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The Future of Commercial Space Technology and Florida

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Home to the leading space operations site of Cape Canaveral, Florida has always been a major player in U.S. space endeavors. SpacePort Florida is already an attractive base for commercial space development and launches. The burgeoning private space industry's commercial development of space means Florida must remain competitive as a launch and operations site. Florida's pro-business environment with no state personal income tax is a good start, but to understand how else Florida can position itself competitively, it's important to see where commercial development in space is headed. A recent Reason Foundation study argues for

rethinking NASA, government and private industry roles in space development to trigger the most advancement, and financial sustainability from where current technology stands.[1]

NASA has contracted with the private sector for innovation and cost savings, but it continues to use the same antiquated and constraining structure that was first developed for exploring space. This carries an opportunity cost that slows the private sector's plans to harness space's many viable materials and properties, compared to the pace it could attain with a more market-friendly approach. Such activities could help solve Earth's most pressing problems and foster a commercial space industry that sustains itself financially.

Many space-based activities have commercial potential. For example:

- tapping space-based clean energy sources
- mining asteroids for useful raw materials
- developing safe venues for scientific experiments
- upcycling/sequestering hazardous but valuable debris currently in space
- tapping sources of water already in space, to decouple into oxygen and hydrogen for space fuels and oxidizers, and to provide radiation shielding mass
- using the low-gravity, low-temperature and other properties of space for many activities, including manufacturing and research

These endeavors—as well as our current use of space for communication, navigation, defense, etc.—argue for a change in our approach to space from the current exploration paradigm to one of commercialization. Transportation infrastructure will create the environment for private players to develop space-based industries that use commerce to greatly increase quality of life and decrease cost of living.

The basic infrastructure needed should be attainable in 10 to 20 years within the same budget currently appropriated to NASA, with the following features:

- Fuel depots (essentially gas stations) in an appropriate orbit
- Fuel (from water) and water itself
- A shuttle for travel to the lunar surface
- Lunar facilities, for resupply and water and aluminum mining for construction in space
- Orbital facility complex

While this list sounds ambitious, it is technologically feasible currently. It would allow the private sector to develop pragmatic use for space's assets much faster than government provision by creating a sustainable market-based economy in space. The current structure ties space development to conflicting political requirements and fails to fund projects adequately, making for suboptimal decisions by managers, administrators, and politicians. In contrast, changing to a commerce paradigm, in which government funds infrastructure, lays the foundation

for a sustainably-funded space industry.

In a commerce-based approach, much like we have with the seas and airspace, the private sector develops the space industry and NASA and other government parties buy transport and other key services, such as on-orbit facilities, as customers of the private providers. NASA has already begun buying some space transportation in this manner, just as we currently do with other transportation systems. Extending this good start and making it more consistent is the only way, within the current NASA budget, that leads to comprehensive advancement in space.

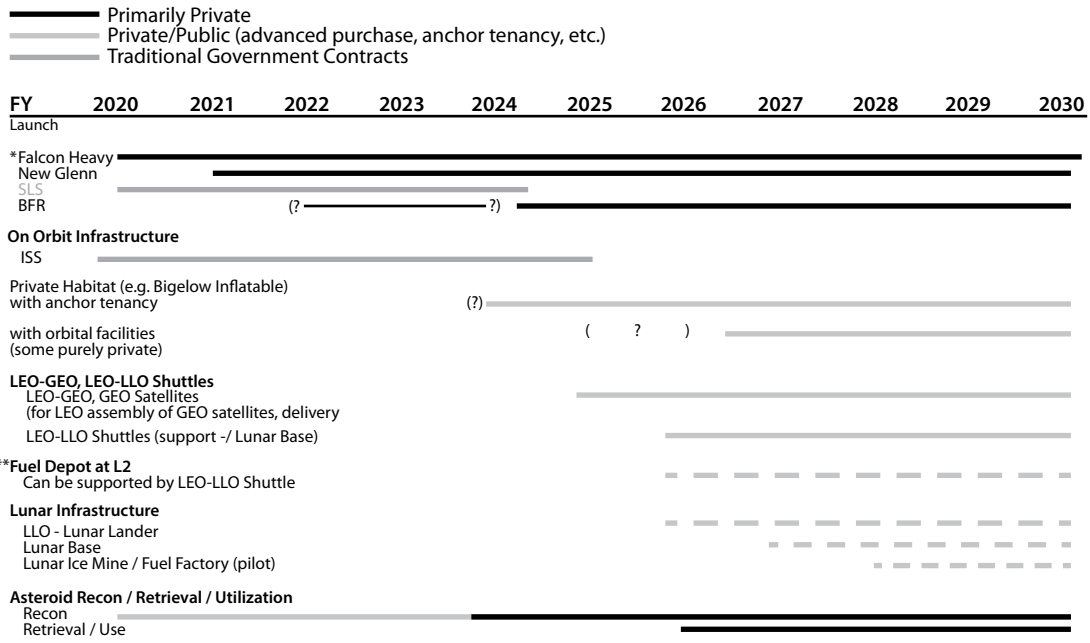
Given a functioning transportation infrastructure, as the private sector develops space industry, government's role changes to fostering that industry. This means a legal framework in which to operate that defines and defends property rights, and research that leads to more diverse space activities. That allows commerce and private endeavor to flourish.

