



Innovating with Procurement: Solving Market Failures & Creating Industries

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Market-Shaping Mechanisms as Innovation Tools

Tackling the greatest national challenges facing the United States requires a redoubled commitment to innovation. The United States put astronauts on the moon, split the atom, built the Internet, and sequenced the human genome. But progress has stagnated — and will continue to stagnate if we do not diversify our national approach to innovation. We must not only make investments in emerging technologies, but also experiment with new ways of solving problems.

Market-shaping mechanisms (MSMs), also known as “demand pull” mechanisms, are excellent tools for catalyzing solutions-oriented innovation. Through MSMs, the government uses its procuring power to create clear demand for a particular product or service. The private sector then utilizes its position and resources to “compete” to address the emerging demand that government investments create. Government agencies can use MSMs to construct “marketplaces of outcomes” that play one or more of the following roles:

- [Correcting market failures](#). MSMs create incentives for the private sector to work towards societal priorities that they otherwise would not invest in. For example, the federal government’s commitment under Operation Warp Speed to purchase hundreds of millions of COVID-19 vaccine doses (contingent on Food and Drug Administration (FDA) approval) spurred companies to invest heavily in vaccine research and production. MSMs aren’t just limited to accelerating progress in existing areas: in some circumstances, MSMs could birth entirely new industries.
- [Propelling the innovation economy](#). MSMs directly drive progress towards relatively narrow goals, but this progress creates spillover benefits for other industries. For example, the National Aeronautics and Space Administration (NASA) used fixed-price milestone payments to support development of SpaceX’s Falcon9 rocket. For an initial investment of roughly \$400 million, these payments gave NASA access to a capability that would have cost the agency up to an estimated \$4 billion USD using a “business as usual” approach. The SpaceX partnership also propelled the United States into a leadership position in commercial launch services, and reduced U.S. dependence on Russian rockets for access to the International Space Station.
- [Motivating frontier investments](#). By positioning the government as the first buyer, MSMs de-risk follow-on investment for other investors, thereby growing the pool of capital available to support projects at the cutting edge of science and technology. In 2011, for example, the Department of Energy (DOE) launched the Sunshot Initiative to

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reduce the total costs of solar energy by 75% by 2020 and make solar cost-competitive with other forms of energy.¹ The \$27 million that DOE allocated for projects to support the development, commercialization, and manufacturing of advanced solar-energy technologies spurred substantial follow-on investment from the private sector — about \$30 for every \$1 of government funding.² This follow-on investment helped DOE achieve Sunshot's goals three years earlier than expected and greatly expanded clean-energy access for millions of Americans.

Types of Market-Shaping Mechanisms

Federal agencies can implement multiple types of MSMs using existing procurement authorities. These MSMs include:

- Volume guarantees. Commitments from a buyer (e.g., a federal agency) to purchase a minimum quantity of an existing product at a set price from multiple vendors.
- Advance purchase agreements. Contract between a single buyer and a single supplier wherein the buyer provides funds in advance for the supplier to acquire necessary resources to manufacture a product or provide a service.
- Advance market commitments. Similar to advance purchase agreements but engage multiple suppliers or producers to produce a product or service.
- Prize competitions. Solicit and reward development of solutions for a particular, well-defined problem. Prize competitions encourage creative ideas and practices and encourage participation from a wide range of actors, including individuals, companies, academic teams, and more.
- Challenge-based acquisitions. Similar to prize competitions, but the prize is an agency's purchase of the winning solution.
- Milestone payments. Series of payments issued on accomplishing defined objectives throughout the life of a contract.

See the [Appendix](#) for more detail on each of these approaches.

¹ U.S. Department of Energy (n.d). [The SunShot Initiative](#).

² U.S. Department of Energy (2012). [Energy Department Announces SunShot Startup Investments and Competition to Unleash Cost-Competitive Solar Energy](#).



