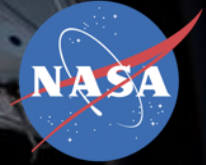


www.nasa.gov/leo-economy

National Aeronautics and
Space Administration



2020 IEEE Aerospace Conference

NASA's Plan for Commercial LEO Development

Doug Comstock

March 13, 2020
Big Sky, Montana

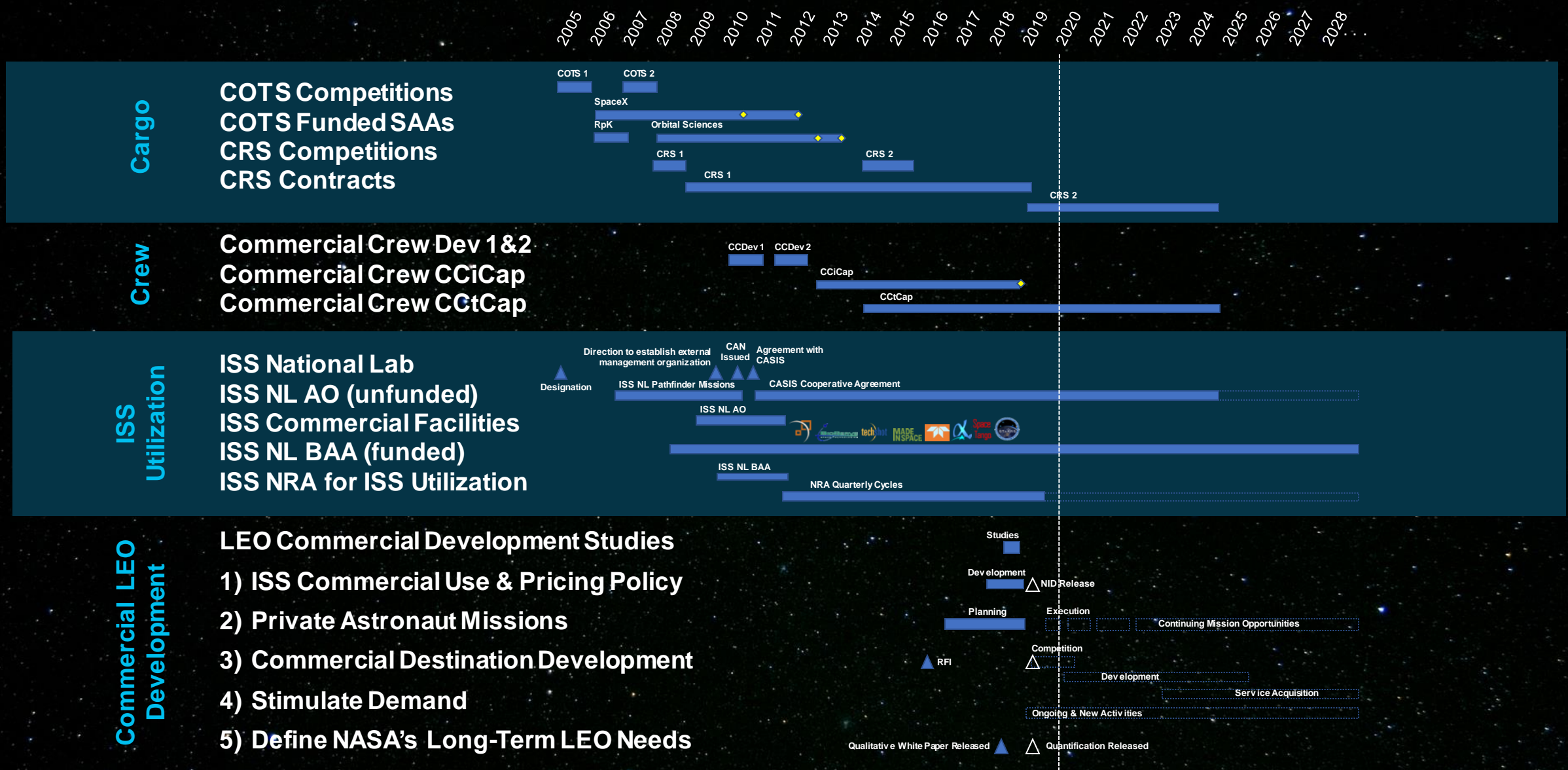


Co-Authors:
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Goals for Human Spaceflight in LEO

