

# Assessment of the Utility of a Government Strategic Investment Fund for Space

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## ABSTRACT

*A robust private sector in space can be instrumental in achieving major space policy goals, such as those promoted by the U.S. Government: fostering private space markets and reducing the cost and time required for the government to develop and procure space systems. Meeting these goals will likely require increased government attention to the challenges facing the private sector, as well as potential implementation of new or underutilized regulatory, policy, and economic mechanisms. This article focuses on a government strategic investment fund as a potential economic mechanism, which would make equity investments in companies pursuing activities of interest to the government, and offers examples of past and current funds both in the United States and internationally. This article then assesses the utility of such a fund in addressing the challenges with meeting these 2 policy goals; these challenges were identified through a literature review and interviews with >60 space experts, economists, and other stakeholders. We identified 5 major challenges to fostering the growth of private space markets and 4 challenges to reducing government costs and accelerating the development and procurement of space systems. Our analysis concludes that although a government strategic investment fund may be useful in select scenarios, it will not most effectively address the current challenges.*

**Keywords:** equity investment, government funding, policy mechanisms, private space markets, strategic investment fund, venture capital

## INTRODUCTION AND STUDY GOALS

Governments may implement many economic policy instruments and programs to support domestic industries and pursue national and international goals. These include capital subsidies (e.g., equity subsidies, government-sponsored loans, and loan guarantees), research and development (R&D) subsidies (e.g., research grants, R&D contracts, and cooperative agreements), and input subsidies (e.g., access to ground facilities, government technologies, launch services, and in-space platforms for testing). Government agencies can also make use of traditional or agency-specific contracting and purchasing mechanisms (e.g., cost-plus or solutions-based contracting; an example of an agency-specific contracting and procurement process is NASA's Commercial Orbital Transportation Services, intended to speed the development of new technologies and to reduce government costs of spaceflight<sup>1</sup>). Some of these efforts can be pursued through organizations designed to facilitate R&D and procurement for space technologies specifically; for example, NASA offers capital and input subsidies through organizations such as the Center for the Advancement of Science in Space, which supports the development of new technologies for human spaceflight through programs on the International Space Station (ISS).

Effective economic mechanisms can be used to meet 2 major policy goals: to foster private space markets and to reduce government costs and accelerate the development and procurement of space systems.<sup>2</sup>

One potential instrument is a government strategic investment fund, through which the government makes equity investments in private companies. We consider a fund focused on space, specifically addressing efforts to foster private space markets and reduce government cost. The findings are relevant to any nation seeking to support a private space sector and reduce government costs in space.

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This analysis is based on a review of the literature regarding economic policy instruments and government strategic funds in the United States and abroad, as well as >60 interviews with individuals representing industry associations, small and large companies (ranging from start-ups to prime contractors), private and government-backed equity investment funds, and government leaders involved in the space sector.<sup>3</sup>

In this article, we describe the characteristics of a government strategic investment fund and discuss advantages and limitations, offering examples of 2 such funds in the United States as well as 1 each in Luxembourg, France, and Australia. We share the challenges that limit the achievement of the 2 government policy goals considered here: fostering private space markets, and reducing government costs and accelerating the development and procurement of space systems. We then offer stakeholder perspectives regarding the applicability of such a fund, followed by our assessment of a fund's potential to address the challenges.

## CHARACTERISTICS OF A GOVERNMENT STRATEGIC INVESTMENT FUND

We define a government strategic investment fund as an equity-taking fund that receives money from government entities. In some cases, the fund is operated by the government, though in others, the government allocates capital to an existing fund and enters a management partnership. The fund makes equity investments in companies, often start-ups, engaged in activities of particular interest to the government, allowing the government to take an ownership stake; these investments help support R&D efforts on a scale and timeline that enable the pursuit of new potentially commercializable technologies.<sup>4</sup> Such a fund would target small emerging companies that have the greatest need for early capital, and for which small equity investments would have a significant impact. Through these equity investments, the government can support the development of products it may later purchase.<sup>5</sup>