Correctly Executing Market-Shaping Mechanisms

Federal agencies seeking to implement MSMs should keep the following goals and best practices in mind:

- (1) Establish a clearly defined objective or outcome, while remaining agnostic as to which actor, team, or approach is most likely to succeed.³
- (2) Increase the number of people and organizations that are working on a particular problem.
- (3) Strive to stimulate follow-on private-sector investment.
- (4) Pay only if a team succeeds in achieving a goal.
- (5) Consider requiring market participants to make upfront investments in order to participate in a government-funded market opportunity. For instance, teams could be required to complete an application to enter a prize competition, or to demonstrate some level of investment in relevant research and production capabilities to be eligible for a contract with milestone payments. These requirements can help winnow the participant pool to teams that genuinely believe they can be successful.
- (6) Increase capacity to use MSMs by hiring knowledgeable staff, offering professional-development opportunities to existing employees, and tapping external expertise.
- (7) Craft problem statements in ways that invite creative solutions from diverse actors. Explore opportunities to disseminate problem statements broadly.
- (8) Proactively identify and address policy, legal, and budgetary barriers to use of MSMs. Clearly define when and how agency sub-entities can use these approaches.

³ This excludes Advanced Purchase Agreements, which is a contract agreement between a single buyer, a single supplier, and an outside funding source guaranteeing the contract.



Potential Use Cases

MSMs offer an innovative approach to solving problems where (i) non-traditional performers and commercial firms are likely to be able to make a significant contribution; (ii) federal agencies can articulate a set of performance-based criteria for evaluating competing solutions; and (iii) the government as an early customer can catalyze an integrated, globally competitive industrial base capable of meeting both government and commercial requirements for production of a given good or service.

With these principles in mind, listed below is a representative suite of challenges within different topical areas that are ripe for progress using MSMs.

Climate Change

- Develop special-purpose Earth observations equipment⁴ (satellites, remote sensing, early-warning systems, etc.) that could mitigate losses from wildfires, droughts, floods, and other extreme-weather events, as well as directly measure environmental change and greenhouse-gas emissions.
- Advance zero-emission alternative fuels and infrastructure for long-haul trucking,⁵ one of the biggest sources of automotive emissions.
- Dramatically improve carbon-capture, -sequestration, and -removal technologies.⁶
- Carry out comprehensive electrification of the aviation and aerospace ecosystems, including airports, ground vehicles, support equipment, and aircraft.
- Develop energy-efficient special-purpose computing solutions for cloud data centers and blockchain mining.
- Accelerate the transition to geothermal energy by making the geothermal-drilling approval process on federal lands as simple as approval processes for oil and gas extraction.
- Accelerate the transition to a cleaner, more humane food system through use of alternative proteins and synthetic-meat manufacturing.⁷
- Meet target goals laid out in DOE's Energy Storage Grand Challenge Roadmap, intended to achieve domestic manufacturing of energy-storage technologies for all U.S. market demand by 2030.

Defense and National Security

- Build ways to evaluate manufacturing cyberthreats and test strategies for ensuring supply-chain cybersecurity.⁸

⁴ Garver, L.; Hammer, D.; Kessler, J. (n.d.). [Earth Observation for Sensible Climate Policy](#). Day One Project.

⁵ Drake, J. (n.d.). [Zero Emission Fueling Stations for Trucks and Buses](#). Day One Project.

⁶ Morton, E. (n.d.). [Ensuring Good Governance of Carbon Dioxide Removal](#). Day One Project.

⁷ Specht, L. (2020). [Advancing Solutions for Alternative Proteins](#). The Good Food Institute, November 11.

⁸ Barkman, B.; Taylor, R.; Miller, D. (n.d.). [Using "Wargaming" to Evaluate Manufacturing Cyberthreats and Ensure Supply-Chain Cybersecurity](#). Day One Project.

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- Grow domestic capabilities to produce semiconductors and electronic chips to hedge against global shortages.

Health and Life Sciences

- Repurpose existing, off-patent generic drugs to [develop new treatments for cancer and other diseases](#).⁹
- Establish on-demand pharmaceutical manufacturing capabilities to ensure a safe, responsive, reliable, and affordable supply of quality medicine.¹⁰
- Track the public-health effects of pervasive environmental threats and remedy them using data-driven approaches, such as [lead-service lines](#) and [wildfire smoke](#).
- Establish capabilities to rapidly detect [emerging zoonotic diseases](#).
- Pioneer [next-generation water monitoring and treatment technologies](#) to provide universal access to affordable and safe drinking water.¹¹
- Jump-start markets and industrial-production capabilities for specific biomolecules that are integral to the biotechnology industry.