- It is the sense of Congress that “an orderly transition for United States human space flight activities in low-Earth orbit from the current regime, that relies heavily on NASA sponsorship, to a regime where ***NASA is one of many customers*** of a low-Earth orbit commercial human space flight enterprise may be necessary.” *P.L. 115-10, NASA Transition Authorization Act of 2017*
- The President’s 2020 Budget: Drives toward a Vibrant, U.S.-Led Economy in Earth Orbit. The Budget provides funding for the International Space Station as well as for new commercial space capabilities that will facilitate a transition to a more robust and cost-effective approach to human space activities near the Earth. By 2025, the Budget envisions ***commercial capabilities on the International Space Station as well as new commercial facilities and platforms*** to continue the American presence in Earth orbit.
- Four goals from Oct 2018 NASA/Commerce/State report to the National Space Council: *Strategy for Human Spaceflight in LEO and Economic Growth in Space*
 1. To achieve a ***continuous U.S. presence in LEO – both with government astronauts and with private citizens*** – in order to support the utilization of space by U.S. citizens, companies, academia, and international partners and to maintain a permanent American foothold on the nearest part of the space frontier.
 2. To create a regulatory environment in LEO that enables American commercial activities to thrive.
 3. To conduct human spaceflight research in LEO that will advance the technology and systems required for long-duration spaceflight systems, including ***systems for interplanetary travel and permanent space habitation***.
 4. To expand and extend commercial opportunity through ***international partnerships and engagement***.

Commercial LEO Development



NASA Plan for Commercial LEO Development

NASA developed a five-point plan building on the work of the last two decades. This plan includes new policies, multiple solicitations, and new information that can be found on the Leo Economy website.

1. NASA established a *commercial use and pricing policy* for the International Space Station (ISS)
2. Enable flight of *private astronauts to the ISS* with the first mission as early as 2020
3. Initiate a process for developing *commercial low-Earth orbit destinations*
4. Seek out opportunities to *stimulate scalable and sustainable demand* for LEO destinations
5. Quantify the agency's *long term needs* in LEO



**NASA Plan for
Commercial LEO Development**
to achieve a robust low-Earth orbit
economy from which NASA can purchase
services as one of many customers

**Summary and
Near-Term Implementation Plans**

June 7, 2019

<https://go.usa.gov/xym78>

Overview of NASA's Commercial LEO Plans

Objectives

Current/Near-Term

- Support NASA's R&D needs and ISS National Laboratory needs
- Leverage ISS capabilities to stimulate demand and catalyze new markets
- Meet International Partner (IP) Intergovernmental Commitments
- Collaborate with IPs on new market development

Mid-Term

- Support NASA's R&D needs and ISS National Laboratory needs
- Incorporate IP commercial needs
- Initiate phased transition from ISS to Commercial with attached (initially) and/or free flyers
- Stimulate global demand and catalyze new markets

Long-Term

- Turn over LEO operations to the private sector
- Purchase NASA's needed R&D Services from commercial provider at lower cost than ISS
- Shift NASA/IP focus and resources towards exploration



Activities

- **Document and share with industry NASA's comprehensive approach for global Commercial LEO Development:**

- 1) **Establish ISS commercial use and pricing policy**
- 2) **Enable private astronaut missions to ISS**
- 3) **Initiate process for commercial development of LEO destinations**
- 4) **Seek out and pursue opportunities to stimulate demand**
- 5) **Quantify NASA's long-term needs for activities in LEO**

- Partner with industry to develop and demonstrate new LEO destinations
- Initiate phased transition to acquire needed services from commercial destinations rather than ISS
- Avoid competition from ISS
- Seek out and pursue opportunities to stimulate demand both domestic and international
- Initiate transition of ISS assets while still satisfying IP agreements

- Complete transition of ISS assets at end of life
- Conduct NASA's needed R&D on commercial destinations in LEO
- Purchase 'LEO National Lab' services from commercial provider?

