's future spectrum policy that ensures adequate and globally-harmonized spectrum for a full range of space uses: commercial, civil, and national security.

These are just a few examples of the many roles – from passing a multi-year NASA reauthorization to investing investment in STEM education and ensuring we have the most talented workforce – where Congress should be an active ally in ensuring a thriving space enterprise.

The commercial space industry has been a partner with government since the earliest days of the U.S. space program and will continue to be while government looks to meet its future space requirements and consider various procurement models. Whatever approach the government chooses, commercial industry is primed to meet the next set of space challenges, from the continued support of U.S. national security to returning to the Moon and going beyond.