Emerging Technologies

- Accelerate commercialization of quantum-computing systems by achieving National Institute of Standards and Technology (NIST) quantum-computing benchmarks.
- Boost American manufacturing through a Department of Defense-led advanced market commitment to procure certain quantities of general-purpose advanced manufacturing equipment.

Education and Workforce

- Develop and deploy [digital 1:1 tutors](#) that can complement traditional K–12 education and/or support broader workforce development.
- Create [meta-cognition tools](#) that automate and scale open-ended reasoning so researchers and students can survey literature and data more comprehensively.

⁹ Kleiman, L.; Bhimaraju, S. (n.d.). [Repurposing Generic Drugs to Combat Cancer](#). Day One Project.

¹⁰ Ling, G. (n.d.). [A Federal Adaptive, On-Demand Pharmaceutical Manufacturing Initiative](#). Day One Project.

¹¹ Santos, M. (n.d.). [Establishing a National Water Technology Pipeline](#). Day One Project.



Appendix: Additional Detail on Different Types of Market-Shaping Mechanisms

Volume Guarantees

Volume guarantees are a commitment from a buyer to purchase a minimum quantity of an existing product at a set price from multiple vendors. This commitment is generally a long-term, multi-year contract that provides stability and security for the manufacturer and often allows the buyer to negotiate a reduced price for the product or service. The federal government uses volume guarantees in its indefinite-delivery, indefinite-quantity (IDIQ) contract type but rarely uses volume guarantees to shape markets or stimulate innovation: a key missed opportunity, given that federal agencies obligate one-third of their total contract obligations through IDIQ contracts (representing more than \$130 billion annually).¹²

Regulatory & Legal Environment

41 U.S.C. § 4104 defines a delivery-order contract as a contract for products that does not include a specified purchase volume but does set a ceiling on the contract value. A task-order contract operates in the same way but is a contract for services instead of products. The Federal Acquisition Regulation (FAR) provides guidance to federal agencies on several different types of contracts, including “indefinite-delivery” contracts. The FAR includes three sub-types of indefinite-delivery contracts: definite-quantity contracts, requirements contracts, and indefinite-quantity contracts. The FAR recommends indefinite-delivery contracts when the delivery timeline and quantity of the product or service is unknown at the time of contract award and requires a minimum quantity of the product or service to be part of the contract. As such, the regulatory version of a volume guarantee is found in **indefinite delivery, indefinite quantity (IDIQ)** contracts. FAR 16.504 describes the use of an IDIQ contract as one that “provides for an indefinite quantity, within stated limits, of supplies or services during a fixed period. The quantity limits can be the number of units or the dollar value, but the contractor must furnish the minimum quantities of the item and must be prepared to supply additional items not to exceed a maximum.” This volume guarantee is intended to provide a minimal level of consideration to make a contract binding and to provide just enough guaranteed sales to make it worthwhile for a vendor to commit the resources to bid for the contract.

Challenges

A key challenge with using IDIQ contracts is the lack of flexibility in changing the scope of the product or service after the contract has been linked. One workaround is to structure the IDIQ to procure a service instead of a product since a service can be more outcome-orientated than product specifications. Another challenge is eliminating duplicate IDIQs, which increase costs for the supplier but also create inconsistent pricing for the buyer.¹³

Examples

- In responding to COVID-19, the Defense Logistics Agency (DLA) obligated \$2.31 billion in IDIQ contracts, which was over half the funds for COVID-19 support to federal

¹² U.S. Government Accountability Office. (2017). Federal Contracts: Agencies Widely Used Indefinite Contracts to Provide Flexibility to Meet Mission Needs. GAO-17-329.

¹³ The Coalition for Government Procurement. (2017). Multiple Award IDIQ Contracts: Essential Tools in the Acquisition Toolbox.

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agencies and DoD customers.¹⁴ The contracts authorized state and local government organizations to purchase non-medical personal protective equipment through the COVID-19 Contingency Corridor in FedMall, the government e-commerce platform for the military services and federal, state, and local government agencies.

