

# NASA'S Transactional Approach to Commercializing Space Systems Activities

## *A Novel Way Forward*

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### **Abstract**

This paper will discuss NASA's novel, hybridized transactional approach to facilitate development of space systems with private sector entities. Specifically, this paper will discuss NASA's strategic alignment and execution of transactional instruments in order to implement a program which builds upon itself and stimulates the commercialization of space, while also working to improve the competitive environment for the traditional government procurement market. In effect, NASA's approach incentivizes companies to develop commercial solutions for complex space systems. NASA then utilizes a more streamlined procurement strategy to purchase services from these commercial vendors using these systems, despite the fact that they have yet to be fully developed and certified. This paper will discuss this innovative procurement design as a proven mechanism for a national space agency to help lead the way forward in the commercialization of space, while also pursuing its own exploratory and scientific mission goals.

### **I. Introduction**

One morning, a few years from today, NASA astronauts will board a crew capsule atop a launch vehicle on Pad 39A at NASA's Kennedy Space Center, bound for the International Space Station (ISS). The astronauts will depart from U.S. soil for low-Earth orbit for the first time since NASA ceased Space Shuttle operations in 2011. To those unfamiliar with this launch, it will appear no different from NASA's prior operations dating back to the Mercury

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program – a partnership with and reliance upon private industry to achieve mission success. But the similarities end here.

Rather, this morning's launch, a programmatic goal over thirty years in the making, will be nothing short of revolutionary in NASA's more than half-century history of human spaceflight. It will represent the successful application of a novel acquisition model, and a significant departure from the traditional "old space" paradigm of government-owned and operated transportation systems that has served as NASA's operating posture for over fifty years.<sup>1</sup> NASA will have achieved two independent programmatic goals: safe transportation of NASA personnel to and from ISS; and the enabling of the development of non-NASA commercial markets for human spaceflight transportation services to and from Low Earth Orbit (LEO). From the launch vehicle and crew capsule hardware, to the launch and mission support services, NASA will be significantly more "out of the loop" than in previous missions. Neither the launch vehicle nor the crew vehicle belong to NASA. Nor will NASA undertake mission control, support systems, and operations activities previously reserved for civil servant and contractor personnel at Johnson Space Center in Houston, Texas. Rather, responsibility for such tasks will be within the purview of NASA's vendor providing these transportation services. It will be the contractor's mission to complete. NASA will be a customer, and its astronauts, passengers on this transportation service.

But perhaps most interesting, this morning's launch will represent a sort of market debut – a first day of business for these service providers – in what represents the most robust endeavor to date by a governmental space agency to foster commercialization of complex space activities. When the crew transportation vehicle successfully docks with ISS and retrieves the flag left by the crew of STS-135,<sup>2</sup> it will mark the capstone of a multi-layered, interdependent web of programs designed to achieve safe, reliable, and cost effective means to access LEO.

Engagement with commercial partners has forced NASA to re-think the way it does business.<sup>3</sup> And a forward-leaning business model has required equally

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1 See Joel Achenbach, *Which Way to Space?*, Wash. Post, Nov. 23, 2013 (describing the characteristics of both "New Space" and "Old Space" philosophies), available at [www.washingtonpost.com/sf/national/2013/11/23/which-way-to-space/](http://www.washingtonpost.com/sf/national/2013/11/23/which-way-to-space/).

2 The crew of Space Shuttle Atlantis's final flight brought with it an American flag that resides on ISS until an American commercial company launches astronauts to the Space Station. See Robert Z. Pearlman, collectSPACE.com, *President Obama Reveals Astronauts' Secret Souvenir on Final Shuttle Mission*, (July 15, 2011), at [www.space.com/12309-obama-space-astronauts-secret-american-flag.html](http://www.space.com/12309-obama-space-astronauts-secret-american-flag.html).

3 See The International Space Station: Hearing of Comm. on Science, Space, and Technology, Subcomm. on Space and Aeronautics, 157 Cong. Rec. D1084-01 (Oct. 12, 2011) (statement of William H. Gerstenmaier) available at [www.hq.nasa.gov/legislative/hearings/2011%20hearings/10-12-11\\_GERSTENMAIER.pdf](http://www.hq.nasa.gov/legislative/hearings/2011%20hearings/10-12-11_GERSTENMAIER.pdf) (summarizing NASA's "new way of doing business" whereby "an overall hybrid structure over the lifecycle of the program")

forward-leaning legal support in order to create the framework necessary to commit parties to these endeavors while doing so within the confines of NASA's congressionally mandated authority.

This paper will discuss the evolution of NASA's novel, hybridized transactional approach to complex space systems development and purchase from its traditional procurement model. This approach has been legally validated under U.S. law and has provided NASA with the toolset to interact with and participate in a growing commercial space environment, while also still meeting the Agency's own needs to accomplish mission objectives and preserving its preeminence in space exploration. In particular, this paper will examine the evolution of and the procedures associated with this transactional model and will explore its successful application in LEO for NASA's needs pertaining to the International Space Station.

Changing the paradigm has not been easy and it is not without programmatic risk. Moreover, application of this model of doing business necessarily realigns NASA's role from sole customer with a traditional aerospace contractor community and nationalized leader in human spaceflight to one of a pool of customers for spaceflight services. But it also opens the door to cost-effective solutions for not only NASA's present transportation needs, but also for those of a potential pool of other customers in this fledgling spaceflight market. This paper will also suggest the continued applicability of this model not only for NASA, but also for other space agencies as well in the next generation of human spaceflight.

## **II. The Evolution of Nasa's Authority to Further the Commercialization of Space**

NASA's original charter, the National Aeronautics and Space Act of 1958 (Space Act), created an agency with a stated policy and purpose to advance space activities for peaceful purposes and for the benefit of all humankind.<sup>4</sup> However, the political backdrop of the time fueled NASA's unstated authorization to be a nationalized organization to "make and maintain [the United States] preeminent in outer space activities."<sup>5</sup> Indeed, NASA's involvement in the commercialization of space activities was not one of its original stated purposes. Rather, NASA's authority and the implementation of this authority so as to fuel advancement in this realm has taken a circuitous route and it has developed incrementally over time.

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would build upon previously awarded development agreements and then "transition [...] into a series of competitively awarded contracts.").

4 National Aeronautics and Space Act of 1958 (Space Act), Pub. L. No. 85-568, 72 Stat. 426 (current version at 51 U.S.C. §20101-20164 (2012)).