Commercialization Creates A Self-Sustaining Space Industry

Launch companies have created a profitable service focusing on occasional launches of very high-value payloads at very high prices. For example, the geosynchronous orbital position for telecommunications is so valuable that even our current highly inefficient way of accessing it is profitable.

SpaceX's Falcon 9 launch success at one-third the price of a traditional NASA-contracted launch demonstrates private-

FIGURE ES1: TIMELINE FOR TRANSITION TO PRIVATE SPACE PARADIGM



*Falcon Heavy has been in service since 2018
**Technologies for a fuel depot at L2 are proven feasible but development has not begun.

sector capability to fulfill many current NASA functions at a fraction of the cost. Such achievement frees up NASA to concentrate on its core research and exploration missions in space and allows the private sector to invest in self-sustaining space-based industry. Developing the industry depends on a certain amount of infrastructure, which can pay for itself by freeing up funds currently used for NASA's SLS (Space Launch System)/Orion program.

This redistribution of current NASA funding is the key to paradigm change, although there are political problems with terminating the current SLS/Orion program in closely contested states, like Florida, in the 2020 presidential elections. A compromise solution might be to push for increased spending on commercial service purchase, while SLS proceeds to flight status, since the SLS will run out of surplus Shuttle engines by the early 2020s.

Changing to a commercial approach also allows for efficiencies such as mass production of equipment and standardized designs that can carry cargo or humans with few modifications—which is much cheaper and more effective than what we do now. No matter how much money Congress sinks into status-quo space activities now, utility will continue to decline, making funding increasingly ineffective, and keeping the U.S. space program confined. The first step in progress is systemic change, beginning with policy change. Every single change

that makes space operations more like airline operations bears fruit in lower costs, and those changes in turn trigger further reduction in costs.

Triggering Large-Scale Advancement In Space Without Additional Federal Funding

Private sector launch allows the market to exploit every available efficiency to develop the cheapest, most effective means of space travel. When NASA becomes a paying customer of such transportation, it fosters the development of simpler and vastly cheaper launch and vessels, which are now the most expensive, difficult and complicated part of space activity. With cheaper launch comes more launch—for the same or less cost.

With NASA as an anchor tenant on a privately contracted space station, funding is available for infrastructure such as orbital facilities, which expands current space activities and makes them better and cheaper to accomplish. Much like what the move to railroads did for U.S. exploration and settlement of the American West, transportation infrastructure levers progress in all sectors, usable for commercial, scientific and military pursuits—without increasing NASA's space activity budget. By redirecting funds, space infrastructure would likely be available by the mid-late 2020s.

The potential exponential cost reduction and technological advancement of such a paradigm shift cannot be precisely quantified. This is especially true in a frontier-like space, where we have only begun to identify caches of resources and uses of physical and material properties of space. The graph gives rough timeline estimates based on our current technological capability, knowledge of space resources and current costs, with firm estimates in the near future—through about 2025, when infrastructure would be complete enough to support a fully commercial space industry. From that point, estimates are less firm, as depicted by the graph's dotted lines, as we cannot know which technologies will dominate and which additional resources and efficiencies will proliferate. New ideas will be tested, and many will fail. Some companies will fold, and others rise with new perspectives. Such a pattern and outcome are consistent with past technology leaps and acquisition

of frontiers. But we know from history that transportation infrastructure catalyzes economic advancement, and that industries are created and sustained through private investment and commerce.

Private actors and market forces have already slashed the costs of accessing space, reducing costs for not only NASA, but also civilian (mostly satellite) and military space transport as well. These cost reductions, especially for classified military applications, cannot be quantified within the current available budget breakdowns, but are likely to follow similar cost reductions to NASA's. As with other transportation industries, increasing efficiencies continue to drive down costs, but order of magnitude efficiencies come with infrastructure that can sustain an industry, as we have seen with shipping and rail industries and even with Antarctic exploration. The way forward for space shifts to an approach based on our current reality of new private launch capability at a fraction of the cost of government procurement.

To remain competitive in a more privatized space economy, legacy space states like Florida should consider what private industry, at current and anticipated technologies, might want. These include specific changes like converting current single-use rocket facilities to those geared toward frequent reusable rocket launches, as well as broad changes like tort reforms necessary for companies to be willing to take controlled risks without fear of unreasonable liability, retaining and growing a labor pool highly skilled in new technologies, limiting business regulations that might stifle innovation, and maintaining efficient transportation/shipping capability for materials and workers.

Dr. Adrian Moore is the Vice President of Reason Foundation.

References

1 Jeff Greason and James C. Bennet, *The Economics of Space: An Industry Ready to Launch*, Reason Foundation, June 2019, https://reason.org/policy-study/the-economics-of-space/