- The General Services Administration uses IDIQ contracts frequently through both Government-wide Acquisition Contracts as well as Multi-Agency Contracts,¹⁵ but does not use IDIQ contracts specifically to shape markets.
- A report¹⁶ from the Reproductive Health Supplies Coalition offers perspective on how to tailor the terms of a volume guarantee to the needs of a specific market.

Advance Market Commitment

An Advance Market Commitment (AMC) is a commitment to purchase a certain quantity, at a certain price, of a product that meets key performance specifications. AMCs can be used to commit to purchase a product that doesn't exist yet, which de-risks private investment in research, development, and manufacturing for that product.

Regulatory & Legal Environment

Requirements for AMC negotiations are included in 22 U.S.C. § 7624. The statute requires the product in question to be purchased at a fair market price, and also requires that any AMC agreement accommodate contract changes due to changes in market size while still maintaining the commitment to purchase the vaccine at the fair market price. The statute requires clearly defined rules for program participation, specifications for the product in question, and mechanisms for settling disputes.

An AMC is a form of advance agreement—an agreement wherein the costs of certain items in a contract are agreed to in advance. Part 31 of the Federal Acquisition Regulation (FAR) addresses advance agreements and offers several examples of where advance agreements are particularly important, including for costs of constructing plants and equipment.

Challenges

The market will be wary of AMCs made by the federal government unless sufficient funds are appropriated to cover product purchase. For example, there was [one attempt](#) by the federal government to use an AMC to shape the biofuels market, but Congress never appropriated the funds and the market never responded.¹⁷

Examples

- *Project BioShield allows the Department of Health and Human Services to obligate funding for chemical, biological, radiological, or nuclear countermeasures up to eight years before development has been completed.*¹⁸

¹⁴ Reece, B. (2020). [DLA offers non-medical COVID-19 protective equipment to state, local government agencies](#). Defense Logistics Agency, July 29.

¹⁵ U.S. General Services Administration. (n.d.). [GSA FAS GWAC Sales Dashboard](#).

¹⁶ Reproductive Health Supplies Coalition. (2014). [Market Shaping for Family Planning](#).

¹⁷ U.S. Department of Energy. (2014). [Memorandum of Understanding Between the Department of the Navy and the Department of Energy and the Department of Agriculture](#). April.

¹⁸ U.S. Health and Human Services Biomedical Advanced Research Projects Agency. (n.d.). [Project BioShield Overview](#).

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- An AMC for a pneumococcal vaccine resulted in the immunization of 150 million children and saved the lives of an estimated 700,00 people.¹⁹
- Operation Warp Speed negotiated AMCs with multiple companies for COVID-19 vaccines, contingent on FDA approval.²⁰

Advance Purchase Agreement

Advance Purchase Agreements (APA) are contracts between a single buyer and a single supplier wherein the buyer provides funds in advance for the supplier to acquire necessary materials, infrastructure, and labor to manufacture the product or provide the service. The federal government uses APAs for multi-year contracts as well as to jump-start production of a product or service needed for war or national defense, but to date has rarely used APAs as market-shaping mechanisms.

APAs are slightly different from AMCs. AMCs signal a broad intent to purchase a product or service and are therefore used when the goal is to influence an entire market. But in an AMC, funding to purchase the product or service is not guaranteed. An APA, by contrast, is an agreement between a single buyer, a single supplier, and an outside funding source guaranteeing the contract.

Non-binding APAs can be used in conjunction with consortia and other transaction authorities to spur government to attract innovative ideas, products, and services from industry.²¹

Regulatory & Legal Environment

Legislation uses several terms related to APAs, including “advance payments” and “advance procurement contracts”. In general, advance payments *are prohibited under statute unless specifically authorized* (see 31 U.S.C § 3324(a)).²²When advance payments are authorized, federal regulations instruct the contracting officer to adhere to statute and standard contracting principles. See 41 U.S.C. § 4501, 4503, 4505(c) for details regarding agency authorities related to advance, partial, progress or other payments.

¹⁹ Kremer, M.; Levin, J.D.; Snyder, C.M. (2020). [Advance Market Commitments: Insights from Theory and Experience](#). National Bureau of Economic Research, February. Working Paper 26775.

²⁰ Congressional Research Service. (2021). [Operation Warp Speed Contracts for COVID-19 Vaccines and Ancillary Vaccination Materials](#). IN11560.