5 Paul G. Dembling, *The National Aeronautics and Space Act of 1958: Revisited*, 34 J. Space L. 203 (2008).

The era of commercialized space began during President Reagan's administration – which undertook the most substantial overhaul of NASA's organizational structure since its creation in 1958 under its National Space Policy platform.<sup>6</sup> The President's Cabinet Council on Commerce and Trade (CCCT) became the center of discussion regarding space commercialization.<sup>7</sup> While President Reagan believed in NASA's place as the nationalized aegis of America's dominance in space, his Administration saw opportunities for NASA to begin cultivating and participating in space commerce. Seeing a place for NASA in this economic philosophical shift, Reagan himself noted that with "NASA's help," his new initiatives on privatization of in space could be carried out.<sup>8</sup> This power to influence the advancement of space commercialization was officially granted to NASA by modification of the Space Act.<sup>9</sup> President Reagan's 1984 State of the Union Address set the stage for a program that would become the epicenter of NASA's dual roles of advancing a space economy while advancing its scientific and exploratory goals – the International Space Station.<sup>10</sup> NASA immediately responded, issuing its first Commercial Space Policy later that year.<sup>11</sup> Nevertheless, at the time these lofty policy goals were beginning to be implemented, there simply was no commercial space industry in the way we conceive of it today.

The commercialization ISS became an even more pronounced policy goal with the Commercial Space Act of 1998, which Congress passed before the Station was even completed. Title I of the Act named the priority goal of ISS as being the economic development of low-Earth orbital space and to study the potential opportunities for commercial providers to play a role in ISS activities.<sup>12</sup> Congress continued to nudge NASA towards taking a more commercialized customer role under Title II of the Act (entitled Federal Acquisition of Space Transportation Services), which required that NASA acquire its space transportation services from United States commercial providers as commercial items, unless NASA found that the payload required the unique capabilities of the Space Shuttle.<sup>13</sup> However, while Congress continued to

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6 Edythe Weeks, *Outer Space Development, International Relations and Space Law: A Method for Elucidating Seeds* at 67 (2012).

7 W.D. Kay, *Defining NASA: The Historical Debate over the Agency's Mission* at 136 (2005).

8 See *id.* at 137.

9 National Aeronautics and Space Administration Authorization Act of 1985, Pub. L. No. 98-361, 98 Stat. 426 (amending the Space Act).

10 See Ronald Reagan, *Address Before a Joint Session of the Congress on the State of the Union* (Jan. 25, 1984).

11 NASA Historical Data Book Volume VI: NASA Space Applications, Aeronautics and Space Research and Technology, Tracking and Data Acquisition/Support Operations, Commercial Programs, and Resources 1979-1988 358 (1994).

12 Pub. L. No. 105-303, 112 Stat. 2845 (1998).

13 *Id.* at 2854-2856.

provide NASA with the statutory “green light” to implement a more commercialized approach to space transportation, once again, no viable commercial enterprises existed at this time with any hope of providing NASA with such services. Specifically, no commercially available ISS construction-related, cargo, or human transportation services were available to procure. But this obligation provided an impetus for NASA. If no commercially available services existed, NASA would have to play a larger role in the fostering of such services in line with its Commercial Space Policy established more than a decade earlier.<sup>14</sup>

Congress continued to recognize NASA's value as facilitator of a burgeoning commercial space transportation industry in 2000, and in 2004, President George W. Bush's Vision for Space Exploration directed NASA to pursue commercial opportunities for providing transportation and other services supporting ISS.<sup>15</sup> In line with this goal, NASA's 2005 Authorization Act directed NASA to contract with private sector entities for crew and cargo services, including those to the ISS to all extent practicable.<sup>16</sup> But just as was the case six years earlier, private commercial space transportation was still relatively nascent, and no ready-for-flight commercial alternatives existed.

So NASA decided to focus its consideration on how to best use its authority to help grow a solution. However, while Congress bestowed upon NASA the authority to *act*, like any other federal agency, NASA may only do so within its authority to *transact*. As discussed below, re-configuring NASA (a national space agency with decades of direct development, purchase, and ownership of transportation systems) to behave more commercially required a complete overhaul the manner in which NASA conducted business with industry and a creative re-thinking of NASA's transactional tools to implement such an overhaul.

### III. Key Aspects of NASA's Transactional Authorities

#### III.1. NASA's Contract Authority

NASA, like every other federal agency, is governed by United States law which establishes the use of procurement contracts when the agency's principal purpose is the acquisition of “property or services for the direct benefit or use of the United States Government.”<sup>17</sup> Additionally, NASA's Space Act bestows upon the Agency specific authority to enter into contracts for such

14 That policy championed “establishing new links with the private sector to stimulate the development of private businesses in space.”

15 George W. Bush, A Renewed Spirit of Discovery: The President's Vision for U.S. Space Exploration (Jan. 14, 2004).

16 Pub. L. No. 109-155, 119 Stat. 2898 (2005).

17 31 U.S.C. §6303 (2012).

property or services.<sup>18</sup> NASA's use of procurement contracts to purchase goods and services is essential to its mission success. Approximately 80% of NASA's budget is obligated in some way to contracting.<sup>19</sup> NASA's procurement regime is governed by federal statute (principally, the Competition in Contracting Act<sup>20</sup>) and regulation (the Federal Acquisition Regulation (FAR),<sup>21</sup> as well as agency-specific regulation) – meaning that NASA is obligated to conduct procurements in a manner that promotes competition where applicable and in strict compliance with the procedures prescribed.<sup>22</sup> Federal law also establishes an independent procurement review system (also known the bid protest process) wherein an unsuccessful offeror or dissatisfied prospective offeror may challenge the procuring agency's actions (or omissions).<sup>23</sup> NASA's procurement regime is loosely analogous (with some notable exceptions) with those established by both the European Space Agency and the Japanese Aerospace Exploration Agency.<sup>24</sup>

Within this regulatory framework, NASA has some flexibility in the type of procurement approach it utilizes, as well as with the type of contract vehicle to be entered into by the parties. Nevertheless, most of NASA's large-scale procurements are undertaken either as “negotiated” procurements<sup>25</sup> or by means of a slightly more streamlined approach of acquiring commercial items.<sup>26</sup> The latter of these procedures adopts many of the same evaluation techniques of the former. In accordance with the procedures set forth in the FAR and the NASA FAR Supplement, the Agency typically issues a Request for Proposals (RFP) inviting offerors to submit responsive proposals.<sup>27</sup> The Agency convenes a Source Evaluation Board (SEB), which consists of experts from various relevant disciplines. The SEB then evaluates submitted proposals and provides their evaluation findings to a Source Selection Authority

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18 51 U.S.C. §20113 (2012).

19 NASA Annual Procurement Report Fiscal Year 2014 (noting a slightly decreasing trend from FY10 through FY14 with FY14's budget comprised of 78.6% of NASA's budget committed to procurement obligations), *available at* [https://prod.nais.nasa.gov/pub/pub\\_library/annual2014.pdf](https://prod.nais.nasa.gov/pub/pub_library/annual2014.pdf).