(1) ISS Commercial Use and Pricing Policy

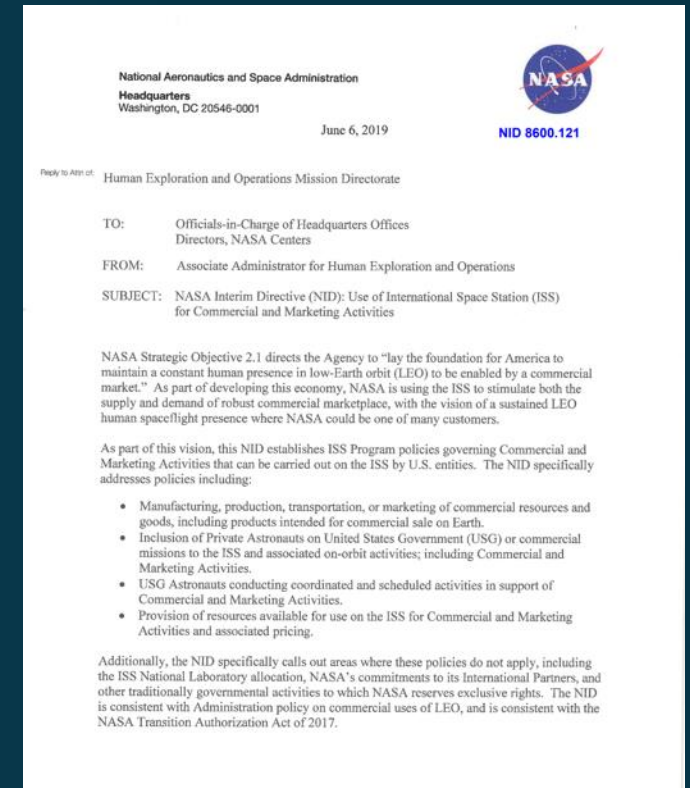
NASA released a NASA Interim Directive (NID) for Use of ISS for Commercial and Promotional Activities

Purpose: to clarify NASA's policy for expanded commercial use of ISS (within the agency's existing authorities) consistent with congressional and administration policy direction

Goal: enable commercial activities in low Earth orbit leading to sustainable LEO economy with NASA as one of many customers

New policy enables:

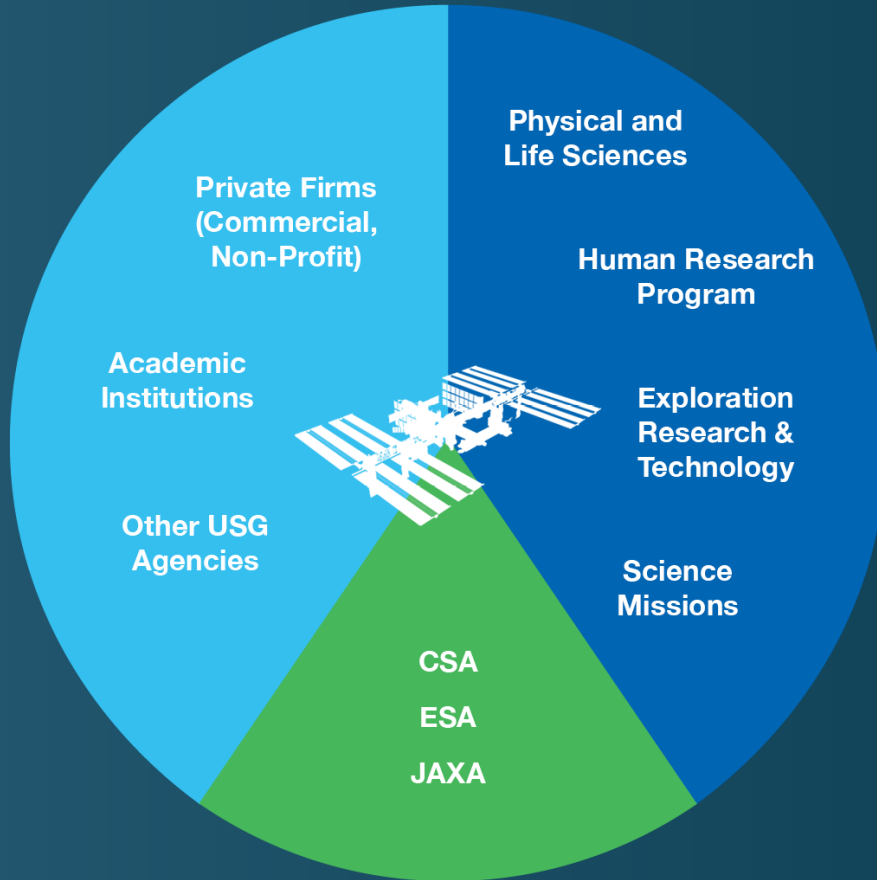
- Manufacturing, production, transportation, or marketing of commercial resources and goods, including products intended for commercial sale on Earth
- Inclusion of private astronauts on USG or commercial missions to the International Space Station and associated on-orbit activities, including commercial and marketing activities
- U.S. government astronauts conducting coordinated and scheduled activities in support of commercial and marketing activities
- Purchase resources available for use on the International Space Station for commercial and marketing activities