The goal of a government strategic investment fund differs from that of a private venture capital (VC) fund: while private VC funds prioritize a high financial rate of return on investment, a government strategic investment fund aims to satisfy the technological needs of its government customer, regardless of any expectation for return on investment. Although the government strategic investment fund does not focus on financial profit, it does aim to invest in companies that are commercially viable, largely to ensure that the target technology will remain available for downstream government procurement. Indeed, for some government strategic

investment funds, success is based on whether the government adopts the resulting technology: if the government does not use it, the investment is considered a failure, regardless of any profit.<sup>3</sup>

Strategic investment funds have implemented timelines similar to those of VC funds, focusing on technologies expected to be commercially available soon after the initial investment and planning to exit the company within 7 to 10 years of the investment.<sup>6</sup> This timeline is based on experiences of both government and private investment funds: if a fund is structured for <7 years, companies may not have time to grow to a point where large returns are captured (*i.e.*, through initial public offerings or sale to an established company), while investments that cannot be profitably exited in <10 years have typically failed to generate the growth expected of successful new start-ups.<sup>3</sup>

A specific government agency sponsors a strategic investment fund, either by operating such a fund or by dedicating financial support to a new or existing fund structured to support the needs of the government agency.<sup>3</sup> The staff of a government strategic investment fund is generally relatively small, ranging from a few dozen to a few 100 people. Staff conduct analyses of each company's finances, business plan, technology, and operations before deciding whether to invest. The fund also employs staff dedicated to coordinating with the government sponsor; staff identify government technology needs, identify viable solutions within the start-up community, and serve as a liaison between the government sponsor and the target company. Technical experts within the sponsoring agency also review candidate companies' technologies.<sup>3</sup> The fund allows government entities to share expertise and advice with the company, providing insight into the potential applications of the technology. The fund's staff can work with the company to adapt the product to meet certain government standards,<sup>3</sup> facilitating government adoption of the technology.

Government funds generally maintain minority ownership stakes, investing alongside private entities. This helps ensure that the company pursues commercial as well as government goals, and reassures private investors that the company will pursue high rates of return in addition to government interests. As a result, government investments are typically modest in size compared with those of private VC firms.<sup>3,6,7</sup> Interviewees identified 2 major benefits to this coinvestment process.<sup>3</sup> First, in selecting companies that have received substantial investment from private VC funds, the government fund focuses on companies that have additional sources of technological and commercial assessment and validation. Second, in maintaining a minority stake, the fund is restricted

from facilitating decisions that solely support government objectives, potentially at the expense of the company's long-term viability.

## EXAMPLES OF GOVERNMENT STRATEGIC INVESTMENT FUNDS

### U.S. Government

Current and recent U.S. Government strategic investment funds have been established with 4 main goals in mind.<sup>3,6,8</sup>

1. Help the government identify, understand, and use emerging technologies.
2. Induce companies to develop products that address needs of the sponsoring agency.
3. Move technologies of government interest from the R&D stage to a final product more quickly.
4. Facilitate government purchase of products from businesses that otherwise may be unlikely to contract with the government.

Two such funds that have been established to serve these functions are the Intelligence Community's (IC's) In-Q-Tel and NASA's Red Planet Capital (RPC). Each offers insight into the structure and activities of such a fund.

*Intelligence Community: In-Q-Tel.* In-Q-Tel was created in 1999 to help the U.S. IC better understand existing products in commercial information technology and other technology sectors.<sup>3,6</sup> It was also intended to support the development of technologies designed for the commercial market that could meet the needs of the IC, either off-the-shelf or with slight modification. In-Q-Tel's Board of Directors worked to build the necessary support throughout the government, easing the IC's acceptance of the fund and helping it avoid closure due to political threats. In advocating strongly for In-Q-Tel in response to congressional questions about the fund's business case,<sup>6</sup> the board helped build confidence among potential partner companies by establishing In-Q-Tel as a stable entity.