20 41 U.S.C. §253; 10 U.S.C. §2304 (2012).

21 Title 48, Chapter 1, Code of Federal Regulations (2015).

22 41 U.S.C. §3306 (2012).

23 See 4 C.F.R. Part 21 (describing the rules governing the United States Government Accountability Office's (GAO's) bid protest regulations. Disappointed offerors may also file a lawsuit before a federal judge challenging a procurement. 28 U.S.C. §1491(b) (conferring bid protest jurisdiction to the United States Court of Federal Claims).

24 See *generally* Keisuke Shimizu, *Procurement Systems of the Japanese Space Agency: A Comparative Assessment*, 44 Pub. Contract L. J. 37-40 (2014) (discussing the governing procurement law and policies of these agencies).

25 See 48 C.F.R. Part 15; 48 C.F.R. Part 1815 (2015).

26 See 48 C.F.R. Part 12; 48 C.F.R. Part 1812 (2015).

27 See 48 C.F.R. §15.208; 48 C.F.R. 1815.208 (2015).

charged with making the ultimate selection decision.<sup>28</sup> The typical outcome of the source selection process is the award of a contract that is generally structured on either a firm-fixed price or one of several cost-reimbursement bases. In firm-fixed price contracts, the offeror's proposed price is fixed at the time of award and will typically not be modified; whereas, under cost-reimbursement contracts, the contractor may recoup all reasonable, allowable, and allocable costs associated with performing the Government's requirement, in addition to profit or a fee. These costs are governed by sophisticated government contractor cost accounting standards.

Traditionally, NASA's acquisition of complex space transportation systems have been relegated to a relatively small number of large defense and aerospace contractors and their cadres of subcontractors.<sup>29</sup> These contracts have typically been cost-reimbursement in nature, which places the risk of cost overruns on NASA. Additionally, many of NASA's traditional major space systems acquisitions are without the benefit of full and open competition.<sup>30</sup> NASA has traditionally developed stringent requirements and redundancies for transportation systems (often with the assistance of these contractors under research and development contracts) and NASA's technical personnel have been substantially involved in engineering and technical activities throughout each system's development. Through the terms of the contract, NASA has traditionally taken ownership of the space transportation system in question, along with its accompanying operating infrastructure. This contracting model has been seen as the most appropriate because of space transportation development's obvious extreme risky nature, given its complexity and the paramount importance of human safety. This is intended to keep NASA deeply involved in the process during the administration of the contract in order to produce more failsafe results. However, invariably, this model has resulted in significant additional cost to the Government over a schedule that is prone to elongation and dependent upon incremental Government funding streams.<sup>31</sup> This contracting model has produced an environment that is not always conducive to participation for commercial companies without significant government procurement experience. For one, a favorable evaluation requires a record of past performance previously fulfilling Government requirements,

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28 See *generally* NASA, Source Selection Guide: Source Evaluation Boards §2.5.3 (NASA Source Selection Guide) available at [ftp://jwocky.gsfc.nasa.gov/pub/tmp/herman/Sandy%20Source\\_Selection\\_Guide\\_final.pdf](ftp://jwocky.gsfc.nasa.gov/pub/tmp/herman/Sandy%20Source_Selection_Guide_final.pdf).

29 NASA, Annual Procurement Report Fiscal Year 2014, *supra* note 19 at 13 (showing a breakdown of NASA's largest contractors by contract value).

30 See Shimizu, *supra* note 24 at 36.

31 See John Tierney, *NASA, We've Got a Problem. But It Can Be Fixed*, N.Y. TIMES, Apr. 12, 2010, at D2 (opining that the "cost-plus approach encourages aerospace companies to find the most expensive way to do something and drag it out as long as possible").

which many smaller firms simply do not have.<sup>32</sup> Firms may also not have the accounting systems necessary to track costs incurred under these contracts.<sup>33</sup> Moreover, NASA's heavy oversight, as well as the intellectual property rights legal regime imposed by both statute<sup>34</sup> and the regulatory terms of the contracts themselves,<sup>35</sup> disincentivize smaller companies from innovative design and development of space systems in the confines of a contractual relationship with the Agency.<sup>36</sup> Finally, even at their most streamlined, U.S. Government commercial-type acquisition procedures are governed by the FAR's complex and voluminous regulatory regime, which creates an intensive process for NASA's purchase of goods and services.<sup>37</sup> This has been recognized as a both an actual and a perceived barrier to entry for commercial entities.

### III.2. NASA's Space Act "Other Transactions" Authority

Under the Space Act, and unlike the vast majority of other federal agencies, NASA also has the unique authority to enter into "other transactions as may be necessary in the conduct of its work."<sup>38</sup> While not expressly defined, Congress recognized at the time that this grant of authority was "broad" in nature.<sup>39</sup> As such, NASA's Space Act authority provides the ability to establish legally binding agreements in which NASA can commit resources in order to accomplish the stated objectives of a joint undertaking with a partner entity, including an Agency mission. Space Act Agreements (SAAs) are not considered traditional government contracts<sup>40</sup> and therefore, can operate outside the bounds of procurement statutes and regulations.<sup>41</sup>

32 See NASA, Commercial Orbital Transportation: A New Era in Spaceflight 14 (2014) (hereinafter "COTS").

33 See Philip McAlister, Commercial Crew Program Status for the NAC, Aug. 2, 2011 available at [https://www.nasa.gov/sites/default/files/files/McAlister\\_COTS\\_CRSNAC\\_508.pdf](https://www.nasa.gov/sites/default/files/files/McAlister_COTS_CRSNAC_508.pdf) (noting concerns about cost accounting system as a deterrent for small businesses).

34 See 51 U.S.C. §§20135(a)(1); (b) (2012); See also 35 U.S.C. §210(a)(7) (2012); 14 C.F.R. §1245.107(b) (2015).

35 See 48 C.F.R Part 27.300 (2015) (discussing patent rights) and 48 C.F.R. Part 27.400 (2015) (discussing rights in technical data first produced under a contract).

36 See COTS, *supra* note 32, at 14.

37 Surya Gablin Gunasekara, "Other Transaction" Authority: NASA's Dynamic Acquisition Instrument for the Commercialization of Manned Spaceflight or Cold War Relic?, 40 Pub. Con. L. J. 896 (2011) (referring to the FAR as inefficient and cumbersome).

38 42 U.S.C. §2473(c)(5) (2012).