²¹ U.S. Digital Service. (2014). [Innovative Contracting Case Studies](#). TechFAR Hub.

²² There are several situations that are specifically authorized in statute or in annual appropriations where advance payments or advance procurement contracts that are advantageous to the government can be used, especially in procurements that span several years and require long lead times, such as shipbuilding. For example, Section 4501 of Title 41 authorizes an executive agency to make advance, partial, progress or other payments under contracts specifically for property or services. Section 4503 requires the agency to ensure adequate security in the form of a lien and determination that the advance payment is in the public interest. In some situations, the amount of advance payments is limited. Section 4505(c) places a limitation on the amount of advance payments for commercial products or services to be no more than 15 percent of the contract price. Progress payments may be used for undefinitized contracts.

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Challenges

The most obvious risk of APAs is the risk that a supplier does not supply the product or service for which they have been funded. There is also a risk that through an APA, the buyer will end up paying more for the product or service today than that buyer would pay in the future. Finally, the supplier risks not accurately forecasting costs of producing the product or service as a result (and running short of funds as a result). Because of these risks, and because legislation explicitly discourages APAs, federal agencies are understandably cautious about entering APAs unless there is clear, specific authorization, funding, and direction from Congress.

Examples

- Congress regularly authorizes advance procurement funding for shipbuilding activities, particularly for long-lead items. Congress authorized and appropriated over \$700 million for advance procurement in FY21 defense appropriations.

Prize Competitions and Challenge-Based Acquisition

Prize competitions, also known as “grand challenges”, offer a prize (typically a cash payment) to a team that accomplishes a particular goal. Every federal agency has the authority to support prize competitions of up to \$50 million. Challenge-based acquisitions (CBAs) are similar to prize competitions, but the prize is the purchase of the winning solution by the federal agency hosting the competition. CBAs allow government agencies to select solutions based on demonstrated capabilities as opposed to written proposals. The U.S. General Services Administration (GSA) estimates that federal agencies have conducted over 1,200 prize competitions and CBAs since 2010.²³

Regulatory & Legal Environment

Congress passed the America COMPETES Reauthorization Act in 2010, providing broad authority to all federal agencies to carry out prize competitions. There is no limit to the value of the prize that an agency may offer in a competition, but prizes exceeding \$1 million require approval of the head of the agency and prizes exceeding \$50 million require Congressional notification. 15 U.S.C. § 3719 requires all funds for the prize to be available prior to announcement. 15 U.S.C. § 3719 is implemented through the Office of Management and Budget Memorandum M-10-11 and individual agency policies. GSA's [Challenge.gov](https://www.gsa.gov/transaction/challenge) website is a centralized repository of information about existing and past federal prize competitions.

There are multiple and duplicative authorities for federal prize competitions, but there is no statute explicitly authorizing or prohibiting CBAs to purchase innovative solutions or to shape a market. As such, CBAs should be considered permissible under existing law.

Despite recent growth over their use, prize competitions still remain underutilized and account for only about \$5 for every \$10,000 spent on R&D. Individual prize awards do not approach the \$1 million or \$50 million threshold levels set forth by the COMPETES Act, with the average size estimated at \$82,000 for COMPETES Act prizes and \$226,000 under agency-specific prize authorities.

²³ General Services Administration (n.d). [About Challenge.gov](https://www.gsa.gov/transaction/challenge).

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Examples

Federal prize competitions are common, and many examples of such competitions are available on Challenge.gov. Government-funded CBAs are rarer. Examples of these include the 2014 JIEDDO Counter-IED Culvert Challenge²⁴ and the 2016 Army Cyber Innovation Challenge.²⁵ No entrants were able to achieve the challenge goal in either of these CBAs, though several were selected for further research and development.

A more recent government-funded CBA is the Army's Innovation Combine challenge for U.S.-based small and non-traditional businesses to propose technologies related to battery management and safe, printable, conformal batteries that can be integrated into military equipment for greater reliability and accuracy.²⁶ The stage winners of the Innovation Combine received prize money ranging from \$5,000 to \$45,000, and the top two ultimate finalists were invited to submit a prototype proposal for the chance to earn up to \$500K in funding through a contract with the military.