The fund's staff examine a company's technology and business plan to ensure the investment will provide a benefit to the sponsoring agency beyond potential financial gain. If its conditions are met, In-Q-Tel makes equity investments in the form of warrants—In-Q-Tel is given the option to purchase undiluted shares at a fixed price at a later date. Because In-Q-Tel's ownership stakes are realized when the warrants are exercised, which occurs when the fund exits the investment, the fund does not have a voting position on the company's board.

Some in the business community initially worried that In-Q-Tel would compete with private VC funds. To avoid crowding

out investors or complicating investment dynamics in later stage activities, In-Q-Tel focuses on early stage funding. In addition, by acquiring only a minority stake with a nonvoting role, In-Q-Tel ensures its investments have buy-in from the private market, reinforcing the fund's due diligence work.

To keep customer agencies in the IC up-to-date on emerging technologies, In-Q-Tel goes beyond surveying the market; staff build relationships with start-ups and VC funds and track technology development in commercial markets of interest. In-Q-Tel has provided the IC improved access to emerging commercial technologies, helping determine what R&D the IC should conduct in-house and what could be purchased. In-Q-Tel's investments also serve as "smart money," an indicator that the company is developing an interesting technology that is likely to have a market; this "halo effect" can encourage other entities including private VC funds to invest alongside In-Q-Tel. In exchange for its investment, In-Q-Tel can, in principle, influence the development of a product to meet the needs of the IC.

In-Q-Tel may also provide grants to help a company meet the requirements of the government customer (e.g., if the fund invests in a database company for an agency that has security encryption requirements, In-Q-Tel may pay the company for the work necessary to strengthen the system). Through this nonrecurring engineering support, project managers and staff at In-Q-Tel help bridge a start-up's need to move rapidly with requirements of the government customer.

In-Q-Tel's performance is assessed based on whether its IC customers ultimately purchase the technologies developed by the companies receiving investment; if the product is a commercial success, but is not adopted by the IC, the investment may be considered unsuccessful. The investment is also considered unsuccessful if the company fails. By many accounts, In-Q-Tel has been highly successful: as of 2018, it has reportedly invested in 172 reported start-ups,<sup>9</sup> the products of which are frequently purchased and used by the customer agencies.

The experience of In-Q-Tel offers 3 lessons for government strategic investment funds:

1. The fund should have long-term support of all stakeholders—from the legislative branch of government in particular. The government's willingness to accept In-Q-Tel's investment decisions—which reinforces the fund's capacity to function independently—has enabled In-Q-Tel to invest in technologies that are successfully used by the customer agencies.
2. The fund should communicate efficiently with its customer agencies. The IC established an office, the In-Q-Tel Interface Center, to share agency needs with the

fund and to integrate the resulting technologies into agency programs.<sup>6</sup>

3. The fund should be accessible to commercial companies of interest. Technology start-ups have often been averse to working with the government, citing lengthy and difficult procurement processes and rigid technology requirements.<sup>3</sup> By presenting a model familiar to technology start-ups, In-Q-Tel can appeal to potential partners and ease these companies into government involvement.

Government leadership identified aspects of In-Q-Tel as potentially useful for public and private R&D collaboration in other areas of the U.S. Government. For example, In-Q-Tel's success motivated the Army to charter OnPoint Technologies, which would "back technology designed to produce lighter-weight and longer-lasting energy sources for soldiers."<sup>10</sup>

*NASA: Red Planet Capital.* In 2006, NASA created its own strategic investment fund with a proposed budget of ~\$90 million for 5 years. This effort was motivated by concerns that NASA was not leading the development of some technologies (e.g., advanced materials, electronics, and biomedical advancements).<sup>8</sup> NASA entered into a funded Space Act Agreement with a nonprofit corporation,<sup>11</sup> Red Planet Capital, Inc., which was established to act as an intermediary; the nonprofit corporation then invested money in RPC Partners, a for-profit, independent equity fund that would focus on target technologies articulated by NASA.<sup>8</sup> The nonprofit organization would release money to the equity fund when needed.