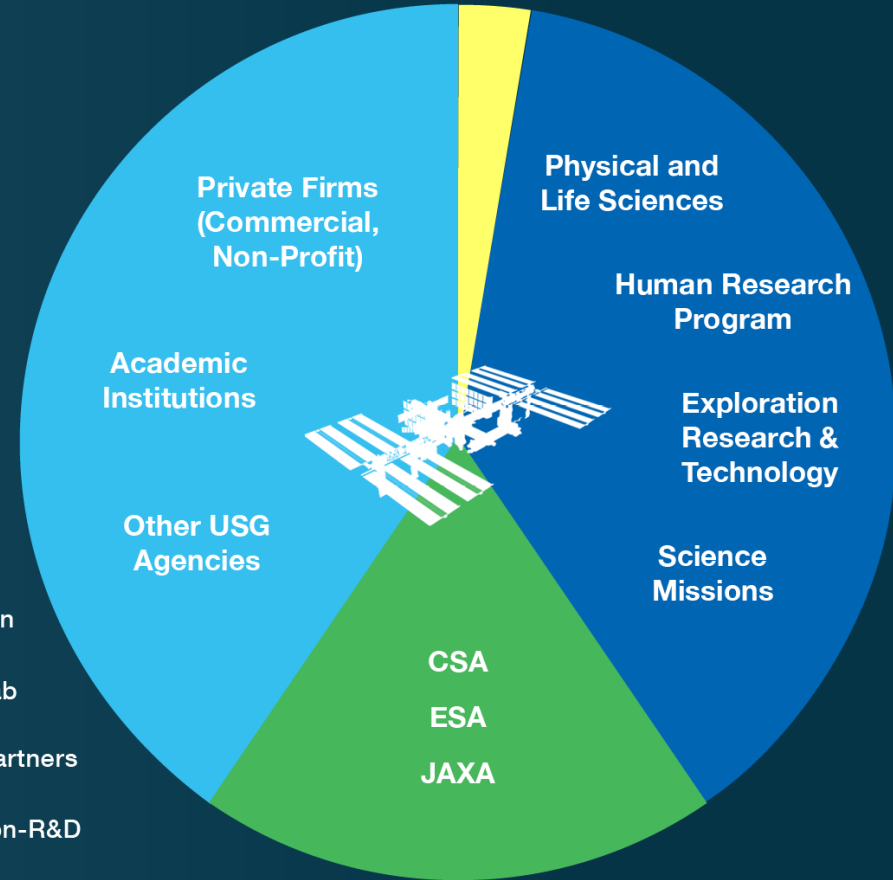
<https://go.usa.gov/xym7f>

Commercial Resource Allocation

Current



Expanded Commercial Use



Benefits of Private Astronaut Missions

- Allow commercial industry to purchase commercial services and gain insight into the costs associated with owning and operating a platform in the future
- Reduce market risk to commercial LEO destination developers by demonstrating the market
- Expands range of commercial activities that can be performed on ISS
- Potential to increase flight rate and strengthen the market for commercial crew launch service providers
- Potential to increase available crew time on orbit for NASA, commercial, and other R&D activities