39 See H.R. No. 1770, at 19 (1958), *reprinted in* 1958 USCCAN 3160, 3178; See also H.R. No. 1758, at 50 (1958).

40 David S. Schuman, *Space Act Agreements: A Practitioner's Guide*, 34 J. Space L 277, 278-79 (2008).

41 One major discriminator between the two instruments is the lack of a bid protest review system to challenge NASA's actions concerning selection of a Space Act Agreement partner except in very limited cases, discussed *infra*. See Schuman at 280.



There are different types of Space Act Agreement structures, but by far the most novel type are known as “funded” SAAs.<sup>42</sup> In such cases, NASA actually transfers funds to an entity.<sup>43</sup> Known as a “catch-all” authority of last resort, funded Space Act Agreements are only utilized when NASA’s objectives cannot be achieved by means of any other agreement type, including procurement contracts, and when the Agency is not otherwise required to use a procurement instrument (*i.e.*, the direct acquisition of a good or service).<sup>44</sup> Nevertheless, Space Act Agreements cannot be used as substitutes for procurements conducted under the FAR and cannot be used simply for the purpose of circumventing the associated procurement statutory and regulatory framework.<sup>45</sup>

Free from the burdens imposed by highly-regulated government contracting, these SAAs provide distinct benefits that have afforded NASA a “commercial-like freedom” to engage in a new business model with commercial entities, as well as the ability to tailor these agreements to best fit both the Agency’s and its respective partners’ needs.<sup>46</sup> Doing so has allowed NASA the opportunity to attract and work with entities outside the traditional government contractor sphere to, among other things, engage in development of space transportation capabilities.<sup>47</sup> Indeed, it has been noted that these agreements represent a “powerful tool to facilitate the commercialization of space.”<sup>48</sup>

As discussed below, NASA has been able to harness the complementary transactional authorities provided by the Space Act and by the more commercialized format of procurement as prescribed by regulation to achieve its complementary goals of stimulating a commercial spaceflight market while innovatively procuring spaceflight services.

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42 See COTS, *supra* note 32, at 20 (discussing NASA’s provision of payments to a commercial partner).

43 See NASA Office of the Inspector General, NASA’s Use of Space Act Agreements, IG-14-020, (2014) at 2 *available at* <https://oig.nasa.gov/audits/reports/FY14/IG-14-020.pdf>.

44 See NASA Office of the General Counsel, Space Act Agreements Guide (effective Aug. 15, 2008) *available at* [www.nasa.gov/pdf/289016main\\_Space%20Act%20Agreements%20Guide%202008.pdf](http://www.nasa.gov/pdf/289016main_Space%20Act%20Agreements%20Guide%202008.pdf); See *also* Schuman at 280-281.

45 Schuman, *supra* note 40, at 280-281.

46 See Gunasekara, *supra* note 37 at 897; See *also* COTS, *supra* note 32, at 24.

47 See Shimizu, *supra* note 24, at 43-44; See *also* Gunasekara, *supra* note 37, at 899-900 (discussing the benefits of NASA’s Space Act Agreement authority to permit the agency to work with commercial firms that refuse to, or are unable to, enter into agreements with the Agency using traditional procurement instruments).

48 Shimizu, *supra* note 24, at 44.

#### IV. **NASA's Use of Transactional Authority to Stage a New Business Model for Cargo and Crew Transportation Services**

##### IV.1. **Commercial Orbital Transportation Services Agreements**

In 2005, NASA Administrator Mike Griffin delivered a speech in which he once again highlighted LEO (and specifically, ISS) as the focal point for future space commerce.<sup>49</sup> Administrator Griffin unveiled NASA's approach to furthering that vision – establishing a commercial cargo and commercial crew program office (later referred to as C3PO), tasked with stimulating commercial enterprise to meet the growing need for transportation services to ISS.<sup>50</sup> The way forward, in Griffin's mind, was by setting performance goals for industry as it developed these complex space systems, instead of the typical process that NASA had previously utilized when contracting with large aerospace contractors.<sup>51</sup> Drawing from a venture capital philosophy, NASA determined that facilitation of commercial spaceflight capabilities for both humans and cargo would necessarily involve the injection of NASA funding to bolster the resources to be committed by the industry partner. However, as discussed below, NASA's involvement would not conclude with a direct subsidization by means of capital injection. Rather, NASA would need to work with industry partners to create a development program that would provide initial "seeding" by NASA funding, but would also require partners to substantiate their own source of funding, as well as demonstrate the continuing maturation of their capabilities designs. This method of partnership was established with the goal of developing a reasonable sharing of financial, schedule, and technical risks associated with the program.

The first step in this direction was NASA's establishment of the Commercial Orbital Transportation Services (COTS) program.<sup>52</sup> This program, conducted over two rounds of awards, tasked industry to propose various capabilities to deliver cargo and crew into LEO. With the programmatic goal in place, NASA's legal team was tasked with the initial challenge of assembling the legal framework to execute COTS. Because the program's intended endgame was the stimulation of development in the private spaceflight industry in a manner that would be *consistent with* NASA's mission, but wherein, NASA would not be receiving a resulting direct and immediate benefit from industry, NASA legal advisors determined that funded Space Act Agreements (and not procurement contracts) would be the appropriate legal instrument to use in this context.<sup>53</sup>

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49 Michael Griffin, Administrator, NASA, Speech to the American Astronautical Society (November 2005).

50 See *id.*

51 See *id.* (referring to this approach as not government "business as usual").

52 NASA, 2006 Human Spaceflight Transition Plan, at 23.

53 See NASA Office of the Inspector General, *supra* note 43 at 2 (discussing requirement that no other appropriate instrument is available).

NASA's legal community also needed to structure the terms and conditions of COTS SAAs in a manner that was conducive to a more commercial-type partnership. As such, the SAAs were much more streamlined than a FAR-regulated procurement contract, and the parties were freed from the imposition of contract clauses such as intellectual property rights in data and inventions that would be typically required in a contract environment.<sup>54</sup> Specifically, the SAAs were structured to grant NASA only minimally necessary intellectual property rights.<sup>55</sup> Likewise, the FAR clauses concerning termination of a contract were not applied in NASA's COTS SAAs. Rather, both parties were permitted to end the relationship if progress was not made or if the partner was unable to demonstrate a sharing of cost risk by failing to secure needed private capital.<sup>56</sup>

NASA realized that without the rigid, regulated competition and evaluation methodology prescribed by the Federal Acquisition Regulation, the Agency would need to devise some way of vetting potential industry partners by use of a common, consistent, and comprehensive system of evaluation. Borrowing guiding principles of NASA's SEB process for selecting a procurement contract awardee, NASA established a Participant Evaluation Panel (PEP) to evaluate submissions.<sup>57</sup> NASA charged itself with evaluating not only a potential partner's technical capability, but also its financial capability to supplement NASA's funding in order to continue development.<sup>58</sup> The PEP evaluated submissions to determine the level of confidence in executing the submitters' plans, not only to deliver a capability, but also to capture a share of the commercial marketplace.<sup>59</sup> Nevertheless, companies were free to propose creative spaceflight solutions, untethered from NASA's restrictive requirements, along with technical milestones which would be tied to NASA's incremental funding. NASA did offer ISS as the environment to demonstrate capabilities,

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54 See R. Locke Bell, Intellectual Property in an Emerging Commercial Spaceflight Market: Taking Advantage of Other Transaction Authority to Keep Pace with Changing Commercial Practices 43 Pub. Cont. L.J. 715, 724-725 (noting the value of being able to freely negotiate data rights-related terms of SAAs as a "terrific opportunity" to develop commercial-friendly terms that "optimize the parties' mutual gain").