Political opposition, primarily from the White House's Office of Management and Budget and Office of Science and Technology Policy, led to RPC's unexpected closure just months after opening. The same policy-makers in the White House that supported In-Q-Tel opposed RPC: they considered a government strategic investment fund necessary for supporting the needs of the IC, but not relevant for civil space; similar nascent efforts in the Department of Energy and the Navy were ended as well.<sup>8</sup> Given other priorities of the then administrator, NASA leadership did not resist RPC's closure.

During its <6 months of operation, RPC made only 1 investment: \$800,000 in AlterG, which helped the company leverage \$12.4 million in private VC investment. AlterG's treadmill, built based on technology transferred from NASA, is used for physical therapy and has been sold both commercially and to NASA; this investment is considered successful based on its private and government use.<sup>8</sup>

## Europe and Australia

A number of governments have established equity investments in areas ranging from recovery efforts to nascent

technologies (e.g., in Sweden,<sup>12</sup> Japan,<sup>13</sup> and Canada<sup>14</sup>), which have eased the transition of research to commercializable technologies. Many of these efforts help support domestic private VC markets. The goals of these funds include facilitating the progress of private R&D efforts and encouraging investment in and growth of domestic industries.

*Luxembourg Space Fund.* Luxembourg's Space Agency, established in 2018, is working with the private sector and other government agencies to establish the Luxembourg Space Fund, with an intended initial funding level of €100 million (\$112.5 million). The fund will "provide equity funding for new space companies with ground-breaking ideas and technology." This includes early stage investments in hardware, software, communications, navigation, and Earth observation services, as well as in space applications such as space logistics and use of space resources.<sup>15</sup> The government will maintain a 30% to 40% share of the fund, with the rest belonging to private entities, both domestic and international.<sup>16</sup>

*France's CosmiCapital.* In 2018, the Centre national d'études spatiales (CNES) announced its plans to sponsor a VC firm called CosmiCapital, focused on supporting European space start-ups both directly (hardware and software) and indirectly (companies of any industry using space technologies or data, e.g., artificial intelligence, nanomaterials, robotics, cybersecurity, and drones).<sup>17</sup> The fund is managed by CapDecisif Management, which focuses on early stage technology investments throughout Europe. CNES is providing strategic support to the companies receiving funding, including due diligence and technological resources.

CNES expects CosmiCapital to be funded initially at €100 million (\$112.5 million) and to make investments ranging from €1 to €10 million (\$1.12–\$11.2 million) in 20–25 companies, potentially beginning in 2019.<sup>17</sup> Experts including CNES leadership expect that funding from CosmiCapital will help companies attract additional funding, largely from private investors due to the vetting conducted by the space agency.<sup>18</sup>

*Australian Innovation Investment Fund.* The Australian Government funds a number of VC programs in many sectors (e.g., Early Stage Venture Capital Limited Partnerships, Venture Capital Limited Partnerships, Australian Venture Capital Fund of Funds, and Pooled Development Funds) that support businesses in commercializing technologies and moving research into products. One major goal of these funds is to spur private investment; for example, the Australian Institute for Innovation estimates that a government expenditure of AU



\$15 million (\$10.5 million) each year for 10 years would yield over AU \$1 billion (\$700 million) in private investment.<sup>19</sup>

Australia's Innovation Investment Fund strives to "encourage the development of new companies that are commercializing research and development" by supporting new innovation funds and fund managers in early stage VC investing.<sup>20</sup> The fund coinvests with private sector entities to support early stage companies and works to commercialize the outcomes of Australian research,<sup>20</sup> offering support beyond capital<sup>7</sup> (companies receive guidance from individuals with the experience and expertise to support these efforts<sup>21</sup>). The fund established its first Early Stage Venture Capital Limited Partnership at AU \$50 million (\$35 million) in 2016 and focuses on early stage businesses that can significantly affect established markets.<sup>7</sup> Of the fund's initial 9 investments, 4 have received follow-on funding.