NASA's LEO Destinations Roadmap

Current/Near-Term

Mid-Term

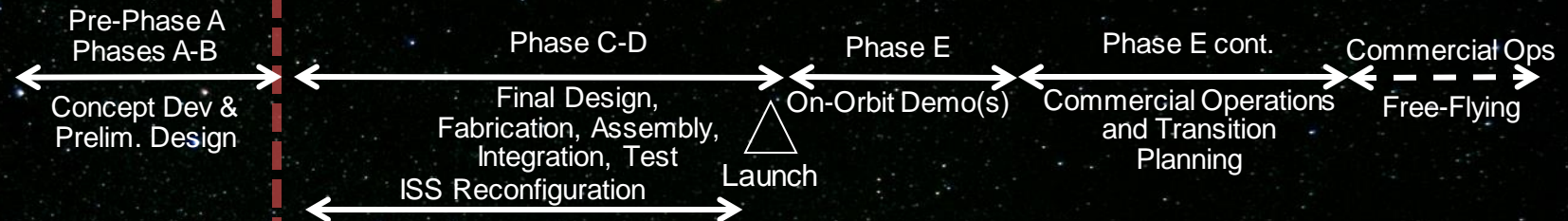
Long-Term



NextStep 2 BAA Appendix I

Selection of Axiom Space announced January 27, 2020

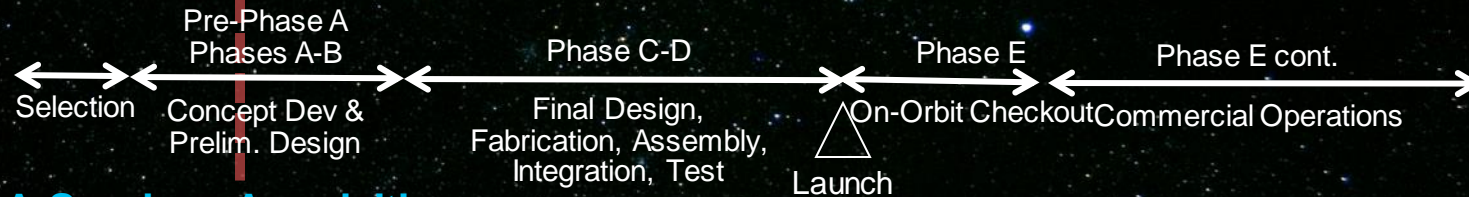
ISS Port Path



NextStep 2 BAA Appendix K

Request for Proposals in work

Free Flyer Path

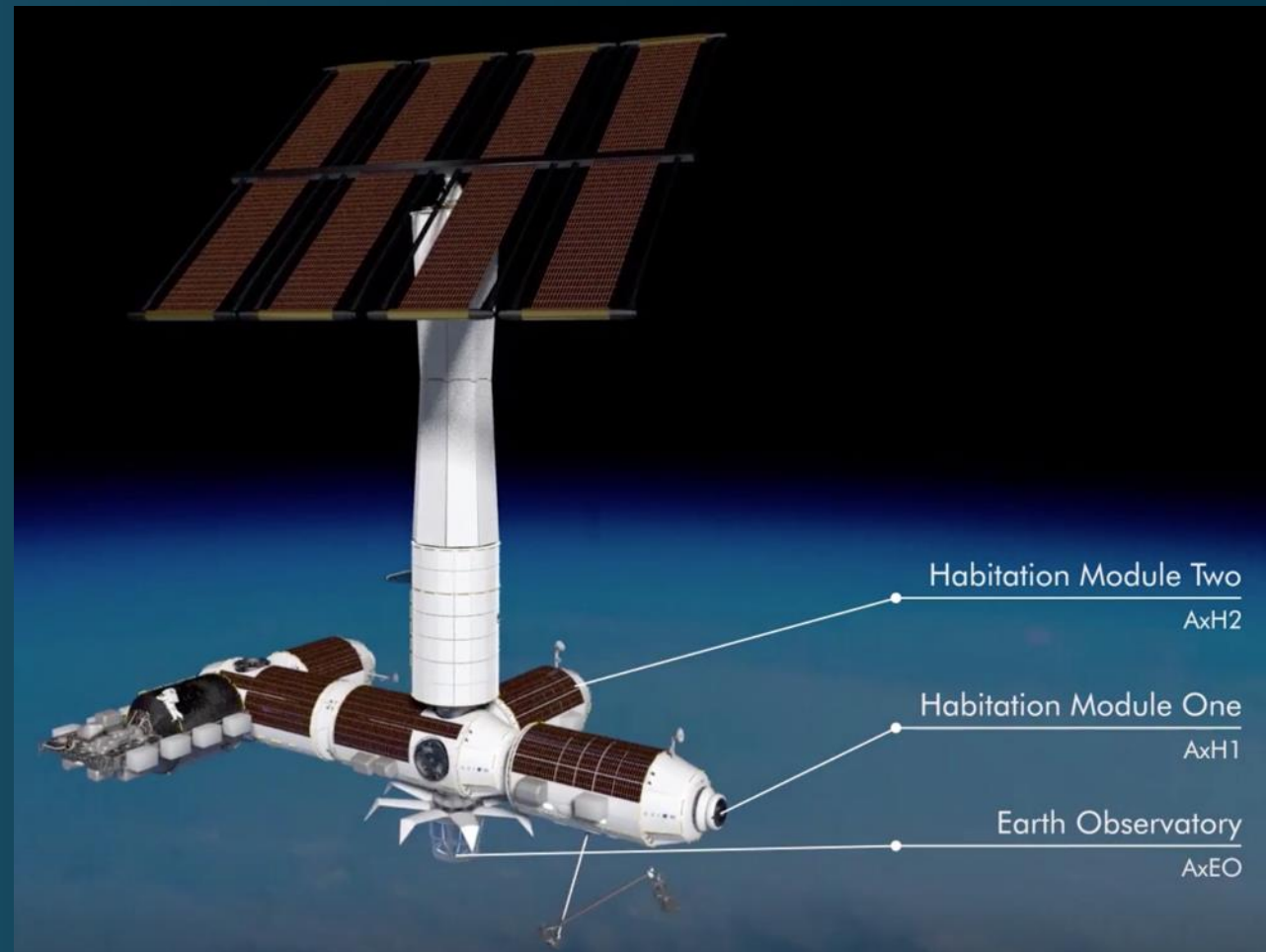
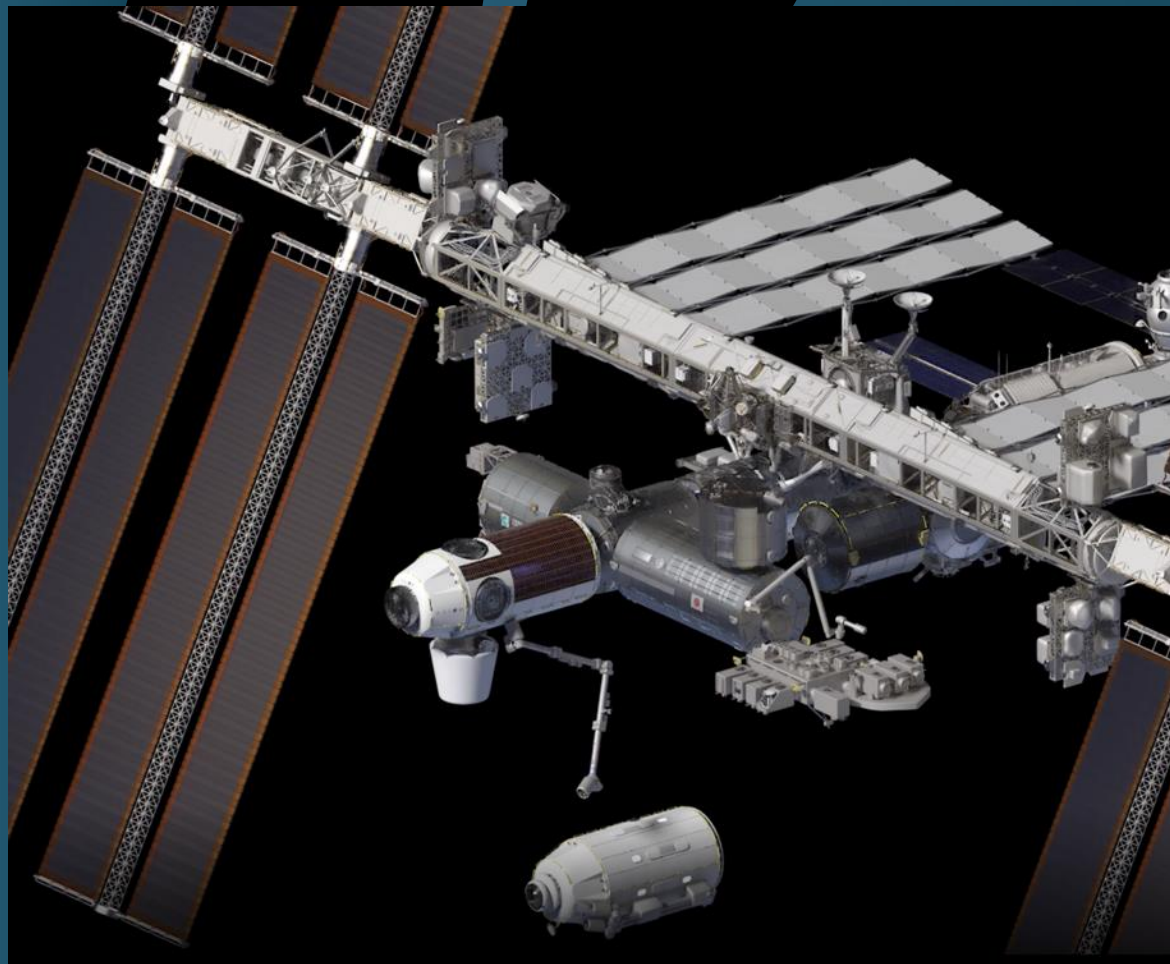