55 For a comprehensive discussion of the intellectual property terms and conditions set forth in NASA's commercial space SAAs, See Bell, *supra* note 54 at 725-731.

56 See *e.g.*, NASA, Space Act Agreement Between NASA and Kistler Aerospace Corporation and Rocketplane Limited, Inc. For Commercial Orbital Transportation Services Demonstration (COTS) Art. 17 (Termination), *available at* [https://www.nasa.gov/centers/johnson/pdf/189226main\\_kistler\\_nnj06ta27s.pdf](https://www.nasa.gov/centers/johnson/pdf/189226main_kistler_nnj06ta27s.pdf). Incidentally, NASA eventually exercised its termination rights in its SAA with Rocketplane Kistler after the firm did not meet its financial and subsequent technical milestones.

57 COTS, *supra* note 32 at 27.

58 *Id.* at 27-28.

59 *Id.* at 28.

but did not include a requirement that a commercial entity do so as a condition of participating in COTS.<sup>60</sup> After a comprehensive evaluation, NASA chose to enter into a first round of COTS SAAs with Space Exploration Technologies Corp. (SpaceX) and Rocketplane Kistler Ltd. Inc. (RpK), awarding \$ 485M in NASA funds to these two firms (\$ 278M and 207M, respectively).<sup>61</sup>

After NASA's first round of selection, its SAA approach met with an initial legal challenge before the United States Government Accountability Office (GAO) – the more common of two fora for review of federal procurements. A firm that had not been selected as a SAA partner, Exploration Partners, LLC, protested NASA's decision and demanded that the GAO review NASA's rationale.<sup>62</sup> NASA prevailed in this administrative proceeding, successfully arguing that the Agency's selection process was not governed under federal procurement law, and therefore, not subject to review.<sup>63</sup> This marked the first time that an outside authority reviewed the legality of NASA's Space Act mechanism and determined that its actions under COTS were not tantamount to the award of a contract for services.<sup>64</sup> This legal decision in a sense legitimized NASA's bifurcated transactional strategy for commercial space transportation services.

NASA announced a second round of COTS in October 2007 and eventually awarded another SAA to Orbital Sciences Corporation (Orbital) in 2008.<sup>65</sup> Nevertheless, challenges to NASA's transactional authority under the COTS program did not end with GAO's first decision. After NASA's termination of RpK's first round SAA,<sup>66</sup> the company protested NASA's second COTS announcement, alleging that NASA had erred in choosing to utilize its Space Act authority rather than procure services directly from industry.<sup>67</sup> RpK argued that the eventual purpose of the COTS SAAs was for NASA to utilize

60 Rather, interested firms were required to include Operational Readiness Plans that would explain how they would plan to offer services to the ISS.

61 NASA, Announcement No. COTS-01-05, Commercial Orbital Transportation Services Demonstrations 2 (Jan. 18, 2006 (as amended Feb. 17, 2006)). NASA later added milestones to SpaceX's COTS SAA, as well as added associate funding, bringing the total funding amount to \$396M. See *NASA's Commercial Cargo Providers; Are They Ready to Supply the Space Station in the Post-Shuttle Era?: Hearing before the Subcommittee on Space and Aeronautics, United States House of Representatives*, 112th Cong., 1st sess., May 26, 2011 (statement of William H. Gerstenmaier, Assoc. Adm'r for Space Operations) (discussing award amounts) (hereinafter, "NASA's Commercial Cargo Providers").

62 See Protest of Exploration Partners, LLC, B-298804, Dec. 19, 2006, 2006 CPD §201.

63 See *id.*

64 See *id.*

65 See NASA's Commercial Cargo Providers, *supra* note 61.

66 See *id.*

67 See Protest of Rocketplane Kistler, B-310741, Jan. 28, 2008, 2008 CPD §22.

such services.<sup>68</sup> On the other hand, NASA's position emphasized the principal purpose of COTS, which was to encourage the growth of a space transportation services market in which government and private customers would participate.<sup>69</sup> While GAO understood NASA's eventual benefit in the way of future capabilities for use, NASA again prevailed and the COTS model was once again determined to be a legally sound application of its authority.<sup>70</sup>

#### **IV.2. Commercial Resupply – Completing the Crossover from Seeded Development Venture to Acquisition of Service**

NASA's C3PO intended to utilize COTS as a first phase development and demonstration effort, before undertaking a second phase – a procurement for resupply services for ISS termed Commercial Resupply Services (CRS).<sup>71</sup> Given the flexibility provided by Congress to consider spaceflight transportation services as “commercial items,” as well as NASA's initial progress in stimulating a commercial market under COTS, NASA was able to rethink its approach to procurement. What would have traditionally been a cost-reimbursement development contract with an aerospace contractor could now be transformed into a fixed-price agreement for services.<sup>72</sup>

NASA issued its CRS RFP exclusively for cargo transportation services to ISS in April 2008, while COTS was still in its infancy. NASA's decision to do so hinged upon an urgent and compelling need for supplies on ISS.<sup>73</sup> However, procuring a service prior a successful system demonstration is a risky strategy for NASA in the event technical problems do arise and schedule slips on account of these issues.<sup>74</sup> The FAR's streamlined procedures for evaluation and award of contracts for commercial supplies and services afforded NASA with the flexibility previously unheard of when procuring services of this type. Orbital and SpaceX both submitted proposals concurrent with their COTS work, however, NASA undertook strict measures to firewall the two programs.<sup>75</sup> NASA awarded resupply contracts to both firms in December

68 See *id.*

69 See *id.*

70 See *id.*

71 See Gerstenmaier, *supra* note 3, at 4.

72 Indeed, the CRS contracts themselves express disclaim NASA's title to either the launch vehicle or the orbital vehicle providing the services. See, e.g., NASA Contract with Space Exploration Technologies, LLC, Contract NNJ09GA04B, Dec. 22, 2008, at 23, *available at*

[https://www.nasa.gov/centers/johnson/pdf/418857main\\_sec\\_nnj09ga04b.pdf](https://www.nasa.gov/centers/johnson/pdf/418857main_sec_nnj09ga04b.pdf) (hereinafter, “SpaceX CRS Contract”).