## DISCUSSION

### Government Strategic Investment Fund Performance

Government strategic investment funds have generally focused on fostering growth in specific industries or regions.<sup>6,8,21</sup> Governments pursuing such funds recognize the key role played by innovative new companies in developed economies (*e.g.*, supporting innovation and productivity, creating high paying jobs, and introducing new competition). Private VC funding has been crucial to the success of many technology companies (*i.e.*, by providing sufficient capital to support R&D over an appropriate timeline); however, due to asymmetric information and financiers' concerns about entrepreneurs' ability to honor their financial obligations, many technology companies may face difficulty raising such capital, especially during their early years.<sup>22</sup> Private VC funds continue to emerge in some countries to provide this financing, but private investment may not be sufficient to support promising companies; consequently, some governments have chosen to create investment funds to provide additional capital.<sup>23</sup>

Governments have often chosen to sponsor, rather than operate, strategic investment funds, in part based on failures of government-operated funds: when civil servants choose companies in which to invest, the results have often been poor,<sup>24</sup> and governments have not been as successful as the private sector in fostering entrepreneurship or managing equity investments.<sup>25</sup> As a consequence, many government strategic investment funds have outsourced their operations to private fund managers, with the government providing the financial resources and general direction.

However, there are drawbacks even to strategic investment funds that are government sponsored but privately operated. Past studies have found that in some instances, these funds

have added to available capital and attracted additional funding, but in others, they have displaced or crowded out private VC funds, making less capital available overall.<sup>14,26</sup> For example, government-supported equity funds in Canada pushed down returns to the point that private sector VC funds exited the market, thereby reducing the total amount of investment available.<sup>14</sup> Although government strategic investment funds were found to contribute to innovation, they failed to increase employment and were not as successful as their private counterparts in investing in companies that grew rapidly or generated substantial rates of return.<sup>26</sup> Additionally, in some cases, a government-funded or operated strategic investment fund may not emphasize (either through its mission or hiring processes) the importance of funding high-technology and high-risk projects, including those that would be useful for government goals and policies.

A strategic investment fund may not facilitate government procurement: in many cases, the timeline of a strategic investment fund does not align with the goals of governments in procuring space systems. If the company will not be ready for exit through acquisition or an initial public offering within the target timeframe of the fund, it is possible that neither the company nor the technology will be commercially viable. Technologies of interest to the government that are unlikely to be ready for the market within 7 to 10 years are thus better financed through other mechanisms, such as R&D grants. If the company may not survive, it likely benefits the government to pursue the technology through a more traditional procurement mechanism, such as a contract, to acquire the technology regardless of the company's performance. In addition, government strategic investment funds largely do not focus on a specific technology (*e.g.*, as would an R&D grant) and may, therefore, be less effective.<sup>4</sup>

Government strategic investment funds typically target companies that are focused on the commercial market rather than on government sales.<sup>3,20</sup> For example, In-Q-Tel strives to ensure that at least two-thirds of a product's sales will eventually be to nongovernment customers.<sup>3</sup> A government strategic investment fund would thus be less applicable for products wherein the government is the sole or largest customer, which is currently the case for many space technologies and services.

In addition, investment funds are relatively expensive to operate: as much as a third of some funds' budgets are spent on staff and operating expenses.<sup>3</sup> For example, the Australian Innovation Investment Fund is estimated to have spent >20% of the total pooled capital on management fees and administrative costs: it has invested nearly AU \$600 million (\$420 million) but cost AU \$130 million (\$90 million) to operate.<sup>19</sup>

### Challenges to Meeting Space Policy Goals

The utility of a government strategic investment fund to meet 2 major policy goals (*i.e.*, fostering private space markets, and reducing government costs and accelerating the development and procurement of space systems) depends on its capacity to address the current challenges to achieving these goals.