Service Acquisition Competitions

NASA Services Acquisition



Axiom Space Selected for Appendix I (port solicitation)



(4) Stimulate Sustainable Demand

- **Development of a scalable, sustainable demand for LEO platforms is a critical element of NASA's plan for development of the LEO economy**
- **ISS National Lab accommodating many industry R&D projects**
 - Promising projects will transition from ISS NL post-R&D to enter production
- **In Space Manufacturing Projects underway:**
 - Exotic Optical Fibers #1 - Demo #1 on NG-11 (April 2019), Demo #2 on NG-13 (February 2020)
 - Exotic Optical Fibers #2 - Demo #1 on NG-11 (April 2019), Demo #2 on SpX-21 (August 2020)
 - Bio-Printing Cardiac Tissue - Demo #1 on SpX-18 (July 2019), #2 SpX-20, #3 NG-13, #4 NG-14
 - Ceramic Turbine Blisk Manufacturing - Demo #1 NET SpX-21 (August 2020)
 - Industrial Crystals Facility - Demo #1 NET NG-14 (October 2020)
 - Super Alloy Turbine Blisk Manufacturing - Demo #1 NET SpX-22 (January 2021)
- **Continuing the development pipeline for these and other promising areas of potential future demand for LEO platforms is a high priority**
- **Intent is to continue building a pipeline of projects through ISS life, migrate successful projects to commercial lab(s) in LEO**