73 See COTS, *supra* note 32, at 81 (discussing the risk of a potential ISS servicing gap).

74 See NASA Office of the Inspector General, Commercial Cargo: NASA's Management of Commercial Orbital Transportation Services and ISS Commercial Resupply Contracts, Report No. IG-13-016 (2013) at 3 *available at* <https://oig.nasa.gov/audits/reports/FY13/IG-13-016.pdf>.

75 See COTS, *supra* note 32, at 82.

2008.<sup>76</sup> Nevertheless, COTS and CRS were programmatically intertwined as the CRS contractors were able to (but were not required to) leverage the capabilities cultivated during COTS and converting their capabilities into successful service providing mechanisms to meet NASA's requirements. As such, CRS's success was dependent upon COTS progress.<sup>77</sup> This allowed NASA the ability to creatively structure its CRS contracts in a manner that fixed payment to the contractors upon demonstrated completion of milestones – the accomplishment criteria for which would be proposed by the contractors themselves.<sup>78</sup> This feature, borrowed from COTS, entailed a “pay-for-progress” and “pay-for-performance” model of procurement which differed significantly from payment on a continual basis, as is customary in cost-reimbursement contracts. This approach was unprecedented in NASA's history of complex space systems acquisitions. And by implementing it, NASA was better prepared to share financial risk with its supply contractors as they progressed from development to delivery.<sup>79</sup>

#### **IV.3. Commercial Crew – Extending the Collaborative Transactional Model from Cargo to People**

With COTS and CRS in place and underway, but far from actual delivery of cargo services to ISS, NASA continued to actualize its ultimate goal to acquire human transportation services to and from ISS and to do so by leveraging commercial participation. On the heels of a comprehensive evaluation of U.S. human spaceflight plans,<sup>80</sup> commercial involvement in human spaceflight programs, NASA decided to implement a transactional model that was

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76 NASA's selection rationale was challenged by a third unsuccessful offeror, PlanetSpace, Inc., but survived scrutiny by the GAO. See Protest of PlanetSpace, Inc., B-401016, B-401016.2, Apr. 22, 2009, 2009 CPD §103.

77 See NASA's Commercial Cargo Providers, *supra* note 61 (noting that COTS partners' developments efforts needed to succeed in order for these firms to provide services to ISS); See also NASA Office of the Inspector General, *supra* note 74 at iii (noting that when a firm's COTS progress slipped, there was an impact on the launch dates for CRS missions).

78 See, e.g., SpaceX CRS Contract, *supra* note 72 at 23-25.

79 CRS and COTS have not been immune from schedule delays and technical setbacks from both providers, which brought with them associated financial risk to NASA, particularly if performance-based milestone payments were made to contractors while the firms were delayed in meeting COTS milestones, which would impact CRS contract performance. See NASA Office of the Inspector General, *supra* note 74 at 19; See also NASA's Commercial Cargo Providers, *supra* note 61 (discussing anticipated startup challenges associated with such a technologically-ambitious endeavor).

80 See Review of U.S. Human Spaceflight Plans Committee (also known as the “Augustine Commission”), Seeking a Human Spaceflight Program Worthy of a Great Nation (2009) 113 (advocating for NASA's continued opportunities to procure systems innovatively, including by use of commercial purchases of systems derived from Space Act Agreements).

substantially similar to the one put into place for COTS/CRS – strategically deploying its transactional authorities to support efforts for the full spectrum of private industry's development of transportation systems capable of eventually providing human spaceflight services. Following on from this initial development effort, and only when those transportation systems were sufficiently matured (in part, through NASA's monetary and technical input), the Agency envisioned the purchase of crew transportation systems to ISS by competitive procurement.<sup>81</sup>

NASA began in late 2009 by utilizing \$ 50M of funding to establish SAAs with industry under the first round of a proposed development partnership, entitled Commercial Crew Development (CCDev). Using another PEP selection process, with review of whether interested firms' proposals would meaningfully advance crew transportation technology, NASA ultimately entered into agreements with five firms – Sierra Nevada Corporation (Sierra Nevada), Boeing, United Launch Alliance (ULA), and Paragon Space Development Corp. (Paragon).<sup>82</sup> NASA's intent was to stimulate the development of any number of systems, concepts and capabilities that could ultimately be implemented to further a commercially available human spaceflight system.<sup>83</sup> When compared to the amount of funding typically required to develop a human-rated capability, the amount of funds at issue in the first round of CCDev agreements were miniscule. Nevertheless, these SAAs provided the initial increment necessary to stimulate development groundwork and signaled NASA's commitment to advancement of these capabilities.

Using new congressional authority in 2010,<sup>84</sup> NASA established the Commercial Crew Program (CCP) and set about funding a second round of CCDev agreements with industry – this time with \$ 270M to fund the further development of fledgling human transportation capabilities. In April 2011, NASA divided these funds among Sierra Nevada, SpaceX, Boeing, and Blue Origin.<sup>85</sup> In August 2012, NASA issued a final round of funded SAAs to three of these four companies – Sierra Nevada, SpaceX, and Boeing. Entitled Commercial Crew Integrated Capability (CCiCap), these SAAs provided an

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81 See Gerstenmaier, *supra* note 3, at 6-7 (discussing the strategy of “building on the progress made” under the predecessor Space Act Agreements and eventually “transitioning into a series of competitively awarded contracts”).

82 See NASA, Selection Statement for Commercial Crew Development (Announcement Number JSC-CCDev-1) 20 (Dec. 8, 2009).

83 See COTS, *supra* note 32, at 88.

84 See NASA 2010 Authorization Act, Pub. L. No. 111-267, 124 Stat. 2820 (Sections 401 and 402) (2010) (directing NASA to continue supporting COTS and formally authorizing a “Commercial Crew Development Program” in fiscal year 2011).