Through interviews with >60 individuals representing industry associations, small and large companies (ranging from start-ups to prime contractors), private and government-backed equity investment funds, and government employees involved in the space sector, and supported by a literature review, we identified 5 main challenges related to fostering the growth of private space markets:

1. Insufficient or unproven demand for products and services inhibits upfront private investment.
2. Lack of commonality between government and private market requirements makes products more expensive than needed.
3. High costs of testing and evaluation prevent companies from bringing products to market.
4. Government funding timelines are not aligned with private approaches, making government support less useful.
5. Capital markets are not sufficient to encourage funding for promising ideas in space.

Through the same process, we identified 4 challenges to reducing government costs and accelerating the development and procurement of space systems:

1. Cost-plus contracting increases costs, lengthens development times, and reduces incentives to innovate on cost.
2. Requirements for optimal solutions can lead to the exclusion of lower cost but “good enough” solutions.
3. Contracting requirements may discourage innovative nontraditional companies from submitting bids.
4. Insufficient demand for products from specialized suppliers makes products unnecessarily expensive.

### Stakeholder Perspectives: Utility of a Government Strategic Investment Fund for Space

We solicited stakeholder input regarding the potential utility of a government strategic investment fund for fostering the growth of private space markets or improving government procurement, given these challenges. Interviewees disagreed on whether a government strategic investment fund would be effective. Among those interviewed, representatives of small companies were the most supportive of such a fund, and employees of large companies and government agencies were the least. Investors themselves were split: while some supported the idea, a slight majority said such a fund is not necessary to

support the development of private markets or even to support private companies, citing growing private investment in space.

Some respondents stated they were not sufficiently familiar with the concept of a strategic investment fund to offer an opinion. Indeed, not all individuals who advocated for a strategic investment fund for space fully understood the mechanism or its implications: in some discussions, individuals were referring to a government fund that would provide undiluted capital to companies, not one that would take equity. When asked whether they would be comfortable with the government taking an equity stake in their company, some interviewees who had initially responded positively to a strategic investment fund demurred; some indicated that equity investing is a private function and that the government should not take equity, though others were hesitant to offer equity in any case. Some respondents indicated that a government equity stake in a company would be acceptable, expecting that a government-funded or operated strategic investment fund would likely offer more favorable terms than would a private VC fund.

Many discussions addressed the applicability of existing funding for space technologies: some investors claimed that funding for space companies is more than adequate, arguing that companies with a useful technology, solid business case, and proven demand are able to obtain adequate financing, citing the large increases in capital invested in space companies in recent years. However, others argued that some emerging subsectors of the industry would benefit from increased capital dedicated to space-related equity investments.

Some investors indicated that funding provided by the government through a strategic investment fund would be detrimental to their activities. They were concerned that the government would provide capital at lower rates and at more favorable terms than those warranted by the market, making private investment less attractive to start-ups. Investors who supported the idea of a government strategic investment fund for space generally did so under the provision that the fund be restricted to taking a minority stake, among other limitations.

### Applicability of a Government Strategic Investment Fund for Space

A government strategic investment fund for space would provide equity capital to promising space start-ups developing products and services that support the goals of the sponsoring government agency. This analysis found that such a fund could be useful for supporting companies in certain situations, such as those that already have received some private VC investment, those with a primary or potential commercial customer base, and those with products focused on commercial sales that can be used by the government with little to no modification. We find

that a government strategic investment fund for space would not be the most effective policy instrument to address the current challenges to achieving the policy goals considered here: fostering the growth of private space markets, and reducing government costs and accelerating the development and procurement of space systems.

*Private sector markets.* The data—interviews, sales of space industry products, and the growth in VC available for space start-ups—indicate that the crucial problem facing space start-ups is a lack of markets (i.e., lack of or unproven demand for products and services that space companies are attempting to develop), rather than a lack of capital. Without verifiable demand for a final product, companies are sometimes unable to attract the capital they need to develop these products.