Commercial Hardware on ISS

- NanoRacks: Internal & External platforms; sat deployers; airlock
- Teledyne Brown Engineering: MUSES External precision pointing platform
- Bigelow Aerospace: Expandable module
- Alpha Space: MISSE-FF External materials exposure platform
- BioServe: Space Biology platforms and services
- Space Tango: TangoLab space biology platforms
- Techshot: Bone densitometer, MVP centrifuge facility
- Made In Space: Additive Manufacturing Facility
- STaARS: Space biology platform
- Sierra Nevada Corp: Small mass measurement device

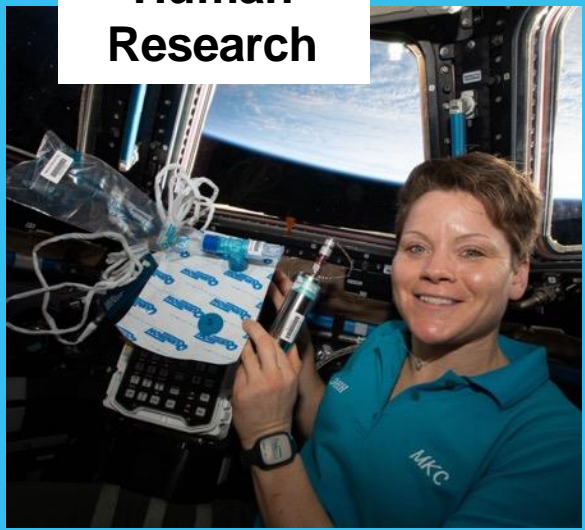


Commercial Research on ISS

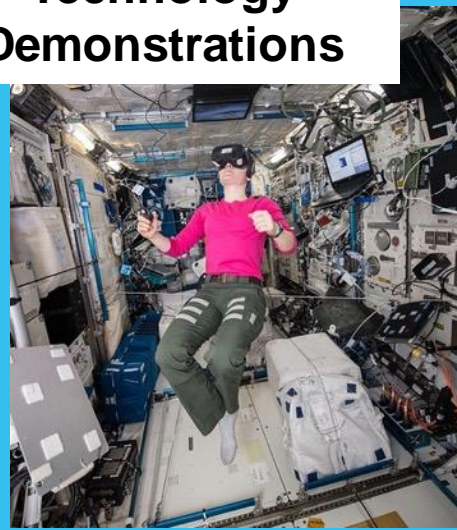


NASA's Future LEO Demand

**Human
Research**



**Technology
Demonstrations**



**Crew Accommodations
& Training**



Science



**Physical &
Biological
Research**



**National Lab
Services**



Resources Available

www.nasa.gov/leo-economy/resources

Low-Earth Orbit Economy Resources



Request for Information (RFI)

- [Plan for Commercial Low-Earth Orbit Development](#) (June 7, 2019)

Document Releases

- [NASA Plan for Commercial LEO Development: Summary and Near Term Implementation Plans](#) (June 7, 2019)
- [NASA Interim Directive: Use of International Space Station \(ISS\) for Commercial and Marketing Activities](#) (memo signed by Bill Gerstenmaier, June 6, 2019)
- [How to Get Your Commercial Activity on ISS](#) (June 7, 2019)
- [Forecasting Future NASA Demand in Low-Earth Orbit: Revision Two – Quantifying Demand](#) (June 7, 2019)
- [Low Earth Orbit Commercialization Study Results - Executive Summaries](#) (June 7, 2019)

Related Previously Released Documents

- [Low Earth Orbit Commercialization Study Results - One Page Summaries](#) (May 20, 2019)
- [Forecasting Future NASA Demand in Low-Earth Orbit](#) (October 26, 2018)
- [Strategy for Human Spaceflight in LEO and Economic Growth in Space](#) (October 19, 2018)
- [International Space Station Transition Planning](#) (March 30, 2018)
- [Economic Development of Low Earth Orbit](#) (July 11, 2016)