85 See NASA, Selection Statement for Commercial Crew Development Round 2 (Announcement Number NASA-CCDev-2) (Apr. 4, 2011) *available at* [www.nasa.gov/sites/default/files/files/508\\_CCDev2\\_SelectionStatement-Final\\_Signed.pdf](http://www.nasa.gov/sites/default/files/files/508_CCDev2_SelectionStatement-Final_Signed.pdf).

additional \$ 1.1B of funding for advancing a complete crew transportation system.<sup>86</sup>

#### **IV.4. Commercial Crew Transportation Services Acquisition**

Following in the footsteps of its ISS Commercial Resupply Services acquisition, NASA proposed an acquisition strategy that would build upon the benefits provided by its commercially-leveraged development model and that would ultimately result in the award of competitively-bid contracts for crew transportation services. Once again, these contracts would be fixed-price and payment would be tied pre-negotiated payment milestones for high-level performance goals and objectives in an effort to shift some cost and performance risk from NASA to industry. It was presumed that NASA's reduced level of oversight for programmatic activities could result in decreased cost and minimize schedule impact previously experienced in the typical procurement model. Much like the case of CRS, a fixed price model for human spaceflight operations was virtually unheard of for NASA. However, while this approach provided a more streamlined acquisition approach, it also presented unique and difficult challenges for the Agency.

Foremost, due to the above-described legal restrictions on NASA's authority,<sup>87</sup> NASA could not (and did not) dictate specific systems concepts, nor mandate compliance with Agency technical and safety requirements during the development phase of the program. Instead, CCDev/CCiCap participants were free to determine capabilities that they believed would be most attractive to their target markets (which could, but might not necessarily include NASA). While NASA would be the most obvious and viable anchor customer for such capabilities, and partners were assumed to have considered it in their best interests to design and develop capabilities with NASA's requirements in mind, there was no obligation on the SAA partner companies (or any other potential offeror) to do so. This limited oversight model begged the question of whether commercial partners would actually in a position to provide NASA such services when the time came. It also raised questions of how to keep the CCDev program separated from the services acquisition to avoid the appearance of a conflict of interest NASA's part in favor of the CCDev/CCiCap partners. Finally, concerns lingered as to how NASA would be purchasing such services on systems for which cost and risk were not fully determined, especially in a firm-fixed price environment.

NASA attempted to reconcile these issues by proposing a "sweet spot" model of insight and oversight to help ensure that commercial partners could demonstrate the ability to meet NASA's human spaceflight certification requirements

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86 See NASA, Selection Statement for Commercial Crew Integrated Capability (Announcement Number NASA-CCiCap) (July 31, 2012).

87 Logically, NASA cannot dictate such technical requirements as it would in the case of a purchase of goods or services vis-à-vis its Space Act Agreement Authority.



and to safely transport U.S. astronauts to ISS without their being directed “how” to do so from the Agency. NASA also worked with industry in an iterative fashion to develop the requirements for certification of vehicle for delivery of crew transportation services and CCDev/CCiCap partners retained the ultimate freedom to align their requirements and capabilities to NASA’s developing requirements for services acquisitions. To begin the daunting process of aligning commercial industry’s requirements with NASA’s certification requirements, NASA began a two-phased acquisition approach.

The first phase of this undertaking was the Certification Products Contract (CPC), a relatively small-value firm-fixed price contract conducted under full and open competition. These CPC contracts were awarded to Boeing, Sierra Nevada, and SpaceX.<sup>88</sup> The contract required these firms to deliver certification plans for meeting NASA’s crew transportation requirements and permitted NASA to provide the contractors feedback. The CPC procurement was undertaken in order to provide NASA with validation as to exactly how close the SAA partners’ designs were to meeting NASA’s requirements.<sup>89</sup> CPC also provided the contractors with needed insight as to the risks associated with certification prior to the partners’ completion of their integrated CCiCap designs, as well as more oversight on NASA’s part.

As CPC progressed on one track, NASA then moved to its second step acquisition – Commercial Crew Transportation Capability (CCtCap). Also conducted under full and open competition, CCtCap required full crew transportation systems to meet NASA’s human spaceflight requirements for safely transporting astronauts to and from ISS, and provided for the purchase of fixed-price missions to do so once certification is achieved. Offerors’ approaches to meeting certification were evaluated for their realism, quality and feasibility, as well as their overall approaches to plan, produce, integrate, and execute post-certification missions to ISS.<sup>90</sup> Offerors were also evaluated for their approaches to permit NASA insight into the certification process, as well as their programmatic management approaches and their plan lifecycle cost management when juxtaposed with a schedule for performance milestone payments.<sup>91</sup> NASA also evaluated each offeror’s past performance and their proposed fixed prices for certification and ISS missions.<sup>92</sup>

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88 See NASA, Source Selection Statement for the Certification Products Contract (CPC) (Solicitation Number NNJ12ZBT002R) (Dec. 5, 2012) *available at* [https://prod.nais.nasa.gov/eps/eps\\_data/153061-OTHER-002-001.pdf](https://prod.nais.nasa.gov/eps/eps_data/153061-OTHER-002-001.pdf).

89 See *id.*

90 See NASA, Source Selection Statement for Commercial Crew Transportation Capability Contract (CCtCap) (Solicitation Number NNNK14467515R) (Sept. 15, 2014) *available at* [www.nasa.gov/sites/default/files/files/CCtCap-Source-Selection-Statement-508.pdf](http://www.nasa.gov/sites/default/files/files/CCtCap-Source-Selection-Statement-508.pdf).

91 See *id.*

92 See *id.*

NASA awarded the CCtCap contracts in September 2014 to Boeing and SpaceX, concluding that these two offerors provided the best value to the Government after consideration of all evaluation factors.<sup>93</sup> NASA's cleared its final transactional hurdle when its source selection was upheld after Sierra Nevada, the unsuccessful offeror, filed a bid protest with the GAO.<sup>94</sup> NASA's commercial crew providers continue to make progress under contract to provide NASA critical astronaut transportation services in the coming years.

#### **V. NASA's Commercialized Approach as a Model for Future Endeavors within and outside the Agency**

NASA's forward-thinking application of its transactional powers, implemented by dedicated program management, has demonstrated a legitimate model enabling the ability to meet a commercial space industry on its own terms in order to assure mutual success.<sup>95</sup> NASA has been able to demonstrate a legally supportable progression of assisted development carried through to an eventual purchase of services from private sources. In doing so, NASA has been able to take advantage of a more commercialized business model in which NASA relinquishes some technical control, thereby permitting flexibility for private industry to determine the optimum approach for NASA's transportation needs. It is NASA's hope that industry will be able to leverage this untapped market potential to spread the costs of continued development and operations across this customer base so that NASA will not bear the full burden of these costs. But perhaps most interestingly, this validated model also opens the door to a plethora of potential future programmatic uses.<sup>96</sup> Indeed, NASA has already begun to consider how to capitalize on this model to not only grow the emerging LEO market, but also to conceptualize markets which do not even exist yet, while at the same time, furthering its own mission goals. In June 2014, NASA issued a Request for Information (RFI) designed to facilitate a discussion concerning the way forward for evolving ISS into a commercial LEO market platform.<sup>97</sup> Such a marketplace would obviously be dependent upon the crew and cargo transportation services

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93 See *id.*

94 See Protest of Sierra Nevada Corporation, B-410485, *et al.*, Jan. 5, 2015, 2015 CPD §23.

95 NASA Aerospace Safety Advisory Panel, Annual Report for 2013 at 19 (Jan. 15, 2014) (discussing the success of NASA's use of its Space Act authority, coupled with the input of well-qualified technical assistance from NASA, as key determiners of success of COTS and CRS) *available at* [http://oiir.hq.nasa.gov/asap/documents/2013\\_ASAP\\_Annual\\_Report.pdf](http://oiir.hq.nasa.gov/asap/documents/2013_ASAP_Annual_Report.pdf).