²⁴ Ferdinando, L. (2014). [JIEDDO holds competition for new counter-IED systems](#). U.S. Army, October 14.

²⁵ ARCYBER. (2016). [Army Cyber Innovation](#). U.S. Army, March 23.

²⁶ U.S. Army. (n.d.). [Innovation Combine](#).

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Milestone Payments

Milestone payments reward innovators for intermediate progress towards a specific goal. Payments are made upon the accomplishment of defined objectives throughout the life of a contract. In government acquisition, milestone payments are used as a form of contract financing, with payments made as specific, measurable events are completed as opposed to progress payments which disperse an agreed-upon percentage of funds based on a period of elapsed time. Current statutes and regulations recommend milestone payments for ongoing, stable production (such as shipbuilding) as a contract-financing mechanism rather than as a market-shaping mechanism.

Regulatory and Legal Environment

The ability to use milestone payments is derived from the “Other Transaction” (OT) authority NASA received for “advanced research projects” in 1958. Rather than the burdensome compliance with standard contracts, grants, and cooperative agreements as defined by the FAR, OTs are intended to enhance innovation by providing flexible mechanisms, like milestone payments. In 1989, OT authority was granted to the Defense Advanced Research Projects Agency (DARPA); since then, it has been granted to the entire Department of Defense as well as Departments of Energy, Health and Human Services, Homeland Security, and more.

41 U.S.C. § 4501 gives federal agencies the authority to make advance, partial, progress or other payments under contracts. The authority is only to be used when the financing is in the public interest. There are certain statutory requirements for any contract-financing arrangement, specifically that:

- The government must ensure payments are commensurate with the work accomplished.
- The contractor must provide information and evidence requested by the government.
- The financing can be no more than 80% of the total cost of the contract.
- The total contract cost must exceed \$25,000.

Some executive agencies have more expansive authorities for contract financing. For instance, the Secretary of the Navy can provide progress payments for up to 90% of a contract for repair, maintenance, and overhaul of naval vessels.

FAR 32.106 states the following order of preference for contract financing:

- (1) No financing.
- (2) Customary contract financing (i.e., progress payments, performance-based payments)
- (3) Loan guarantees.
- (4) Uncustomary contract financing (anything other than progress payments and performance-based payments), and advance payments.

In other words, the FAR interprets 41 U.S.C. § 4501 as a direction to only use contract financing when it is in the public interest. No financing is the first preference.

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Challenges

Milestone payments involve a complexity in identifying and monitoring the correct moments of progress, which may disincentivize acquisition managers from using them. Over the years, government watchdogs have found fault with the use of milestone payments within the Department of Defense. In 2003, a Department of Defense Inspector General report found that the Pentagon was not complying with statute or regulations in administering 43 of 67 contracts comprising a total of \$5.5 billion of performance-based payments.²⁷ The report also found inadequate documentation for \$5 billion of the payments.

To avoid similar problems, agencies should (i) establish clear policies for when and how to use milestone payments and (ii) establish clear oversight mechanisms to allay concerns that milestone payments will reward contractors who fail to perform (taking into account that an acceptable level of risk should be assumed when trying to shape markets).

Examples

- NASA's partnership²⁸ with SpaceX for the development of the Falcon9 rocket—capable of delivering cargo and astronauts to the International Space Station (ISS)—was structured as a series of milestone payments.²⁹ This partnership reduced U.S. dependence on Russian rockets to send astronauts to the ISS. For an investment of roughly \$400 million, NASA gained access to a capability that would have cost them \$1.7 billion to \$4 billion under a “business as usual” approach.³⁰ This partnership also propelled the United States to a leadership position in commercial launch services. In 2010, the United States had 0% of the commercial-launch market. In 2018, the U.S.-based SpaceX had 65% of that market.

²⁷ U.S. Department of Defense Inspector General (2003), [Administration of Performance-Based Payments Made to Defense Contractors](#).

²⁸ National Aeronautics and Space Agency. (2014). [Commercial Orbital Transportation Services: A New Era in Spaceflight](#). NASA/SP-2014-617.

²⁹ Zapata, E. (2017). [An Assessment of Cost Improvements in the NASA COTS/CRS Program and Implications for Future NASA Missions](#). National Aeronautics and Space Administration.

³⁰ Ibid.