Government strategic investment funds do not and cannot generate demand for new products. Although such funds could stimulate increased private investment and support companies with technologies that may enable other efforts (e.g., the company receiving the investment may rely on suppliers, thus increasing the demand for those technologies), the funds themselves are not designed to increase demand for technologies. Rather, they are designed to provide equity capital to emerging companies with products that are targeting sale in commercial markets. Although governments may procure the technologies of companies that receive investment, the demand for these technologies is not stimulated by the fund itself: it was the technology's relation to the government's existing demand that spurred the initial government investment.

Government strategic investment funds may not be the best mechanism to support the development of target technologies. For example, companies pursuing activities that will not generate revenues from sales to private markets in the near and medium terms (e.g., asteroid mining or on-orbit manufacturing) and have thus had difficulty attracting capital are likely better helped through research grants or other forms of government support. The timelines for these endeavors are too long and the returns too uncertain for government equity investments to be a preferred mechanism; these companies will likely not perform on the timeline of private VC and government strategic investment funds, making it difficult to solicit coinvestment from private entities. These equity investments are also potentially risky, given that the government may invest in a company that either is unable to produce the desired technology or does not survive commercially.

Indeed, a lack of equity capital was not the most pressing challenge facing these companies; they were more concerned with the costs of burdensome contracting mechanisms and the need for greater support for research, development, testing,

and evaluation (RDT&E) activities. This is especially relevant as the demand for a company's technology cannot be realized until the technology has been adequately evaluated. These issues are also more effectively addressed through other efforts, such as the streamlining of contracting mechanisms, an increase in support for RDT&E activities (e.g., grants and in-kind subsidies), and efforts to involve potential suppliers that have creative solutions (e.g., solutions-based contracting). One such effort could be a shift to purchasing items for government uses commercially and in bulk, rather than designing a unique product for each of several government missions.

Government strategic investment funds focus on companies whose major customer is private entities, not the government; however, in the space industry, government entities are often the primary, if not the sole, customers. Making equity investments in these companies through a government strategic investment fund may appear to tilt procurement in favor of the companies that received investment, which could indicate that procurement competitions will no longer be free and fair. In addition, such a fund is most useful for a company in its early stages, where a small equity investment can have a large impact on the company and the development of its technology. However, many government space purchases are made from established companies. If the government wishes to acquire a new technology, it is likely more cost-effective for the government to purchase that technology directly, rather than invest in a company that may fail to develop the technology.<sup>4</sup>

A strategic investment fund is not designed to fund RDT&E activities for innovative technologies or to improve government contracting procedures. Although a government strategic fund would provide additional capital, several venture capitalists as well as representatives of newer space companies argued that investment capital is generally available for commercially viable space companies with solid management and near-term products. Companies whose products will take longer to bring to market are likely better supported through targeted R&D grants and contracts rather than equity investments from a government fund.

*Improving government procurement.* The primary challenge facing the policy goal of reducing government costs and accelerating the development and procurement of space systems is the complicated process through which companies contract with the government, which may preclude smaller and potentially more innovative entities from bidding on government contracts. Indeed, past instances of technology-focused government strategic investment funds, such as In-Q-Tel, have been designed to connect the government agency with companies pursuing interesting technologies, and have not

addressed contracting or procurement processes. These funds have helped some companies become aware of government agencies' needs and have helped the government stay familiar with cutting edge technologies in the private sector; however, a lack of this awareness was not perceived to be a current challenge in the space sector. A government strategic investment fund also would not change government requirements for optimal solutions, nor would it generate demand for specialized technologies from suppliers. As such, a government strategic investment fund would not effectively address the major factors challenging the reduction of government cost and acceleration of development and procurement of space systems.

## CONCLUSION

The implementation of mechanisms to support commercial participation in space is particularly important in both traditional and emerging spacefaring nations. This is especially true in the United States, where a robust commercial space sector is integral to government policy goals and which will benefit greatly from strong nongovernmental demand for space products and services. However, challenges to fostering this private space market, as well as factors restricting government costs, development, and procurement, are not best addressed by a government strategic investment fund.

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