96 See *id.* (recommending consideration of adopting similar approaches where possible).

97 NASA, Evolving ISS into a LEO Commercial Market – Request for Information NNHXXZCJ001L, (Apr. 28, 2014) *available at* [https://prod.nais.nasa.gov/eps/eps\\_data/160471-OTHER-001-001.pdf](https://prod.nais.nasa.gov/eps/eps_data/160471-OTHER-001-001.pdf).

previously developed, but NASA is also asking bigger questions, including: whether there are certain types of ISS payload integration that would be best suited for fulfillment by a commercially-provided service and whether ISS would be useful as a demonstration for COTS-based or other assisted-developed systems.<sup>98</sup> NASA also stated that it wishes to leverage other commercial capabilities in LEO that could later be applicable to deep space exploration.<sup>99</sup>

While continued commercialization of ISS-related activities seems to be the logical progression in this endeavor, there is little reason why tested development-cum-acquisition model should be relegated to LEO and may eventually be expandable for use in other contexts. Specifically, NASA's previous models of commercial cargo and crew transportation were built upon a presumption that NASA's preceding exploratory and science-focused presence with ISS had created the basis for a marketplace for the provision of more "routine" recurring services. Put simply, what was once pioneered would eventually become supplanted by more routinized commercial efforts. But the dominant paradigm may well continue to shift in coming years as commerce and exploration converge and cross-use of new capabilities fosters new market expansion. Indeed, NASA has already begun to consider these models for continued applicability.

For instance, NASA established its Lunar Cargo Transportation and Landing by Soft Touchdown (Lunar CATALYST) program last year.<sup>100</sup> This program is intended to explore the possibility of spurring partnerships with commercial providers to develop capabilities for delivering payloads to the lunar surface for a plethora of potential uses, while potentially enabling new science and exploration missions of interest to NASA.<sup>101</sup> NASA's intent is to seek partners who will demonstrate a likelihood of completing development of a commercially-viable lunar surface cargo transportation capability with achievable approaches lunar lander development and realistic financial strategies to support eventual commercial application.<sup>102</sup> These early partnerships will take the form of unfunded SAAs with industry.<sup>103</sup> NASA also recently

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98 See *id.*

99 See *id.*

100 NASA, Lunar Cargo Transportation And Landing by Soft Touchdown (Lunar CATALYST), Pre-Proposal Conference (Jan. 27, 2014) *available at* [www.nasa.gov/sites/default/files/files/Lunar-CATALYST-Pre-Proposal-Conference\\_27Jan2014.pdf](http://www.nasa.gov/sites/default/files/files/Lunar-CATALYST-Pre-Proposal-Conference_27Jan2014.pdf).

101 See *id.*

102 See *id.*

103 See *id.* NASA made these awards in April 2014 to: Astrobiotic Technology, Inc., Masten Space Systems, Inc., and Moon Express, Inc. See Press Release, NASA Selects Partners for U.S. Commercial Lander Capabilities (Apr. 30, 2014) *available at* [www.nasa.gov/press/2014/april/nasa-selects-partners-for-us-commercial-lander-capabilities/#.VgRLaRFViko](http://www.nasa.gov/press/2014/april/nasa-selects-partners-for-us-commercial-lander-capabilities/#.VgRLaRFViko).

funded an independent study analyzing the potentiality of leveraging commercial space technologies in establishing a lunar human presence.<sup>104</sup> Whether or how any of these capabilities fit with NASA's continuously evolving deep space exploration mission profile remains to be seen. But regardless, this transactional model is available for use in any number of customizable ways. NASA's innovative use of its transactional authority has turned the "old space" model of direct acquisition of contractor-built systems on its head and in doing so, has cemented NASA's place as an influencer in "new space." Indeed, NASA's commercialization efforts have helped to facilitate the beginning of a culture shift, both inward at the Agency and outward. NASA has been able to demonstrate the initial feasibility of its "market participant" role alongside its traditional nationalized approach to space activities. Doing so has given the Agency the freedom to leverage its public funding to foster new ways to achieve programmatic goals in a leaner, more cost-effective commercial environment.

Finally, this adaptable model may prove useful to other national space agencies, many of which operate by a direct acquisition similar to NASA's.<sup>105</sup> In particular, these agencies could consider this approach as a tool to align themselves and their missions with a growing commercial space industry.<sup>106</sup> Nevertheless, these programs bring with them questions concerning which direction the commercial space market will eventually take. These include: space tourism, research opportunities, and resource exploitation. They also raise the significant question of how NASA's role as a national space agency changes in response to and because of this commercialization.

Whatever the future holds, NASA's legal advisors will be ready to employ the same "cautious innovation"<sup>107</sup> that permitted the Agency to structure and execute its first major commercial space transportation services endeavor in order to meet the Agency's needs within the confines of its legal limits.

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104 See Nex Gen Space, Economic Assessment and Systems Analysis of an Evolvable Lunar Architecture that Leverages Commercial Space Capabilities and Public-Private Partnerships (July 13, 2015) *available at* [http://science.ksc.nasa.gov/shuttle/nexgen/Nexgen\\_Downloads/NexGen\\_ELA\\_Report\\_FINAL.pdf](http://science.ksc.nasa.gov/shuttle/nexgen/Nexgen_Downloads/NexGen_ELA_Report_FINAL.pdf).

105 See *generally* Shimizu, *supra* note 24 (advocating for modernization of JAXA's procurement system in an effort to achieve more flexibility).

106 See *generally* Shimizu (advocating for a more flexible procurement regime for JAXA); See also Peter B de Selding, *How ESA's Next Director-General Got the Job*, SpaceNews, December 23, 2014 (quoting ESA's Director-General Johann-Dietrich Woerner as discussing a paradigm shift in the role of industry in space program development and recommending looking to the United States as the lines of responsibility between government and private industry continue to shift).

107 See COTS, *supra* note 32, at 19 (quoting NASA's attorneys).