Press Releases

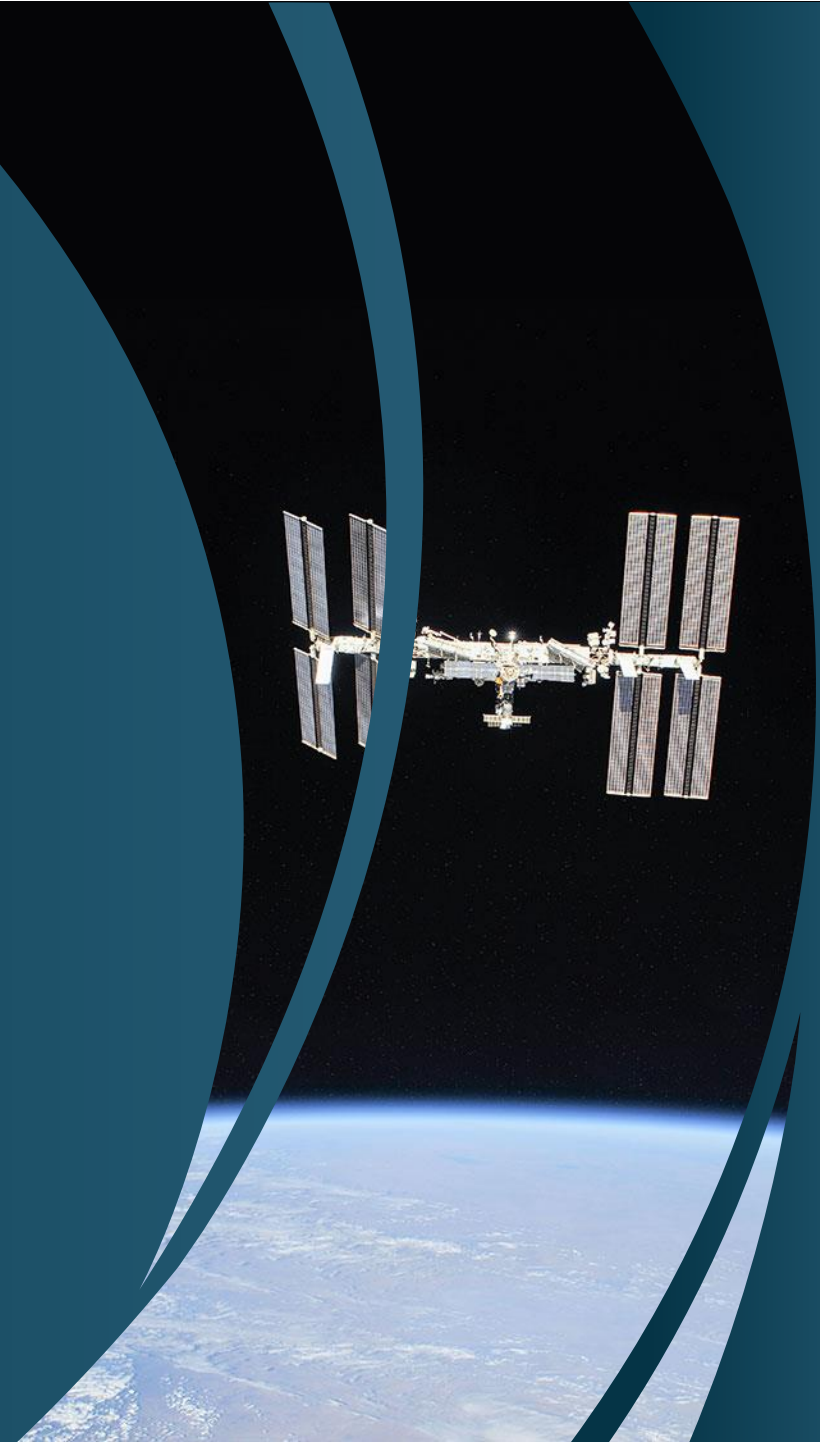
- [NASA Opens International Space Station to New Commercial Opportunities, Private Astronauts](#) (press release 19-044, June 7, 2019)

Related Previous Press Releases

- [NASA Invests in Concepts for a Vibrant Future Commercial Space Economy](#) (press release 18-071, August 8, 2018)

Opportunity Releases

- [NextSTEP](#)
 - Synopsis: [FedBizOpps NextSTEP-2 Appendix I: Commercial Destination Development in LEO Using the ISS](#) (Solicitation Number: NNH16ZCQ001K-CDISS; June 7, 2019)
 - Solicitation: [FedBizOpps NextSTEP-2 Appendix I: Commercial Destination Development in LEO Using the ISS](#) (Solicitation Number: NNH16ZCQ001K-CDISS; June 21, 2019)



Learn more at
www.nasa.gov/leo-economy

